**imgaug** is a library for image augmentation in machine learning experiments. It supports a wide range of augmentation techniques, allows to easily combine these and to execute them in random order or on multiple CPU cores, has a simple yet powerful stochastic interface and can not only augment images, but also keypoints/landmarks, bounding boxes, heatmaps and segmentation maps.

![Example augmentations of a single input image.](image)

**Fig. 1:** Example augmentations of a single input image.
The library uses python, which must be installed. Python 2.7, 3.4, 3.5, 3.6, 3.7 and 3.8 are supported. The below sections explain how to install the library in anaconda and pip. If you don’t know what anaconda (aka conda) is, simply use pip instead.

### 1.1 Installation in Anaconda

To install in anaconda simply perform the following commands:

```
conda config --add channels conda-forge
conda install imgaug
```

Note that you may also use the pip-based installation commands described below. They work with and without anaconda.

To also be able to use the augmenters in `imgaug.augmenters.imgcorruptlike`, you have to manually install the `imagecorruptions` package:

```
pip install imagecorruptions
```

### 1.2 Installation in pip

To install the library via pip, simply execute:

```
pip install imgaug
```

This installs the latest version from pypi.

If you encounter any problems with Shapely, try the following:
pip install six numpy scipy Pillow matplotlib scikit-image opencv-python imageio  

The first command installs manually all dependencies except Shapely, the second only the library. Note that Shapely is required for some operations, mainly when operating with line strings or polygons.

The version installed above is the latest official release from pypi. That release often lags behind the latest version from github by a few months. To instead install the very latest version of imgaug use

```
pip install git+https://github.com/aleju/imgaug.git
```

Independent of whether you install from pypi or github, in order to be able to use the augmenters in `imgaug.augmenters.imgcorruptlike`, you have to manually install the `imagecorruptions` package:

```
pip install imagecorruptions
```

### 1.3 Uninstall

To deinstall the library use

```
conda remove imgaug
```

on anaconda and

```
pip uninstall imgaug
```

otherwise.
2.1 A standard use case

The following example shows a standard use case. An augmentation sequence (crop + horizontal flips + gaussian blur) is defined once at the start of the script. Then many batches are loaded and augmented before being used for training.

```python
from imgaug import augmenters as iaa

seq = iaa.Sequential(
    [iaa.Crop(px=(0, 16)),  # crop images from each side by 0 to 16px (randomly chosen)
     iaa.Fliplr(0.5),  # horizontally flip 50% of the images
     iaa.GaussianBlur(sigma=(0, 3.0))  # blur images with a sigma of 0 to 3.0
    ])

for batch_idx in range(1000):
    # 'images' should be either a 4D numpy array of shape (N, height, width, channels)
    # or a list of 3D numpy arrays, each having shape (height, width, channels).
    # Grayscale images must have shape (height, width, 1) each.
    # All images must have numpy’s dtype uint8. Values are expected to be in
    # range 0-255.
    images = load_batch(batch_idx)
    images_aug = seq(images=images)
    train_on_images(images_aug)
```

2.2 A simple and common augmentation sequence

The following example shows an augmentation sequence that might be useful for many common experiments. It applies crops and affine transformations to images, flips some of the images horizontally, adds a bit of noise and blur and also changes the contrast as well as brightness.

```python
from imgaug import augmenters as iaa

seq = iaa.Sequential(
    [iaa.Crop(px=(0, 16)),  # crop images from each side by 0 to 16px (randomly chosen)
     iaa.Fliplr(0.5),  # horizontally flip 50% of the images
     iaa.GaussianBlur(sigma=(0, 3.0))  # blur images with a sigma of 0 to 3.0
    ])

for batch_idx in range(1000):
    # 'images' should be either a 4D numpy array of shape (N, height, width, channels)
    # or a list of 3D numpy arrays, each having shape (height, width, channels).
    # Grayscale images must have shape (height, width, 1) each.
    # All images must have numpy’s dtype uint8. Values are expected to be in
    # range 0-255.
    images = load_batch(batch_idx)
    images_aug = seq(images=images)
    train_on_images(images_aug)
```
```python
import numpy as np
import imgaug as ia
import imgaug.augmenters as iaa

ia.seed(1)

# Example batch of images.
# The array has shape (32, 64, 64, 3) and dtype uint8.
images = np.array([ia.quokka(size=(64, 64)) for _ in range(32)], dtype=np.uint8)

seq = iaa.Sequential(
    [iaa.Fliplr(0.5),  # horizontal flips
     iaa.Crop(percent=(0, 0.1)),  # random crops
      # Small gaussian blur with random sigma between 0 and 0.5.
     iaa.Sometimes(0.5, iaa.GaussianBlur(sigma=(0, 0.5)))]
    # Strengthen or weaken the contrast in each image.
    iaa.LinearContrast((0.75, 1.5)),
    # Add gaussian noise.
    # For 50% of all images, we sample the noise once per pixel.
    # For the other 50% of all images, we sample the noise once per pixel AND
    # channel. This can change the color (not only brightness) of the
    # pixels.
    iaa.AdditiveGaussianNoise(loc=0, scale=(0.0, 0.05*255), per_channel=0.5),
    # Make some images brighter and some darker.
    # In 20% of all cases, we sample the multiplier once per channel,
    # which can end up changing the color of the images.
    iaa.Multiply((0.8, 1.2), per_channel=0.2),
    # Apply affine transformations to each image.
    # Scale/zoom them, translate/move them, rotate them and shear them.
    iaa.Affine(
        scale={"x": (0.8, 1.2), "y": (0.8, 1.2)},
        translate_percent={"x": (-0.2, 0.2), "y": (-0.2, 0.2)},
        rotate=(-25, 25),
        shear=(-8, 8)
    ),
    random_order=True)  # apply augmenters in random order

images_aug = seq(images=images)
```

### 2.3 Heavy Augmentations

The following example shows a large augmentation sequence containing many different augmenters, leading to significant changes in the augmented images. Depending on the use case, the sequence might be too strong. Occasionally it can also break images by changing them too much. To weaken the effects you can lower the value of `iaa.SomeOf((0, 5), ...)` to e.g. `(0, 3)` or decrease the probability of some augmenters to be applied by decreasing in `sometimes = lambda aug: iaa.Sometimes(0.5, aug)` the value `0.5` to e.g. `0.3`. 
import numpy as np
import imgaug as ia
import imgaug.augmenters as iaa

ia.seed(1)

# Example batch of images.
# The array has shape (32, 64, 64, 3) and dtype uint8.
images = np.array([ia.quokka(size=(64, 64)) for _ in range(32)], dtype=np.uint8)

# Sometimes(0.5, ...) applies the given augmenter in 50% of all cases,
# e.g. Sometimes(0.5, GaussianBlur(0.3)) would blur roughly every second
# image.
sometimes = lambda aug: iaa.Sometimes(0.5, aug)

# Define our sequence of augmentation steps that will be applied to every image.
seq = iaa.Sequential([
    # Apply the following augmenters to most images.
    iaa.Fliplr(0.5),  # horizontally flip 50% of all images
    iaa.Flipud(0.2),  # vertically flip 20% of all images

    # crop some of the images by 0-10% of their height/width
    sometimes(iaa.Crop(percent=(0, 0.1))),

    # Apply affine transformations to some of the images

    # (continues on next page)
    ]

Fig. 1: Example results of the above simple augmentation sequence.

2.3. Heavy Augmentations
# - scale to 80–120% of image height/width (each axis independently)
# - translate by -20 to +20 relative to height/width (per axis)
# - rotate by -45 to +45 degrees
# - shear by -16 to +16 degrees
# - order: use nearest neighbour or bilinear interpolation (fast)
# - mode: use any available mode to fill newly created pixels
# see API or scikit-image for which modes are available
# - cval: if the mode is constant, then use a random brightness
# for the newly created pixels (e.g. sometimes black,
# sometimes white)
sometimes(iaa.Affine(
    scale={"x": (0.8, 1.2), "y": (0.8, 1.2)},
    translate_percent={"x": (-0.2, 0.2), "y": (-0.2, 0.2)},
    rotate=(-45, 45),
    shear=(-16, 16),
    order=[0, 1],
    cval=(0, 255),
    mode=ia.ALL
)),

# Execute 0 to 5 of the following (less important) augmenters per image. Don't execute all of them, as that would often be way too strong.
# iaa.SomeOf((0, 5),
[  # Convert some images into their superpixel representation, sample between 20 and 200 superpixels per image, but do not replace all superpixels with their average, only some of them (p_replace).
  sometimes(
    iaa.Superpixels(
      p_replace=(0, 1.0),
      n_segments=(20, 200)
    )
  ),

  # Blur each image with varying strength using gaussian blur (sigma between 0 and 3.0), average/uniform blur (kernel size between 2x2 and 7x7) median blur (kernel size between 3x3 and 11x11).
  iaa.OneOf([  
    iaa.GaussianBlur((0, 3.0)),
    iaa.AverageBlur(k=(2, 7)),
    iaa.MedianBlur(k=(3, 11)),
  ]),

  # Sharpen each image, overlay the result with the original image using an alpha between 0 (no sharpening) and 1 (full sharpening effect).
  iaa.Sharpen(alpha=(0, 1.0), lightness=(0.75, 1.5)),

  # Same as sharpen, but for an embossing effect.
  iaa.Emboss(alpha=(0, 1.0), strength=(0, 2.0)),

  # Search in some images either for all edges or for...
# directed edges. These edges are then marked in a black
# and white image and overlayed with the original image
# using an alpha of 0 to 0.7.
sometimes(iaa.OneOf([
    iaa.EdgeDetect(alpha=(0, 0.7)),
    iaa.DirectedEdgeDetect(
        alpha=(0, 0.7), direction=(0.0, 1.0)
    ),
]),
],)

# Add gaussian noise to some images.
# In 50% of these cases, the noise is randomly sampled per
# channel and pixel.
# In the other 50% of all cases it is sampled once per
# pixel (i.e. brightness change).
iaa.AdditiveGaussianNoise(
    loc=0, scale=(0.0, 0.05*255), per_channel=0.5
),

# Either drop randomly 1 to 10% of all pixels (i.e. set
# them to black) or drop them on an image with 2-5% percent
# of the original size, leading to large dropped
# rectangles.
iaa.OneOf([iaa.Dropout((0.01, 0.1), per_channel=0.5),
            iaa.CoarseDropout(
                (0.03, 0.15), size_percent=(0.02, 0.05),
                per_channel=0.2
            ),
        ],)

# Invert each image’s channel with 5% probability.
# This sets each pixel value v to 255-v.
iaa.Invert(0.05, per_channel=True), # invert color channels

# Add a value of -10 to 10 to each pixel.
iaa.Add((-10, 10), per_channel=0.5),

# Change brightness of images (50-150% of original value).
iaa.Multiply((0.5, 1.5), per_channel=0.5),

# Improve or worsen the contrast of images.
iaa.LinearContrast((0.5, 2.0), per_channel=0.5),

# Convert each image to grayscale and then overlay the
# result with the original with random alpha. I.e. remove
# colors with varying strengths.
iaa.Grayscale(alpha=(0.0, 1.0)),

# In some images move pixels locally around (with random
# strengths).
sometimes(
    iaa.ElasticTransformation(alpha=(0.5, 3.5), sigma=0.25)
),

# In some images distort local areas with varying strength.
sometimes(iaa.PiecewiseAffine(scale=(0.01, 0.05)))
Fig. 2: Example results of the above heavy augmentation sequence.
Examples: Keypoints

`imgaug` can handle not only images, but also keypoints/landmarks on these. E.g. if an image is rotated during augmentation, the library can also rotate all landmarks correspondingly.

### 3.1 Notebook

A jupyter notebook for keypoint augmentation is available at [Jupyter Notebooks](#). The notebooks are usually more up to date and contain more examples than the ReadTheDocs documentation.

### 3.2 A simple example

The following example loads an image and places four keypoints on it. The image is then augmented to be brighter, slightly rotated and scaled. These augmentations are also applied to the keypoints. The image is then shown before and after augmentation (with keypoints drawn on it).

```python
import imgaug as ia
import imgaug.augmenters as iaa
from imgaug.augmentables import Keypoint, KeypointsOnImage

ia.seed(1)

image = ia.quokka(size=(256, 256))
kps = KeypointsOnImage([ Keypoint(x=65, y=100), Keypoint(x=75, y=200), Keypoint(x=100, y=100), Keypoint(x=200, y=80) ], shape=image.shape)

seq = iaa.Sequential([
```

(continues on next page)
iaa.Multiply((1.2, 1.5)),  # change brightness, doesn't affect keypoints
iaa.Affine(
    rotate=10,
    scale=(0.5, 0.7)
)  # rotate by exactly 10deg and scale to 50-70%, affects keypoints
]

# Augment keypoints and images.
image_aug, kps_aug = seq(image=image, keypoints=kps)

# print coordinates before/after augmentation (see below)
# use after.x_int and after.y_int to get rounded integer coordinates
for i in range(len(kps.keypoints)):
    before = kps.keypoints[i]
    after = kps_aug.keypoints[i]
    print("Keypoint %d: (%.8f, %.8f) -> (%.8f, %.8f)" % (i, before.x, before.y, after.x, after.y))

# image with keypoints before/after augmentation (shown below)
image_before = kps.draw_on_image(image, size=7)
image_after = kps_aug.draw_on_image(image_aug, size=7)

Console output of the example:

Keypoint 0: (65.00000000, 100.00000000) -> (97.86113503, 107.69632182)
Keypoint 1: (75.00000000, 200.00000000) -> (93.93710117, 160.01366917)
Keypoint 2: (100.00000000, 100.00000000) -> (115.85492750, 110.86911292)
Keypoint 3: (200.00000000, 80.00000000) -> (169.07878659, 109.65206321)

Fig. 1: Image with keypoints, before (left) and after (right) augmentation. Keypoints are shown in green and drawn in after the augmentation process.
Examples: Bounding Boxes

*imgaug* offers support for bounding boxes (aka rectangles, regions of interest). E.g. if an image is rotated during augmentation, the library can also rotate all bounding boxes on it correspondingly.

Features of the library’s bounding box support:

- Represent bounding boxes as objects (*imgaug.augmentables.bbs.BoundingBox*).
- Augment bounding boxes.
- Draw bounding boxes on images.
- Move/shift bounding boxes on images, project them onto other images (e.g. onto the same image after resizing), compute their intersections/unions and IoU values.

### 4.1 Notebook

A jupyter notebook for bounding box augmentation is available at [Jupyter Notebooks](https://jupyter.org). The notebooks are usually more up to date and contain more examples than the ReadTheDocs documentation.

### 4.2 A simple example

The following example loads an image and places two bounding boxes on it. The image is then augmented to be brighter, slightly rotated and scaled. These augmentations are also applied to the bounding boxes. The image is then shown before and after augmentation (with bounding boxes drawn on it).

```python
import imgaug as ia
import imgaug.augmenters as iaa
from imgaug.augmentables.bbs import BoundingBox, BoundingBoxesOnImage

ia.seed(1)
```
image = ia.quokka(size=(256, 256))
bbs = BoundingBoxesOnImage([  
    BoundingBox(x1=65, y1=100, x2=200, y2=150),  
    BoundingBox(x1=150, y1=80, x2=200, y2=130)  
], shape=image.shape)

seq = iaa.Sequential([  
    iaa.Multiply((1.2, 1.5)),  # change brightness, doesn't affect BBs  
    iaa.Affine(  
        translate_px={"x": 40, "y": 60},  
        scale=(0.5, 0.7)  
    )  # translate by 40/60px on x/y axis, and scale to 50-70%, affects BBs  
])  

# Augment BBs and images.  
image_aug, bbs_aug = seq(image=image, bounding_boxes=bbs)

# print coordinates before/after augmentation (see below)  
# use .x1_int, .y_int, ... to get integer coordinates  
for i in range(len(bbs.bounding_boxes)):  
    before = bbs.bounding_boxes[i]  
    after = bbs_aug.bounding_boxes[i]  
    print("BB %d: (%.4f, %.4f, %.4f, %.4f) -> (%.4f, %.4f, %.4f, %.4f)\n" % (  
        i,  
        before.x1, before.y1, before.x2, before.y2,  
        after.x1, after.y1, after.x2, after.y2)  
)

# image with BBs before/after augmentation (shown below)  
image_before = bbs.draw_on_image(image, size=2)  
image_after = bbs_aug.draw_on_image(image_aug, size=2, color=[0,0,255])

Note that the bounding box augmentation works by augmenting each box’s edge coordinates and then drawing a 
bounding box around these augmented coordinates. Each of these new bounding boxes is therefore axis-aligned. This 
can sometimes lead to oversized new bounding boxes, especially in the case of rotation. The following image shows 
the result of the same code as in the example above, but Affine was replaced by Affine(rotate=45):

4.3 Dealing with bounding boxes outside of the image

When augmenting images and their respective bounding boxes, the boxes can end up fully or partially outside of the 
image plane. By default, the library still returns these boxes, even though that may not be desired. The following example shows how to (a) remove bounding boxes that are fully/partially outside of the image and (b) how to clip 
bounding boxes that are partially outside of the image so that their are fully inside.
Fig. 1: Image with bounding boxes, before (left) and after (right) augmentation. Bounding boxes are shown in green (before augmentation) and blue (after augmentation).

Fig. 2: Image with bounding boxes, before (left) and after (right) augmentation. The image was augmentated by rotating it by 45 degrees. The axis-aligned bounding box around the augmented keypoints ends up being oversized.
import imgaug.augmenters as iaa
from imgaug.augmentables.bbs import BoundingBox, BoundingBoxesOnImage

ia.seed(1)
GREEN = [0, 255, 0]
ORANGE = [255, 140, 0]
RED = [255, 0, 0]

# Pad image with a 1px white and (BY-1)px black border
def pad(image, by):
    image_border1 = ia.pad(image, top=1, right=1, bottom=1, left=1,
                         mode="constant", cval=255)
    image_border2 = ia.pad(image_border1, top=by-1, right=by-1,
                         bottom=by-1, left=by-1,
                         mode="constant", cval=0)
    return image_border2

# Draw BBs on an image
# and before doing that, extend the image plane by BORDER pixels.
# Mark BBs inside the image plane with green color, those partially inside
# with orange and those fully outside with red.
def draw_bbs(image, bbs, border):
    image_border = pad(image, border)
    for bb in bbs.bounding_boxes:
        if bb.is_fully_within_image(image.shape):
            color = GREEN
        elif bb.is_partly_within_image(image.shape):
            color = ORANGE
        else:
            color = RED
        image_border = bb.shift(left=border, top=border)
            .draw_on_image(image_border, size=2, color=color)
    return image_border

# Define example image with three small square BBs next to each other.
# Augment these BBs by shifting them to the right.
image = ia.quokka(size=(256, 256))
bbs = BoundingBoxesOnImage(
    [
        BoundingBox(x1=25, x2=75, y1=25, y2=75),
        BoundingBox(x1=100, x2=150, y1=25, y2=75),
        BoundingBox(x1=175, x2=225, y1=25, y2=75)
    ], shape=image.shape)
seq = iaa.Affine(translate_px={"x": 120})
image_aug, bbs_aug = seq(image=image, bounding_boxes=bbs)

# Draw the BBs (a) in their original form, (b) after augmentation,
# (c) after augmentation and removing those fully outside the image,
# (d) after augmentation and removing those fully outside the image and
# clipping those partially inside the image so that they are fully inside.
image_before = draw_bbs(image, bbs, 100)
image_after1 = draw_bbs(image_aug, bbs_aug, 100)
image_after2 = draw_bbs(image_aug, bbs_aug.remove_out_of_image(), 100)
image_after3 = draw_bbs(image_aug, bbs_aug.remove_out_of_image().clip_out_of_image(), 100)
4.4 Shifting/Moving Bounding Boxes

The function \texttt{shift\(\texttt{top=<int>, right=<int>, bottom=<int>, left=<int>\)} can be used to change the x/y position of all or specific bounding boxes.

```python
import imgaug as ia
from imgaug.augmentables.bbs import BoundingBox, BoundingBoxesOnImage

ia.seed(1)

# Define image and two bounding boxes
image = ia.quokka(size=(256, 256))
bbs = BoundingBoxesOnImage([
    BoundingBox(x1=25, x2=75, y1=25, y2=75),
    BoundingBox(x1=100, x2=150, y1=25, y2=75)
], shape=image.shape)

# Move both BBs 25px to the right and the second BB 25px down
bbs_shifted = bbs.shift(left=25)

# Draw images before/after moving BBs
image = bbs.draw_on_image(image, color=[0, 255, 0], size=2, alpha=0.75)
image = bbs_shifted.draw_on_image(image, color=[0, 0, 255], size=2, alpha=0.75)
```

4.5 Projection of BBs Onto Rescaled Images

Bounding boxes can easily be projected onto rescaled versions of the same image using the function \texttt{.on(image)}. This changes the coordinates of the bounding boxes. E.g. if the top left coordinate of the bounding box was before at x=10% and y=15%, it will still be at x/y 10%/15% on the new image, though the absolute pixel values will change depending on the height/width of the new image.

```python
import imgaug as ia
from imgaug.augmentables.bbs import BoundingBox, BoundingBoxesOnImage

ia.seed(1)

# Define image with two bounding boxes
image = ia.quokka(size=(256, 256))
bbs = BoundingBoxesOnImage([
    BoundingBox(x1=25, x2=75, y1=25, y2=75),
    BoundingBox(x1=100, x2=150, y1=25, y2=75)
], shape=image.shape)

# Rescale image and bounding boxes
image_rescaled = ia.imresize_single_image(image, (512, 512))
bbs_rescaled = bbs.on(image_rescaled)
```
Fig. 3: Results of the above example code. Top left: Original/unaugmented image with bounding boxes (here visualized with an additional black border around the image). Right, top: Image after augmentation (translation 120px to the right). One bounding box is now fully outside of the image area (red), one is partially outside of it (orange). Right, middle: After using `.remove_out_of_image()` the BB that was fully outside of the image area was removed. Right, center: After using `.remove_out_of_image()` and `.clip_out_of_image()`, one BB was removed and the one partially outside of the image area was clipped to be fully inside it.
# Draw image before/after rescaling and with rescaled bounding boxes
image_bbs = bbs.draw_on_image(image, size=2)
image_rescaled_bbs = bbs_rescaled.draw_on_image(image_rescaled, size=2)

## 4.6 Computing Intersections, Unions and IoUs

Computing intersections, unions and especially IoU values (intersection over union) is common for many machine learning experiments. The library offers easy functions for that.

```python
import numpy as np
import imgaug as ia
from imgaug.augmentables.bbs import BoundingBox

ia.seed(1)

# Define image with two bounding boxes.
image = ia.quokka(size=(256, 256))
bb1 = BoundingBox(x1=50, x2=100, y1=25, y2=75)
bb2 = BoundingBox(x1=75, x2=125, y1=50, y2=100)

# Compute intersection, union and IoU value
bb_inters = bb1.intersection(bb2).extend(all_sides=-1)
```
Fig. 5: Using `on()` to project bounding boxes from one image to the other, here onto an image of 2x the original size. New coordinates are determined based on their relative positions on the old image.

```python
bb_union = bb1.union(bb2).extend(all_sides=2)
iou = bb1.iou(bb2)

# Draw bounding boxes, intersection, union and IoU value on image.
image_bbs = np.copy(image)
image_bbs = bb1.draw_on_image(image_bbs, size=2, color=[0, 255, 0])
image_bbs = bb2.draw_on_image(image_bbs, size=2, color=[0, 255, 0])
image_bbs = bb_inters.draw_on_image(image_bbs, size=2, color=[255, 0, 0])
image_bbs = bb_union.draw_on_image(image_bbs, size=2, color=[0, 0, 255])
image_bbs = ia.draw_text(image_bbs, text="IoU= %.2f" % (iou,),
                        x=bb_union.x2+10, y=bb_union.y1+bb_union.height//2,
                        color=[255, 255, 255], size=13)
```

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Fig. 6: Two bounding boxes on an image (green), their intersection (red, slightly shrunk), their union (blue, slightly extended) and their IoU value (white).
Examples: Heatmaps

`imgaug` offers support for heatmap-like data. This can be used e.g. for depth map or keypoint/landmark localization maps. Heatmaps can be augmented correspondingly to images, e.g. if an image is rotated by 45°, the corresponding heatmap for that image will also be rotated by 45°.

**Note:**

- Heatmaps have to be bounded within value ranges, e.g. 0.0 to 1.0 for keypoint localization maps or something like 0.0 to 200.0 (meters) for depth maps. Choosing arbitrarily low/high min/max values for unbounded heatmaps is not recommended as it could lead to numerical inaccuracies.

- All augmentation functions for heatmaps are implemented under the assumption of augmenting **ground truth** data. As such, heatmaps will be affected by augmentations that change the geometry of images (e.g. affine transformations, cropping, resizing), but not by other augmentations (e.g. gaussian noise, saturation changes, grayscaling, dropout, ...).

Features of the library’s heatmap support:

- Represent heatmaps as objects (`imgaug.augmentables.heatmaps.HeatmapsOnImage`).
- Augment heatmaps (only geometry-affecting augmentations, e.g. affine transformations, cropping, ...).
- Use different resolutions for heatmaps than for images (e.g. 32x32 heatmaps for 256x256 images).
- Draw heatmaps – on their own or on images (`HeatmapsOnImage.draw()`, `HeatmapsOnImage.draw_on_image()`).
- Resize, average pool or max pool heatmaps (`HeatmapsOnImage.scale()`, `HeatmapsOnImage.avg_pool()`, `HeatmapsOnImage.max_pool()`).
- Pad heatmaps by pixel amounts or to desired aspect ratios (`HeatmapsOnImage.pad()`, `HeatmapsOnImage.pad_to_aspect_ratio()`).

### 5.1 Notebook

A jupyter notebook for heatmap augmentation is available at *Jupyter Notebooks*. The notebooks are usually more up to date and contain more examples than the ReadTheDocs documentation.
5.2 A simple example

The following example loads a standard image and a generates a corresponding heatmap. The heatmap is supposed to be a depth map, i.e. is supposed to resemble the depth of objects in the image, where higher values indicate that objects are further away. (For simplicity we just use a simple gradient as a depth map with a cross in the center, so there is no real correspondence between the image and the depth values.)

This example shows:

- Creating heatmaps via `HeatmapsOnImage(heatmap_array, shape=image_shape)`.
- Using value ranges outside of simple 0.0 to 1.0 (here 0.0 to 50.0) by setting `min_value` and `max_value` in the `HeatmapsOnImage` constructor.
- Resizing heatmaps, here via `HeatmapsOnImage.avg_pool(kernel_size)` (i.e. average pooling).
- Augmenting heatmaps via `Augmenter.__call__()` which is equivalent to `Augmenter.augment()`.
- Drawing heatmaps as overlays over images `HeatmapsOnImage.draw_on_image(image)`.
- Drawing heatmaps on their own via `HeatmapsOnImage.draw()` in jet color map or via `HeatmapsOnImage.draw(cmap=None)` as intensity maps.

```python
import imageio
import numpy as np
import imgaug as ia
import imgaug.augmenters as iaa
from imgaug.augmentables.heatmaps import HeatmapsOnImage

ia.seed(1)

# Load an example image (uint8, 128x128x3).
image = ia.quokka(size=(128, 128), extract="square")

# Create an example depth map (float32, 128x128).
# Here, we use a simple gradient that has low values (around 0.0)
# towards the left of the image and high values (around 50.0)
# towards the right. This is obviously a very unrealistic depth
# map, but makes the example easier.
depth = np.linspace(0, 50, 128).astype(np.float32)
# 128 values from 0.0 to 50.0
depth = np.tile(depth.reshape(1, 128), (128, 1))
# change to a horizontal gradient
depth[64-2:64+2, 16:128-16] = 0.75 * 50.0
# line from left to right
depth[16:128-16, 64-2:64+2] = 1.0 * 50.0
# line from top to bottom

depth = HeatmapsOnImage(
    depth, shape=image.shape, min_value=0.0, max_value=50.0)

# We add a cross to the center of the depth map, so that we can more
# easily see the effects of augmentations.
depth[64-2:64+2, 16:128-16] = 0.75 * 50.0
# line from left to right
depth[16:128-16, 64-2:64+2] = 1.0 * 50.0
# line from top to bottom

depth = depth.avg_pool(2)
```

(continues on next page)
# Define our augmentation pipeline.
seq = iaa.Sequential(
    
    iaa.Dropout([0.05, 0.2]),  # drop 5% or 20% of all pixels
    iaa.Sharpen((0.0, 1.0)),  # sharpen the image
    iaa.Affine(rotate=(-45, 45)),  # rotate by -45 to 45 degrees (affects heatmaps)
    iaa.ElasticTransformation(alpha=50, sigma=5)  # apply water effect (affects
    # heatmaps)
    
), random_order=True)

# Augment images and heatmaps.
images_aug = []
heatmaps_aug = []
for _ in range(5):
    images_aug_i, heatmaps_aug_i = seq(image=image, heatmaps=depth)
    images_aug.append(images_aug_i)
    heatmaps_aug.append(heatmaps_aug_i)

# We want to generate an image of original input images and heatmaps
# before/after augmentation.
# It is supposed to have five columns:
# (1) original image,
# (2) augmented image,
# (3) augmented heatmap on top of augmented image,
# (4) augmented heatmap on its own in jet color map,
# (5) augmented heatmap on its own in intensity colormap.
# We now generate the cells of these columns.
# We only used one sub-heatmap, so our lists always have one entry.
cells = []
for image_aug, heatmap_aug in zip(images_aug, heatmaps_aug):
    cells.append(image)  # column 1
    cells.append(image_aug)  # column 2
    cells.append(heatmap_aug.draw_on_image(image_aug)[0])  # column 3
    cells.append(heatmap_aug.draw(size=image_aug.shape[:2])[0])  # column 4
    cells.append(heatmap_aug.draw(size=image_aug.shape[:2], cmap=None)[0])  # column 5

# Convert cells to grid image and save.
grid_image = ia.draw_grid(cells, cols=5)
imageio.imwrite("example_heatmaps.jpg", grid_image)

5.3 Multiple sub-heatmaps per heatmaps object

The above example augmented a single heatmap with shape $(H, W)$ for the example image. If you want to augment more heatmaps per image, you can simply extend the heatmap array’s shape to $(H, W, C)$, where $C$ is the number of heatmaps. The following example instantiates one heatmap object containing three sub-heatmaps and draws them onto the image. Heatmap augmentation would be done in the exactly same way as in the previous example.

```python
import imageio
import numpy as np
import imgaug as ia
from imgaug.augmentables.heatmaps import HeatmapsOnImage
```

5.3. Multiple sub-heatmaps per heatmaps object
Fig. 1: Results of the above example code. Columns show: (1) Original image, (2) augmented image, (3) augmented heatmap overlayed with augmented image, (4) augmented heatmap alone in jet color map, (5) augmented heatmap alone as intensity map.
# Load an image and generate a heatmap array with three sub-heatmaps.
# Each sub-heatmap contains just three horizontal lines, with one of them
# having a higher value (1.0) than the other two (0.2).
image = ia.quokka(size=(128, 128), extract="square")
heatmap = np.zeros((128, 128, 3), dtype=np.float32)
for i in range(3):
    heatmap[1*30-5:1*30+5, 10:-10, i] = 1.0 if i == 0 else 0.5
    heatmap[2*30-5:2*30+5, 10:-10, i] = 1.0 if i == 1 else 0.5
    heatmap[3*30-5:3*30+5, 10:-10, i] = 1.0 if i == 2 else 0.5
heatmap = HeatmapsOnImage(heatmap, shape=image.shape)

# Draw image and the three sub-heatmaps on it.
# We draw four columns: (1) image, (2-4) heatmaps one to three drawn on
# top of the image.
subheatmaps_drawn = heatmap.draw_on_image(image)
cells = [image, subheatmaps_drawn[0], subheatmaps_drawn[1],
         subheatmaps_drawn[2]]
grid_image = np.hstack(cells)  # Horizontally stack the images
imageio.imwrite("example_multiple_heatmaps.jpg", grid_image)

5.4 Accessing the heatmap array

After augmentation you probably want to access the heatmap’s numpy array. This is done using the function HeatmapsOnImage.get_arr(). That function’s output shape will match your original heatmap array’s shape, i.e. either \((H, W)\) or \((H, W, C)\). The below code shows an example, where that function’s result is changed and then used to instantiate a new HeatmapsOnImage object.

Alternatively you could also change the heatmap object’s internal array, saved as HeatmapsOnImage.arr_0to1. As the name indicates, it is always normalized to the range 0.0 to 1.0, while get_arr() reverses that normalization. It has also always shape \((H, W, C)\), with \(C\geq1\).

```python
import imageio
import numpy as np
import imgaug as ia
from imgaug.augmentables.heatmaps import HeatmapsOnImage

# Load an image and generate a heatmap array containing one horizontal line.
```
image = ia.quokka(size=(128, 128), extract="square")
heatmap = np.zeros((128, 128, 1), dtype=np.float32)
heatmap[64-4:64+4, 10:-10, 0] = 1.0
heatmap1 = HeatmapsOnImage(heatmap, shape=image.shape)

# Extract the heatmap array from the heatmap object, change it and create
# a second heatmap.
arr = heatmap1.get_arr()
arr[10:-10, 64-4:64+4] = 0.5
heatmap2 = HeatmapsOnImage(arr, shape=image.shape)

# Draw image and heatmaps before/after changing the array.
# We draw three columns:
# (1) original image,
# (2) heatmap drawn on image,
# (3) heatmap drawn on image, with some changes made to the heatmap array.
cells = [image,
    heatmap1.draw_on_image(image)[0],
    heatmap2.draw_on_image(image)[0]]
grid_image = np.hstack(cells)  # Horizontally stack the images
imageio.imwrite("example_heatmaps_arr.jpg", grid_image)

Fig. 3: Results of the above example code. It shows the original image, a corresponding heatmap and again the same
heatmap after its array was read out and changed.

5.5 Resizing heatmaps

When working with heatmaps it is common that the size of the input images and the heatmap sizes don’t match or
are supposed to not match (e.g. because predicted network output are of low resolution). HeatmapsOnImage of-
fers several functions to deal with such situations: HeatmapsOnImage.avg_pool(kernel_size) applies
average pooling to images, HeatmapsOnImage.max_pool(kernel_size) analogously max pooling and
HeatmapsOnImage.resize(size, [interpolation]) performs resizing. For the pooling functions the
kernel size is expected to be a single integer or a tuple of two/three entries (size along each dimension). For resize,
the size is expected to be a (height, width) tuple and interpolation can be one of the strings nearest
(nearest neighbour interpolation), linear, cubic (default) or area.

The below code shows an example. It instantiates a simple 128x128 heatmap with two horizontal lines (one of which
is blurred) and a small square in the center. It then applies average pooling, max pooling and resizing to heatmap sizes
64x64, 32x32 and 16x16. Then, an output image is generated with six rows: The first three show the results
of average/max pooling and resizing, while the rows three to six show the same results after again resizing them to
128x128 using nearest neighbour upscaling.
```python
import imageio
import numpy as np
import imgaug as ia
top=amount, right=amount, bottom=amount, left=amount)

def draw_heatmaps(heatmaps, upscale=False):
    drawn = []
    for heatmap in heatmaps:
        if upscale:
            drawn.append(heatmap.resize((128, 128), interpolation="nearest")
                          .draw()[0])
        else:
            size = heatmap.get_arr().shape[0]
            pad_amount = (128-size)//2
            drawn.append(pad_by(heatmap.draw()[0], pad_amount))
    return drawn

# Generate an example heatmap with two horizontal lines (first one blurry, # second not) and a small square.
heatmap = np.zeros((128, 128, 1), dtype=np.float32)
heatmap[32-4:32+4, 10:-10, 0] = 1.0
heatmap = iaa.GaussianBlur(3.0).augment_image(heatmap)
heatmap[96-4:96+4, 10:-10, 0] = 1.0
heatmap[64-2:64+2, 64-2:64+2, 0] = 1.0
heatmap = HeatmapsOnImage(heatmap, shape=(128, 128, 1))

# Scale the heatmaps using average pooling, max pooling and resizing with # default interpolation (cubic).
avg_pooled = [heatmap, heatmap.avg_pool(2), heatmap.avg_pool(4),
              heatmap.avg_pool(8)]
max_pooled = [heatmap, heatmap.max_pool(2), heatmap.max_pool(4),
              heatmap.max_pool(8)]
resized = [heatmap, heatmap.resize((64, 64)), heatmap.resize((32, 32)),
           heatmap.resize((16, 16))]

# Draw an image of all scaled heatmaps.
cells = draw_heatmaps(avg_pooled) +
        draw_heatmaps(max_pooled) +
        draw_heatmaps(resized) +
        draw_heatmaps(avg_pooled, upscale=True) +
        draw_heatmaps(max_pooled, upscale=True) +
        draw_heatmaps(resized, upscale=True)
grid_image = ia.draw_grid(cells, cols=4)
imageio.imwrite("example_heatmaps_scaling.jpg", grid_image)
```

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Fig. 4: Results of the above example code. It shows six rows: (Rows 1-3) scaling via average pooling, max pooling and (cubic) resizing to 64x64 (column 2), 32x32 (column 3) and 16x16 (column 4) and then zero-padding to 128x128. (Rows 4-6) Doing the same again, but not padding to 128x128 but instead resizing using nearest neighbour upscaling.
5.6 Padding heatmaps

Another common operation is padding of images and heatmaps, especially to squared sizes. This is done for images using `imgaug.pad(image, [top], [right], [bottom], [left], [mode], [cval])` and `imgaug.pad_to_aspect_ratio(image, aspect_ratio, [mode], [cval], [return_pad_amounts])`. For heatmaps it is done using `HeatmapsOnImage.pad([top], [right], [bottom], [left], [mode], [cval])` and `HeatmapsOnImage.pad_to_aspect_ratio(aspect_ratio, [mode], [cval], [return_pad_amounts])`. In both cases, `pad()` expects pixel amounts (i.e. integers) and `pad_to_aspect_ratio()` the target aspect ratio, given as a float denoting `ratio = width / height` (i.e. a value of 1.0 would lead to a squared image/heatmap, while 2.0 would lead to a fairly wide image/heatmap).

The below code shows an example for padding. It starts with a squared sized image and heatmap, cuts both so that they are more wide than high and then zero-pads both back to squared size.

```python
import imageio
import numpy as np
import imgaug as ia
from imgaug.augmentables.heatmaps import HeatmapsOnImage

# Load example image and generate example heatmap with one horizontal line
image = ia.quokka((128, 128), extract="square")
heatmap = np.zeros((128, 128, 1), dtype=np.float32)
heatmap[64-4:64+4, 10:-10, 0] = 1.0

# Cut image and heatmap so that they are no longer squared
image = image[32:-32, :, :]
heatmap = heatmap[32:-32, :, :]
heatmap = HeatmapsOnImage(heatmap, shape=(128, 128, 1))

# Pad images and heatmaps by pixel amounts or to aspect ratios
# We pad both back to squared size of 128x128
images_padded = [
    ia.pad(image, top=32, bottom=32),
    ia.pad_to_aspect_ratio(image, 1.0)
]
heatmaps_padded = [
    heatmap.pad(top=32, bottom=32),
    heatmap.pad_to_aspect_ratio(1.0)
]

# Draw an image of all padded images and heatmaps
cells = [
    images_padded[0],
    heatmaps_padded[0].draw_on_image(images_padded[0])[0],
    images_padded[1],
    heatmaps_padded[1].draw_on_image(images_padded[1])[0]
]

grid_image = ia.draw_grid(cells, cols=2)
imageio.imwrite("example_heatmaps_padding.jpg", grid_image)
```
Fig. 5: Results of the above example code. It shows an input image and a heatmap that were both first cut to 64x128 and then padded back to squared size of 128x128. First row uses `pad()`, second uses `pad_to_aspect_ratio()`.
Examples: Segmentation Maps and Masks

`imgaug` offers support for segmentation map data, such as semantic segmentation maps, instance segmentation maps or ordinary masks. Segmentation maps can be augmented correspondingly to images. E.g. if an image is rotated by 45°, the corresponding segmentation map for that image will also be rotated by 45°.

**Note**: All augmentation functions for segmentation maps are implemented under the assumption of augmenting ground truth data. As such, segmentation maps will be affected by augmentations that change the geometry of images (e.g. affine transformations, cropping, resizing), but not by other augmentations (e.g. gaussian noise, saturation changes, grayscaling, dropout, ...).

Features of the library's segmentation map support:

- Represent segmentation maps as objects (`imgaug.augmentables.segmaps.SegmentationMapsOnImage`).
- Support integer maps (integer dtypes, usually `int32`) and boolean masks (dtype `numpy.bool_`).
- Augment segmentation maps (only geometry-affecting augmentations, e.g. affine transformations, cropping, ...).
- Use different resolutions for segmentation maps and images (e.g. 32x32 segmentation maps and 256x256 for the corresponding images).
- Draw segmentation maps – on their own or on images (`SegmentationMapsOnImage.draw()`, `SegmentationMapsOnImage.draw_on_image()`).
- Resize segmentation maps (`SegmentationMapsOnImage.resize()`).
- Pad segmentation maps by pixel amounts or to desired aspect ratios (`SegmentationMapsOnImage.pad()`, `SegmentationMapsOnImage.pad_to_aspect_ratio()`).

### 6.1 Notebook

A jupyter notebook for segmentation map augmentation is available at *Jupyter Notebooks*. The notebooks are usually more up to date and contain more examples than the ReadTheDocs documentation.
6.2 A simple example

The following example loads a standard image and defines a corresponding int32 segmentation map. The image and segmentation map are augmented in the same way and the results are visualized.

```python
import imageio
import numpy as np
import imgaug as ia
import imgaug.augmenters as iaa
from imgaug.augmentables.segmaps import SegmentationMapsOnImage

ia.seed(1)

# Load an example image (uint8, 128x128x3).
image = ia.quokka(size=(128, 128), extract="square")

# Define an example segmentation map (int32, 128x128).
# Here, we arbitrarily place some squares on the image.
# Class 0 is our intended background class.
segmap = np.zeros((128, 128, 1), dtype=np.int32)
segmap[28:71, 35:85, 0] = 1
segmap[10:25, 30:45, 0] = 2
segmap[10:25, 70:85, 0] = 3
segmap[10:110, 5:10, 0] = 4
segmap[118:123, 10:110, 0] = 5
segmap = SegmentationMapsOnImage(segmap, shape=image.shape)

# Define our augmentation pipeline.
seq = iaa.Sequential([
    iaa.Dropout([0.05, 0.2]),  # drop 5% or 20% of all pixels
    iaa.Sharpen((0.0, 1.0)),  # sharpen the image
    iaa.Affine(rotate=(-45, 45)),  # rotate by -45 to 45 degrees (affects segmaps)
    iaa.ElasticTransformation(alpha=50, sigma=5)  # apply water effect (affects segmaps)
], random_order=True)

# Augment images and segmaps.
images_aug = []
segmaps_aug = []
for _ in range(5):
    images_aug_i, segmaps_aug_i = seq(image=image, segmentation_maps=segmap)
    images_aug.append(images_aug_i)
    segmaps_aug.append(segmaps_aug_i)

# We want to generate an image containing the original input image and
# segmentation maps before/after augmentation. (Both multiple times for
# multiple augmentations.)
#
# The whole image is supposed to have five columns:
# (1) original image,
# (2) original image with segmap,
# (3) augmented image,
# (4) augmented segmap on augmented image,
# (5) augmented segmap on its own in.
#
# We now generate the cells of these columns.
```

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# Note that draw_on_image() and draw() both return lists of drawn images. Assuming that the segmentation map array has shape \((H,W,C)\), the list contains \(C\) items.

```python
cells = []
for image_aug, segmap_aug in zip(images_aug, segmaps_aug):
    cells.append(image) # column 1
    cells.append(segmap.draw_on_image(image)[0]) # column 2
    cells.append(image_aug) # column 3
    cells.append(segmap_aug.draw_on_image(image_aug)[0]) # column 4
    cells.append(segmap_aug.draw(size=image_aug.shape[:2])[0]) # column 5

# Convert cells to a grid image and save.
grid_image = ia.draw_grid(cells, cols=5)
imageio.imwrite("example_segmaps.jpg", grid_image)
```

## 6.3 Using boolean masks

In order to augment masks, you can simply use boolean arrays. Everything else is identical to int32 maps. The below code shows an example and is very similar to the previous code for int32 maps. It notably changes `np.zeros((128, 128, 1), dtype=np.int32)` to `np.zeros((128, 128, 1), dtype=bool).

```python
import imageio
import numpy as np
import imgaug as ia
from imgaug.augmentables.segmaps import SegmentationMapsOnImage

# Load an example image (uint8, 128x128x3).
image = ia.quokka(size=(128, 128), extract="square")

# Create an example mask (bool, 128x128).
# Here, we arbitrarily place a square on the image.
segmap = np.zeros((128, 128, 1), dtype=bool)
segmap[28:71, 35:85, 0] = True
segmap = SegmentationMapsOnImage(segmap, shape=image.shape)

# Draw three columns: (1) original image, (2) original image with mask on top, (3) only mask
cells = [
    image,
    segmap.draw_on_image(image)[0],
    segmap.draw(size=image.shape[:2])[0]
]

# Convert cells to a grid image and save.
grid_image = ia.draw_grid(cells, cols=3)
imageio.imwrite("example_segmaps_bool.jpg", grid_image)
```

## 6.4 Accessing the segmentation map array

After augmentation it is often desired to re-access the segmentation map array. This can be done using `SegmentationMapsOnImage.get_arr()`, which returns a segmentation map array with the same shape and dtype as was originally provided as `arr` to `SegmentationMapsOnImage(arr, ...).`
Fig. 1: Results of the above example code. Columns show: (1) Original image, (2) original segmentation map drawn on original image, (3) augmented image, (4) augmented segmentation map drawn on augmented image, (5) augmented segmentation map drawn on its own.
Fig. 2: Results of the above example code. Columns show: (1) Original image, (2) boolean segmentation map (i.e. mask) drawn on image, (3) boolean segmentation map drawn on its own.

The below code shows an example that accesses and changes the array.

```python
import imageio
import numpy as np
import imgaug as ia
from imgaug.augmentables.segmaps import SegmentationMapsOnImage

# Load an example image (uint8, 128x128x3).
image = ia.quokka(size=(128, 128), extract="square")

# Create an example segmentation map (int32, 128x128).
# Here, we arbitrarily place some squares on the image.
# Class 0 is the background class.
segmap = np.zeros((128, 128, 1), dtype=np.int32)
segmap[28:71, 35:85, 0] = 1
segmap[10:25, 30:45, 0] = 2
segmap[10:25, 70:85, 0] = 3
segmap[10:110, 5:10, 0] = 4
segmap[118:123, 10:110, 0] = 5
segmap1 = SegmentationMapsOnImage(segmap, shape=image.shape)

# Read out the segmentation map's array, change it and create a new segmentation map
arr = segmap1.get_arr()
arr[10:110, 5:10, 0] = 5
segmap2 = ia.SegmentationMapsOnImage(arr, shape=image.shape)

# Draw three columns: (1) original image, (2) original image with unaltered segmentation map on top, (3) original image with altered segmentation map on top
cells = [
    image,
    segmap1.draw_on_image(image)[0],
    segmap2.draw_on_image(image)[0]
]

# Convert cells to grid image and save.
grid_image = ia.draw_grid(cells, cols=3)
imageio.imwrite("example_segmaps_array.jpg", grid_image)
```

6.4. Accessing the segmentation map array
6.5 Resizing and padding

Segmentation maps can easily be resized and padded. The methods are identical to the ones used for heatmaps (see :doc:`examples_heatmaps`), though segmentation maps do not offer resizing via average or max pooling. The resize() method also defaults to nearest neighbour interpolation (instead of cubic interpolation) and it is recommended to not change that.

The functions for resizing and padding are:

- `SegmentationMapsOnImage.resize(sizes, interpolation="nearest")`: Resizes to sizes given as a tuple (height, width). Interpolation can be nearest, linear, cubic and area, but only nearest is actually recommended.

- `SegmentationMapsOnImage.pad(top=0, right=0, bottom=0, left=0, mode="constant", cval=0)`: Pads the segmentation map by given pixel amounts. Uses by default constant value padding with value 0, i.e. zero-padding. Possible padding modes are the same as for `numpy.pad()`, i.e. constant, edge, linear_ramp, maximum, mean, median, minimum, reflect, symmetric and wrap.

- `SegmentationMapsOnImage.pad_to_aspect_ratio(aspect_ratio, mode="constant", cval=0, return_pad_amounts=False)`: Same as pad(), but pads an image towards a desired aspect ratio (ratio = width / height). E.g. use 1.0 for squared segmentation maps or 2.0 for maps that are twice as wide as they are high.
7.1 Introduction

When augmenting images during experiments, usually one wants to augment each image in different ways. E.g. when rotating images, not every image is supposed to be rotated by 10 degrees. Instead, only some are supposed to be rotated by 10 degrees, while others should be rotated by 17 degrees or 5 degrees or -12 degrees - and so on. This can be achieved using random functions, but reimplementing these, making sure that they generate the expected values and getting them to work with determinism is cumbersome. To avoid all of this work, the library uses Stochastic Parameters. These are usually abstract representations of probability distributions, e.g. the normal distribution $N(0, 1.0)$ or the uniform range $[0.0, 10.0]$. Basically all augmenters accept these stochastic parameters, making it easy to control value ranges. They are all adapted to work with determinism out of the box.

The below code shows their usage:

```python
from imgaug import augmenters as iaa
from imgaug import parameters as iap

seq = iaa.Sequential(
    iaa.GaussianBlur(
        sigma=iap.Uniform(0.0, 1.0)
    ),
    iaa.ContrastNormalization(
        iap.Choice(
            [1.0, 1.5, 3.0],
            p=[0.5, 0.3, 0.2]
        )
    ),
    iaa.Affine(
        rotate=iap.Normal(0.0, 30),
        translate_px=iap.RandomSign(iap.Poisson(3))
    ),
    iaa.AddElementwise(
        iap.Discretize(
            (iap.Beta(0.5, 0.5) * 2 - 1.0) * 64
        )
    ),
)
```

(continues on next page)
The example does the following:

- Blur each image by \( \sigma \), where \( \sigma \) is sampled from the uniform range \([0.0, 1.0)\). Example values: 0.053, 0.414, 0.389, 0.277, 0.981.
- Increase the contrast either to 100% (50% chance of being chosen) or by 150% (30% chance of being chosen) or 300% (20% chance of being chosen).
- Rotate each image by a random amount of degrees, where the degree is sampled from the normal distribution \( N(0, 30) \). Most of the values will be in the range -60 to 60.
- Translate each image by \( n \) pixels, where \( n \) is sampled from a poisson distribution with alpha=3 (pick should be around \( x=3 \)). As we can't translate by a fraction of a pixel, we pick a discrete distribution here, which poisson is. However, we do not just want to translate towards the right/top (only positive values). So we randomly flip the sign sometimes to get negative pixel amounts too.
- Add to each pixel a random value, sampled from the beta distribution \( \text{Beta}(0.5, 0.5) \). This distribution has its peaks around 0.0 and 1.0. We multiply this with 2 and subtract 1 to get it into the range \([-1, 1]\). Then we multiply by 64 to get the range \([-64, 64]\). As we beta distribution is continuous, we convert it to a discrete distribution. The result is that a lot of pixel intensities are shifted by -64 or 64 (or a value very close to these two). Some other pixel intensities are kept (mostly) at their old values.
- We use Multiply to make each image brighter. The brightness increase is sampled from a normal distribution, converted to have only positive values. So most values are expected to be in the range 0.0 to 0.2. We add 1.0 to set the brightness to 1.0 (100%) to 1.2 (120%).

7.2 Continuous Probability Distributions

The following continuous probability distributions are available:

- \( \text{Normal}(\text{loc}, \text{scale}) \): The popular normal distribution with mean \( \text{loc} \) and standard deviation \( \text{scale} \). Example:

```python
from imgaug import parameters as iap
params = [
    iap.Normal(0, 1),
    iap.Normal(5, 3),
    iap.Normal(iap.Choice([-3, 3]), 1),
    iap.Normal(iap.Uniform(-3, 3), 1)
] iap.show_distributions_grid(params)
```

- \( \text{Laplace}(\text{loc}, \text{scale}) \): Similarly shaped to a normal distribution. Has its peak at \( \text{loc} \) and width \( \text{scale} \). Example:

```python
from imgaug import parameters as iap
params = [
    iap.Laplace(0, 1),
    iap.Laplace(5, 3),
    iap.Laplace(iap.Choice([-3, 3]), 1),
    iap.Laplace(iap.Uniform(-3, 3), 1)
]
```

(continues on next page)
• ChiSquare(df): The chi-square (“X^2”) distribution with df degrees of freedom. Roughly similar to a continuous version of the poisson distribution. Has its peak at df and no negative values, only positive ones. Example:

```python
from imgaug import parameters as iap
defparams = [
    iap.ChiSquare(1),
    iap.ChiSquare(3),
    iap.ChiSquare(iap.Choice([1, 5])),
    iap.ChiSquare(iap.Choice([1, 5])),
]
```
• **Weibull(a):** Weibull distribution with shape a. Example:

```python
from imgaug import parameters as iap
params = [
    iap.Weibull(0.5),
    iap.Weibull(1),
    iap.Weibull(1.5),
    iap.Weibull((0.5, 1.5))
]
```
• Uniform\((a, b)\): Uniform distribution in the range \([a, b)\). Example:

```python
from imgaug import parameters as iap
params = [
    iap.Uniform(0, 1),
    iap.Uniform(iap.Normal(-3, 1), iap.Normal(3, 1)),
    iap.Uniform([-1, 0], 1),
    iap.Uniform((-1, 0), 1)
]
iap.show_distributions_grid(params)
```
- **Beta(alpha, beta):** Beta distribution with parameters $alpha$ and $beta$. Example:

```python
from imgaug import parameters as iap
params = [
    iap.Beta(0.5, 0.5),
    iap.Beta(2.0, 2.0),
    iap.Beta(1.0, 0.5),
    iap.Beta(0.5, 1.0)
]
iap.show_distributions_grid(params)
```
7.3 Discrete Probability Distributions

The following discrete probability distributions are available:

- **Binomial(p)**: The common binomial distribution with probability \( p \). Useful to simulate coinflips. Example:

  ```python
  from imgaug import parameters as iap
  params = [
    iap.Binomial(0.5),
    iap.Binomial(0.9)
  ]
  iap.show_distributions_grid(params)
  ```

- **DiscreteUniform(a, b)**: The discrete uniform distribution in the range \([a..b]\). Example:

  ```python
  from imgaug import parameters as iap
  params = [
    iap.DiscreteUniform(0, 10),
    iap.DiscreteUniform(-10, 10),
    iap.DiscreteUniform([-10, -9, -8, -7], 10),
    iap.DiscreteUniform((-10, -7), 10)
  ]
  iap.show_distributions_grid(params)
  ```

- **Poisson(lam)**: Poisson distribution with shape \( \text{lam} \). Generates no negative values. Example:

  ```python
  from imgaug import parameters as iap
  params = [
    iap.Poisson(1),
    iap.Poisson(2.5),
    iap.Poisson((1, 2.5)),
    iap.RandomSign(iap.Poisson(2.5))
  ]
  iap.show_distributions_grid(params)
  ```
7.3. Discrete Probability Distributions
7.4 Arithmetic

The library supports arithmetic operations on stochastic parameters. This allows to modify values sampled from distributions or combine several distributions with each other.

- **Add(param, val, elementwise)**: Add `val` to the values sampled from `param`. The shortcut is `+`, e.g. `Uniform(...) + 1`. `val` can be a stochastic parameter itself. Usually, only one value is sampled from `val` per sampling run and added to all samples generated by `param`. Alternatively, `elementwise` can be set to `True` in order to generate as many samples from `val` as from `param` and add them elementwise. Note that `Add` merely adds to the results of `param` and does not combine probability density functions (see e.g. example image 3 and 4). Example:

```python
from imgaug import parameters as iap
params = [
    iap.Uniform(0, 1) + 1,  # identical to: Add(Uniform(0, 1), 1)
    iap.Add(iap.Uniform(0, 1), iap.Choice([0, 1], p=[0.7, 0.3])),
    iap.Normal(0, 1) + iap.Uniform(-5.5, -5) + iap.Uniform(5, 5.5),
    iap.Normal(0, 1) + iap.Uniform(-7, 5) + iap.Poisson(3),
    iap.Add(iap.Normal(-3, 1), iap.Normal(3, 1)),
    iap.Add(iap.Normal(-3, 1), iap.Normal(3, 1), elementwise=True)
]
iap.show_distributions_grid(params,
    rows=2,
    sample_sizes=[  # (iterations, samples per iteration)
        (1000, 1000), (1000, 1000), (1000, 1000),
        (1000, 1000), (1, 100000), (1, 100000)
    ]
)```

![Image showing distributions](image-url)
Subtract(param, val, elementwise): Same as Add, but subtracts val from the results of param. The shortcut is -, e.g. Uniform(...) - 1.

Multiply(param, val, elementwise): Same as Add, but multiplies val with the results of param. The shortcut is *, e.g. Uniform(...) * 2. Example:

```python
from imgaug import parameters as iap
params = [
    iap.Uniform(0, 1) * 2,  # identical to: Multiply(Uniform(0, 1), 2)
    iap.Multiply(iap.Uniform(0, 1), iap.Choice([0, 1], p=[0.7, 0.3])),
    (iap.Normal(0, 1) * iap.Uniform(-5.5, -5)) * iap.Uniform(5, 5.5),
    iap.Multiply(iap.Uniform(-7, 5)) * iap.Poisson(3),
    iap.Multiply(iap.Normal(-3, 1), iap.Normal(3, 1)),
    iap.Multiply(iap.Normal(-3, 1), iap.Normal(3, 1), elementwise=True)
]
iap.show_distributions_grid(
    params,
    rows=2,
    sample_sizes=[  # (iterations, samples per iteration)
        (1000, 1000), (1000, 1000), (1000, 1000),
        (1000, 1000), (1, 100000), (1, 100000)
    ]
)
```

Divide(param, val, elementwise): Same as Multiply, but divides by val. The shortcut is /, e.g. Uniform(...) / 2. Division by zero is automatically prevented (zeros are replaced by ones). Example:

```python
from imgaug import parameters as iap

(continues on next page)```
params = [
    iap.Uniform(0, 1) / 2, # identical to: Divide(Uniform(0, 1), 2)
    iap.Divide(iap.Uniform(0, 1), iap.Choice([0, 2], p=[0.7, 0.3])),
    (iap.Normal(0, 1) / iap.Uniform(-5.5, -5)) / iap.Uniform(5, 5.5),
    (iap.Normal(0, 1) * iap.Uniform(-7, 5)) / iap.Poisson(3),
    iap.Divide(iap.Normal(-3, 1), iap.Normal(3, 1)),
    iap.Divide(iap.Normal(-3, 1), iap.Normal(3, 1), elementwise=True)
]

iap.show_distributions_grid(
    params,
    rows=2,
    sample_sizes=
    [(1000, 1000), (1000, 1000), (1000, 1000),
     (1000, 1000), (1, 100000), (1, 1000000)]
)

- **Power(param, val, elementwise):** Same as Add, but raises sampled values to the exponent val. The shortcut is `**`. Example:

```python
from imgaug import parameters as iap
def powerful_expansion():
    params = [
        iap.Uniform(0, 1) ** 2, # identical to: Power(Uniform(0, 1), 2)
        iap.Clip(iap.Uniform(-1, 1) ** iap.Normal(0, 1), -4, 4)
    ]
    iap.show_distributions_grid(params, rows=1)
```
7.5 Special Parameters

- **Deterministic(v)**: A constant. Upon sampling, this always returns v.

- **Choice(values, replace=True, p=None)**: Upon sampling, this parameter picks randomly elements from a list values. If replace is set to True (default), the picking happens with replacement. By default, all elements have the same probability of being picked. This can be modified using p. Note that values may also contain strings and other stochastic parameters. In the latter case, each picked parameter will be replaced by a sample from that parameter. This allows merging of probability mass functions, but is a rather slow process. All elements in values should have the same datatype (except for stochastic parameters). Example:

```python
from imgaug import parameters as iap
params = [
    iap.Choice([0, 1, 2]),
    iap.Choice([0, 1, 2], p=[0.15, 0.5, 0.35]),
    iap.Choice([iap.Normal(-3, 1), iap.Normal(3, 1)]),
    iap.Choice([iap.Normal(-3, 1), iap.Poisson(3)])
]
iap.show_distributions_grid(params)
```

- **Clip(param, minval=None, maxval=None)**: Clips the values sampled from param to the range [minval, maxval]. minval and maxval may be None. In that case, only minimum or maximum clipping is applied (depending on what is None). Example:

```python
from imgaug import parameters as iap
params = [
    iap.Clip(iap.Normal(0, 1), -2, 2),
    iap.Clip(iap.Normal(0, 1), -2, None)
]
iap.show_distributions_grid(params, rows=1)
```

- **Discretize(param)**: Converts a continuous parameter param into a discrete one (using rounding). Discrete parameters are not changed. Example:
• **Absolute(param)**: Applies an absolute function to each value sampled from `param`, turning them to positive ones. Example:

```python
from imgaug import parameters as iap

params = [
    iap.Discretize(iap.Normal(0, 1)),
    iap.Discretize(iap.ChiSquare(3))
]

iap.show_distributions_grid(params, rows=1)
```
• **RandomSign(param, p_positive=0.5)**: Randomly flips the signs of values sampled from `param`. Optionally, the probability of flipping a value's sign towards positive can be set. Example:

```python
from imgaug import parameters as iap
params = [
    iap.ChiSquare(3),
    iap.RandomSign(iap.ChiSquare(3)),
    iap.RandomSign(iap.ChiSquare(3), p_positive=0.75),
    iap.RandomSign(iap.ChiSquare(3), p_positive=0.9)
]  
iap.show_distributions_grid(params)
```

• **ForceSign(param, positive, mode="invert", reroll_count_max=2)**: Converts all values sampled from `param` to positive or negative ones. Signs of positive/negative values may simply be flipped (`mode="invert"`) or resampled from `param` (`mode="reroll"`). When rerolling, the number of iterations is limited to `reroll_count_max` (afterwards `mode="invert"` is used). Example:

```python
from imgaug import parameters as iap
params = [
    iap.ForceSign(iap.Normal(0, 1), positive=True),
    iap.ChiSquare(3) - 3.0,
    iap.ForceSign(iap.ChiSquare(3) - 3.0, positive=True, mode="invert"),
    iap.ForceSign(iap.ChiSquare(3) - 3.0, positive=True, mode="reroll")
]  
iap.show_distributions_grid(params)
```

• **Positive(other_param, mode="invert", reroll_count_max=2)**: Shortcut for `ForceSign` with `positive=True`. E.g. `Positive(Normal(0, 1))` restricts a normal distribution to only positive values.
• `Negative(other_param, mode="invert", reroll_count_max=2)`: Shortcut for `ForceSign` with `positive=False`. E.g. `Negative(Normal(0, 1))` restricts a normal distribution to only negative values.

• `FromLowerResolution(other_param, size_percent=None, size_px=None, method="nearest", min_size=1)`: Intended for 2d-sampling processes, e.g. for masks. Samples these in a lower resolution space. E.g. instead of sampling a mask at 100x100, this allows to sample it at 10x10 and then upsample to 100x100. One advantage is, that this can be faster. Another possible use is, that the upsampling may result in large, correlated blobs (linear interpolation) or rectangles (nearest neighbour interpolation).

### 7.6 Noise Parameters

TODO
8.1 Introduction

Most augmenters in the library affect images in uniform ways per image. Sometimes one might not want that and instead desires more localized effects (e.g. change the color of some image regions, while keeping the others unchanged) or wants to keep a fraction of the old image (e.g. blur the image and mix in a bit of the unblurred image). Blending augmenters are intended for these use cases. They either mix two images using a constant alpha factor or using a pixel-wise mask. Below image shows examples.

```python
# First row
iaa.BlendAlpha(
    (0.0, 1.0),
    foreground=iaa.MedianBlur(11),
    per_channel=True
)

# Second row
iaa.BlendAlphaSimplexNoise(
    foreground=iaa.EdgeDetect(1.0),
    per_channel=False
)

# Third row
iaa.BlendAlphaSimplexNoise(
    foreground=iaa.EdgeDetect(1.0),
    background=iaa.LinearContrast((0.5, 2.0)),
    per_channel=0.5
)

# Forth row
iaa.BlendAlphaFrequencyNoise(
    foreground=iaa.Affine(
        rotate=(-10, 10),
        translate_px={"x": (-4, 4), "y": (-4, 4)}
    )
)
```
8.2 Imagewise Constant Alphas Values

The augmenter `imgaug.augmenters.blend.BlendAlpha` allows to mix the results of two augmentation branches using an alpha factor that is constant throughout the whole image, i.e. it follows roughly \( I_{\text{blend}} = \alpha I_{\text{fg}} + (1 - \alpha) I_{\text{bg}} \) per image, where \( I_{\text{fg}} \) is the image from the foreground branch and \( I_{\text{bg}} \) is the image from the background branch. Often, the first branch will be an augmented version of the image and the second branch will be the identity function, leading to a blend of augmented and unaugmented image. The background branch can also contain non-identity augmenters, leading to a blend of two distinct augmentation effects.

`imgaug.augmenters.blend.BlendAlpha` is already built into some augmenters as a parameter, e.g. into `imgaug.augmenters.convolutional.EdgeDetect`.

The below example code generates images that are a blend between `imgaug.augmenters.convolutional.Sharpen` and `imgaug.augmenters.arithmetic.CoarseDropout`. Notice how the sharpening does not affect the black rectangles from dropout, as the two augmenters are both applied to the original images and merely blended.

```python
import imgaug as ia
from imgaug import augmenters as iaa
ia.seed(1)

# Example batch of images.
# The array has shape (8, 128, 128, 3) and dtype uint8.
images = np.array([ia.quokka(size=(128, 128)) for _ in range(8)], dtype=np.uint8)
```

8.2. Imagewise Constant Alphas Values
seq = iaa.BlendAlpha(
    factor=(0.2, 0.8),
    foreground=iaa.Sharpen(1.0, lightness=2),
    background=iaa.CoarseDropout(p=0.1, size_px=8)
)
images_aug = seq(images=images)

Fig. 2: Mixing imgaug.augmenters.convolutional.Sharpen and imgaug.augmenters.
arithmetic.CoarseDropout via imgaug.augmenters.blend.BlendAlpha. The resulting effect
is very different from executing them in sequence.

Similar to other augmenters, imgaug.augmenters.blend.BlendAlpha supports a per_channel mode, in
which it samples blending strengths for each channel independently. As a result, some channels may show more
from the foreground (or background) branch’s outputs than other channels. This can lead to visible color effects. The
following example is the same as the one above, only per_channel was activated.

iaa.BlendAlpha(..., per_channel=True)

imgaug.augmenters.blend.BlendAlpha can also be used with augmenters that change the position of pix-
els, leading to “ghost” images. (This should not be done when also augmenting keypoints, as their position becomes
unclear.)

seq = iaa.BlendAlpha(
    factor=(0.2, 0.8),
    foreground=iaa.Affine(rotate=(-20, 20)),
    per_channel=True
)
Fig. 3: Mixing `imgaug.augmenters.convolutional.Sharpen` and `imgaug.augmenters.arithmetic.CoarseDropout` via `imgaug.augmenters.blend.BlendAlpha` and `per_channel` set to True.

Fig. 4: Mixing original images with their rotated version. Some channels are more visibly rotated than others.
8.3 BlendAlphaSimplexNoise

`imgaug.augmenters.blend.BlendAlpha` uses a constant blending factor per image (or per channel). This limits its possibilities. Often, a more localized factor is desired to create unusual patterns. `imgaug.augmenters.blend.BlendAlphaSimplexNoise` is an augmenter that does that. It generates continuous masks following simplex noise and uses them to perform local blending. The following example shows a combination of `imgaug.augmenters.blend.BlendAlphaSimplexNoise` and `imgaug.augmenters.arithmetic.Multiply` (with `per_channel=True`) that creates blobs of various colors in the image.

```python
import imgaug as ia
from imgaug import augmenters as iaa

ia.seed(1)

# Example batch of images.
# The array has shape (8, 128, 128, 3) and dtype uint8.
images = np.array([ia.quokka(size=(128, 128)) for _ in range(8)], dtype=np.uint8)

seq = iaa.SimplexNoiseAlpha(
    foreground=iaa.Multiply(iap.Choice([0.5, 1.5]), per_channel=True)
)

images_aug = seq(images=images)
```

![Fig. 5: Mixing original images with their versions modified by `imgaug.augmenters.arithmetic.Multiply` (with `per_channel` set to True). Simplex noise masks are used for the blending process, leading to blobby patterns.](image)

`imgaug.augmenters.blend.BlendAlphaSimplexNoise` also supports `per_channel=True`, leading to unique noise masks sampled per channel. The following example shows the combination of `imgaug.augmenters.blend.BlendAlphaSimplexNoise` (with `per_channel=True`) and `imgaug.```
Even though `imgaug.augmenters.convolutional.EdgeDetect` usually generates black and white images (white=edges, black=everything else), here the combination leads to strong color effects as the channel-wise noise masks only blend EdgeDetect’s result for some channels.

```
seq = iaa.BlendAlphaSimplexNoise(
  foreground=iaa.EdgeDetect(1.0),
  per_channel=True
)
```

Fig. 6: Blending images via simplex noise can lead to unexpected but diverse patterns when `per_channel` is set to `True`. Here, a mixture of original images with `EdgeDetect(1.0)` is used.

`imgaug.augmenters.blend.BlendAlphaSimplexNoise` uses continuous noise masks (2d arrays with values in the range [0.0, 1.0]) to blend images. The below image shows examples of 64x64 noise masks generated by `imgaug.augmenters.blend.BlendAlphaSimplexNoise` with default settings. Values close to 1.0 (white) indicate that pixel colors will be taken from the first image source, while 0.0 (black) values indicate that pixel colors will be taken from the second image source. (Often only one image source will be given in the form of augmenters and the second will fall back to the original images fed into `imgaug.augmenters.blend.BlendAlphaSimplexNoise`.)

Fig. 7: Examples of noise masks generated by `imgaug.augmenters.blend.BlendAlphaSimplexNoise` using default settings.

`imgaug.augmenters.blend.BlendAlphaSimplexNoise` generates its noise masks in low resolution images and then up scales the masks to the size of the input images. During upscaling it usually uses nearest neighbour interpolation (`nearest`), linear interpolation (`linear`) or cubic interpolation (`cubic`). Nearest neighbour interpolation leads to noise maps with rectangular blobs. The below example shows noise maps generated when only using nearest neighbour interpolation.
```
seq = iaa.BlendAlphaSimplexNoise(
    ...,  
    upscale_method="nearest"
)
```

Fig. 8: Examples of noise masks generated by `imgaug.augmenters.blend.BlendAlphaSimplexNoise` when restricting the upscaling method to nearest.

Similarly, the following example shows noise maps generated when only using linear interpolation.

```
seq = iaa.BlendAlphaSimplexNoise(
    ...,  
    upscale_method="linear"
)
```

Fig. 9: Examples of noise masks generated by `imgaug.augmenters.blend.BlendAlphaSimplexNoise` when restricting the upscaling method to linear.

### 8.4 FrequencyNoiseAlpha

`imgaug.augmenters.blend.BlendAlphaFrequencyNoise` is mostly identical to `imgaug.augmenters.blend.BlendAlphaSimplexNoise`. In contrast to `imgaug.augmenters.blend.BlendAlphaSimplexNoise` it uses a different sampling process to generate the blend masks. The process is based on starting with random frequencies, weighting them with a random exponent and then transforming from frequency domain to spatial domain. When using a low exponent value this leads to large, smooth blobs. Slightly higher exponents lead to cloudy patterns. High exponent values lead to recurring, small patterns. The below example shows the usage of `imgaug.augmenters.blend.BlendAlphaFrequencyNoise`.

```
import imgaug as ia
from imgaug import augmenters as iaa
from imgaug import parameters as iap

ia.seed(1)

# Example batch of images.
# The array has shape (8, 64, 64, 3) and dtype uint8.
images = np.array([ia.quokka(size=(128, 128)) for _ in range(8)], dtype=np.uint8)

seq = iaa.BlendAlphaFrequencyNoise(
    foreground=iaa.Multiply(iap.Choice([0.5, 1.5]), per_channel=True)
)

images_aug = seq.augment_images(images)
```
Fig. 10: Mixing original images with their versions modified by `imgaug.augmenters.arithmetic.Multiply` (with `per_channel` set to True). Frequency noise masks are used for the blending process, leading to blobby patterns.

Similarly to simplex noise, `imgaug.augmenters.blend.BlendAlphaFrequencyNoise` also supports `per_channel=True`, leading to different noise maps per image channel.

```python
seq = iaa.BlendAlphaFrequencyNoise(
    foreground=iaa.EdgeDetect(1.0),
    per_channel=True
)
```

The below image shows random example noise masks generated by `imgaug.augmenters.blend.BlendAlphaFrequencyNoise` with default settings.

The following image shows the effects of varying exponent between -4.0 and 4.0. To show these effects more clearly, a few features of `imgaug.augmenters.blend.BlendAlphaFrequencyNoise` were deactivated (e.g. multiple iterations). In the code, E is the value of the exponent (e.g. E=−2.0).

```python
seq = iaa.BlendAlphaFrequencyNoise(
    exponent=E,
    foreground=iaa.Multiply(iap.Choice([0.5, 1.5]), per_channel=True),
    size_px_max=32,
    upscale_method="linear",
    iterations=1,
    sigmoid=False
)
```

Similarly to `imgaug.augmenters.blend.BlendAlphaSimplexNoise`, `imgaug.augmenters.blend.BlendAlphaFrequencyNoise` also generates the noise masks as low resolution versions and then upscales them to the full image size. The following images show the usage of nearest neighbour interpolation (`upscale_method="nearest"`) and linear interpolation (`upscale_method="linear"`).
Fig. 11: Blending images via frequency noise can lead to unexpected but diverse patterns when `per_channel` is set to `True`. Here, a mixture of original images with `imgaug.augmenters.convolutional.EdgeDetect(1.0)` is used.

Fig. 12: Examples of noise masks generated by `imgaug.augmenters.blend.FrequencyNoiseAlpha` using default settings.

Fig. 13: Examples of noise masks generated by `imgaug.augmenters.blend.BlendAlphaFrequencyNoise` using default settings with varying exponents.
**8.5 IterativeNoiseAggregator**

Both `imgaug.augmenters.blend.BlendAlphaSimplexNoise` and `imgaug.augmenters.blend.BlendAlphaFrequencyNoise` wrap around `imgaug.parameters.IterativeNoiseAggregator`, a component to generate noise masks in multiple iterations. It has parameters for the number of iterations (1 to N) and for the aggregation methods, which controls how the noise masks from the different iterations are to be combined. Valid aggregation methods are "min", "avg" and "max", where `min` takes the minimum over all iteration’s masks, `max` the maximum and `avg` the average. As a result, masks generated with method `min` tend to be close to 0.0 (mostly black values), those generated with `max` close to 1.0 and `avg` converges towards 0.5. (0.0 means that the results of the second image dominate the final image, so in many cases the original images before the augmenter). The following image shows the effects of changing the number of iterations when combining `imgaug.parameters.FrequencyNoise` with `imgaug.parameters.IterativeNoiseAggregator`.

```
# This is how the iterations would be changed for BlendAlphaFrequencyNoise.
# (Same for BlendAlphaSimplexNoise.)
seq = iaa.BlendAlphaFrequencyNoise(
    ...
    iterations=N
)
```

The following image shows the effects of changing the aggregation mode (with varying iterations).

```
# This is how the iterations and aggregation method would be changed for
# BlendAlphaFrequencyNoise. (Same for BlendAlphaSimplexNoise.)
seq = iaa.BlendAlphaFrequencyNoise(
    ...
    ...
)
```

(continues on next page)
8.6 Sigmoid

Generated noise masks can often end up having many values around 0.5, especially when running `imgaug.parameters.IterativeNoiseAggregator` with many iterations and aggregation method `avg`. This can be undesired. `imgaug.parameters.Sigmoid` is a method to compensate that. It applies a sigmoid function to the noise masks, forcing the values to mostly lie close to 0.0 or 1.0 and only rarely in between. This can lead to blobs of values close to 1.0 ("use only colors from images coming from source A"), surrounded by blobs with values close to 0.0 ("use only colors from images coming from source B"). This is similar to taking either from one image source (per pixel) or the other, but usually not both. Sigmoid is inte-
grated into both class:`imgaug.augmenters.blend.BlendAlphaSimplexNoise` and `imgaug.augmenters.blend.BlendAlphaFrequencyNoise`. It can be dynamically activated/deactivated and has a threshold parameter that controls how aggressive and pushes the noise values towards 1.0.

```python
# This is how the Sigmoid would be activated/deactivated for
# BlendAlphaFrequencyNoise (same for BlendAlphaSimplexNoise). P is the
# probability of the Sigmoid being activated (can be True/False), T is the
# threshold (sane values are usually around -10 to +10, can be a
# tuple, e.g. sigmoid_thresh=(-10, 10), to indicate a uniform range).
seq = iaa.BlendAlphaFrequencyNoise(
    ...
    sigmoid=P,
    sigmoid_thresh=T
)
```

The below image shows the effects of applying `imgaug.parameters.Sigmoid` to noise masks generated by `imgaug.parameters.FrequencyNoise`.

Fig. 18: Examples of noise maps without and with activated `imgaug.parameters.Sigmoid` (noise maps here from `imgaug.parameters.FrequencyNoise`).

The below image shows the effects of varying the sigmoid’s threshold. Lower values place the threshold further to the “left” (lower x values), leading to more x-values being above the threshold values, leading to more 1.0s in the noise masks.

Fig. 19: Examples of varying the `imgaug.parameters.Sigmoid` threshold from $-10.0$ to $10.0$. 

8.6. Sigmoid
9.1 augmenters.meta

9.1.1 Sequential

List augmenter that may contain other augmenters to apply in sequence or random order.

API link: Sequential

Example. Apply in predefined order:

```python
import imgaug.augmenters as iaa
aug = iaa.Sequential([  
    iaa.Affine(translate_px={"x":-40}),  
    iaa.AdditiveGaussianNoise(scale=0.1*255)  
])
```

Example. Apply in random order (note that the order is sampled once per batch and then the same for all images within the batch):

```python
aug = iaa.Sequential([  
    iaa.Affine(translate_px={"x":-40}),  
    iaa.AdditiveGaussianNoise(scale=0.1*255)  
], random_order=True)
```

9.1.2 SomeOf

List augmenter that applies only some of its children to images.

API link: SomeOf

Example. Apply two of four given augmenters:
**import imgaug.augmenters as iaa**

```python
aug = iaa.SomeOf(2, [  
    iaa.Affine(rotate=45),
    iaa.AdditiveGaussianNoise(scale=0.2*255),
    iaa.Add(50, per_channel=True),
    iaa.Sharpen(alpha=0.5)
  ])
```

**Example.** Apply 0 to `<max>` given augmenters (where `<max>` is automatically replaced with the number of children):

```python
aug = iaa.SomeOf((0, None), [  
    iaa.Affine(rotate=45),
    iaa.AdditiveGaussianNoise(scale=0.2*255),
    iaa.Add(50, per_channel=True),
    iaa.Sharpen(alpha=0.5)
  ])
```

**Example.** Pick two of four given augmenters and apply them in random order:

```python
aug = iaa.SomeOf(2, [  
    iaa.Affine(rotate=45),
    iaa.AdditiveGaussianNoise(scale=0.2*255),
    iaa.Add(50, per_channel=True),
    iaa.Sharpen(alpha=0.5)
  ], random_order=True)
```

### 9.1.3 OneOf

Augmenter that always executes exactly one of its children.

**API link:** `OneOf()`

**Example.** Apply one of four augmenters to each image:
9.1.4 Sometimes

Augment only p percent of all images with one or more augmenters.
API link: *Sometimes*

**Example.** Apply gaussian blur to about 50% of all images:

```python
import imgaug.augmenters as iaa
aug = iaa.Sometimes(0.5, iaa.GaussianBlur(sigma=2.0))
```

**Example.** Apply gaussian blur to about 50% of all images. Apply a mixture of affine rotations and sharpening to the other 50%.

```python
aug = iaa.Sometimes(
    0.5,
    iaa.GaussianBlur(sigma=2.0),
    iaa.Sequential([iaa.Affine(rotate=45), iaa.Sharpen(alpha=1.0)])
)
```

---

**9.1.5 WithChannels**

Apply child augmenters to specific channels.

API link: *WithChannels*

**Example.** Increase each pixel’s R-value (redness) by 10 to 100:

```python
import imgaug.augmenters as iaa
aug = iaa.WithChannels(0, iaa.Add((10, 100)))
```

**Example.** Rotate each image’s red channel by 0 to 45 degrees:

```python
aug = iaa.WithChannels(0, iaa.Affine(rotate=(0, 45)))
```
9.1.6 Identity

Augmenter that does not change the input data.
This augmenter is useful e.g. during validation/testing as it allows to re-use the training code without actually performing any augmentation.

API link: Identity

Example. Create an augmenter that does not change inputs:

```python
import imgaug.augmenters as iaa
aug = iaa.Identity()
```

9.1.7 Noop

Alias for augmenter Identity.
It is recommended to now use Identity. Noop might be deprecated in the future.

API link: Noop

Example. Create an augmenter that does nothing:

```python
import imgaug.augmenters as iaa
aug = iaa.Noop()
```

9.1.8 Lambda

Augmenter that calls a lambda function for each batch of input image.

API link: Lambda

Example. Replace in every image each fourth row with black pixels:

```python
import imgaug.augmenters as iaa

def img_func(images, random_state, parents, hooks):
    for img in images:
        img[::4] = 0
    return images

def keypoint_func(keypoints_on_images, random_state, parents, hooks):
    return keypoints_on_images

aug = iaa.Lambda(img_func, keypoint_func)
```
9.1.9 AssertLambda

Augmenter that runs an assert on each batch of input images using a lambda function as condition.

API link: AssertLambda

TODO examples

9.1.10 AssertShape

Augmenter to make assumptions about the shape of input image(s) and keypoints.

API link: AssertShape

Example. Check if each image in a batch has shape 32x32x3, otherwise raise an exception:

```python
import imgaug.augmenters as iaa
seq = iaa.Sequential([
    iaa.AssertShape(((None, 32, 32, 3)),
    iaa.Fliplr(0.5) # only executed if shape matches
])
```

Example. Check if each image in a batch has a height in the range 32<=x<64, a width of exactly 64 and either 1 or 3 channels:

```python
seq = iaa.Sequential([
    iaa.AssertShape((None, (32, 64), 32, [1, 3])),
    iaa.Fliplr(0.5)
])
```

9.1.11 ChannelShuffle

Randomize the order of channels in input images.

API link: ChannelShuffle

Example. Shuffle all channels of 35% of all images:

```python
import imgaug.augmenters as iaa
aug = iaa.ChannelShuffle(0.35)
```
Example. Shuffle only channels 0 and 1 of 35% of all images. As the new channel orders 0, 1 and 1, 0 are both valid outcomes of the shuffling, it means that for $0.35 \times 0.5 = 0.175$ or 17.5% of all images the order of channels 0 and 1 is inverted.

```python
aug = iaa.ChannelShuffle(0.35, channels=[0, 1])
```

9.1.12 RemoveCBAsByOutOfImageFraction

Remove coordinate-based augmentables exceeding an out of image fraction.

This augmenter inspects all coordinate-based augmentables (e.g. bounding boxes, line strings) within a given batch and removes any such augmentable which’s out of image fraction is exactly a given value or greater than that. The out of image fraction denotes the fraction of the augmentable’s area that is outside of the image, e.g. for a bounding box that has half of its area outside of the image it would be 0.5.

API link: RemoveCBAsByOutOfImageFraction

Example. Translate all inputs by -100 to 100 pixels on the x-axis, then remove any coordinate-based augmentable (e.g. bounding boxes) which has at least 50% of its area outside of the image plane:

```python
import imgaug as ia
import imgaug.augmenters as iaa
image = ia.quokka_square((100, 100))
bb = ia.BoundingBox(x1=50-25, y1=0, x2=50+25, y2=100)
bbsoi = ia.BoundingBoxesOnImage([bb], shape=image.shape)
aug_without = iaa.Affine(translate_px="x": (-100, 100))
aug_with = iaa.Sequential([
    iaa.Affine(translate_px="x": 51)),
    iaa.RemoveCBAsByOutOfImageFraction(0.5)
])
```
image_without, bbsoi_without = aug_without(
    image=image, bounding_boxes=bbsoi)
image_with, bbsoi_with = aug_with(
    image=image, bounding_boxes=bbsoi)

assert len(bbsoi_without.bounding_boxes) == 1
assert len(bbsoi_with.bounding_boxes) == 0

9.1.13 ClipCBAsToImagePlanes

Clip coordinate-based augmentables to areas within the image plane.

This augmenter inspects all coordinate-based augmentables (e.g. bounding boxes, line strings) within a given batch and from each of them parts that are outside of the image plane. Parts within the image plane will be retained. This may e.g. shrink down bounding boxes. For keypoints, it removes any single points outside of the image plane. Any augmentable that is completely outside of the image plane will be removed.

API link: ClipCBAsToImagePlanes

Example. Translate input data on the x-axis by -100 to 100 pixels, then cut all coordinate-based augmentables (e.g. bounding boxes) down to areas that are within the image planes of their corresponding images:
import imgaug.augmenters as iaa
aug = iaa.Sequential([
    iaa.Affine(translate_px={"x": (-100, 100)}),
    iaa.ClipCBAsToImagePlanes()
])

9.2 augmenters.arithmetic

9.2.1 Add

Add a value to all pixels in an image.

API link: Add

Example. Add random values between -40 and 40 to images, with each value being sampled once per image and then being the same for all pixels:

import imgaug.augmenters as iaa
aug = iaa.Add((-40, 40))

Example. Add random values between -40 and 40 to images. In 50% of all images the values differ per channel (3 sampled value). In the other 50% of all images the value is the same for all channels:

aug = iaa.Add((-40, 40), per_channel=0.5)

9.2.2 AddElementwise

Add values to the pixels of images with possibly different values for neighbouring pixels.

API link: AddElementwise

Example. Add random values between -40 and 40 to images, with each value being sampled per pixel:
Example. Add random values between -40 and 40 to images. In 50% of all images the values differ per channel (3 sampled values per pixel). In the other 50% of all images the value is the same for all channels per pixel:

```python
aug = iaa.AddElementwise((-40, 40), per_channel=0.5)
```

### 9.2.3 AdditiveGaussianNoise

Add noise sampled from gaussian distributions elementwise to images.

API link: [AdditiveGaussianNoise()](#)
Example. Add gaussian noise to an image, sampled once per pixel from a normal distribution $N(0, s)$, where $s$ is sampled per image and varies between 0 and 0.2*255:

```python
import imgaug.augmenters as iaa
aug = iaa.AdditiveGaussianNoise(scale=(0, 0.2*255))
```

Example. Add gaussian noise to an image, sampled once per pixel from $N(0, 0.05*255)$:

```python
aug = iaa.AdditiveGaussianNoise(scale=0.2*255)
```

Example. Add gaussian noise to an image, sampled channelwise from $N(0, 0.2*255)$ (i.e. three independent samples per pixel):

```python
aug = iaa.AdditiveGaussianNoise(scale=0.2*255, per_channel=True)
```

### 9.2.4 AdditiveLaplaceNoise

Add noise sampled from laplace distributions elementwise to images.

The laplace distribution is similar to the gaussian distribution, but puts more weight on the long tail. Hence, this noise will add more outliers (very high/low values). It is somewhere between gaussian noise and salt and pepper noise.

API link: `AdditiveLaplaceNoise()`

Example. Add laplace noise to an image, sampled once per pixel from $\text{Laplace}(0, s)$, where $s$ is sampled per image and varies between 0 and 0.2*255:

```python
import imgaug.augmenters as iaa
aug = iaa.AdditiveLaplaceNoise(scale=(0, 0.2*255))
```

Example. Add laplace noise to an image, sampled once per pixel from $\text{Laplace}(0, 0.2*255)$:

```python
aug = iaa.AdditiveLaplaceNoise(scale=0.2*255)
```
Example. Add laplace noise to an image, sampled channelwise from $\text{Laplace}(0, 0.2 \times 255)$ (i.e. three independent samples per pixel):

```
import imgaug.augmenters as iaa
aug = iaa.AdditiveLaplaceNoise(scale=0.2*255, per_channel=True)
```

### 9.2.5 AdditivePoissonNoise

Add noise sampled from poisson distributions elementwise to images.

Poisson noise is comparable to gaussian noise, as e.g. generated via `AdditiveGaussianNoise`. As poisson distributions produce only positive numbers, the sign of the sampled values are here randomly flipped.

Values of around 20.0 for lam lead to visible noise (for uint8). Values of around 40.0 for lam lead to very visible noise (for uint8). It is recommended to usually set per_channel to True.

API link: `AdditivePoissonNoise()`

Example. Add poisson noise to an image, sampled once per pixel from $\text{Poisson}(\text{lam})$, where lam is sampled per image and varies between 0 and 40:

```
import imgaug.augmenters as iaa
aug = iaa.AdditivePoissonNoise(scale=(0, 40))
```

Example. Add poisson noise to an image, sampled once per pixel from $\text{Poisson}(40)$:

```
aug = iaa.AdditivePoissonNoise(40)
```

Example. Add poisson noise to an image, sampled channelwise from $\text{Poisson}(40)$ (i.e. three independent samples per pixel):

```
aug = iaa.AdditivePoissonNoise(scale=40, per_channel=True)
```
9.2.6 Multiply

Multiply all pixels in an image with a specific value, thereby making the image darker or brighter.

API link: Multiply

Example. Multiply each image with a random value between 0.5 and 1.5:

```python
import imgaug.augmenters as iaa
aug = iaa.Multiply((0.5, 1.5))
```

Example. Multiply 50% of all images with a random value between 0.5 and 1.5 and multiply the remaining 50% channel-wise, i.e. sample one multiplier independently per channel:

```python
aug = iaa.Multiply((0.5, 1.5), per_channel=0.5)
```

9.2.7 MultiplyElementwise

Multiply values of pixels with possibly different values for neighbouring pixels, making each pixel darker or brighter.

API link: MultiplyElementwise

Example. Multiply each pixel with a random value between 0.5 and 1.5:

```python
import imgaug.augmenters as iaa
aug = iaa.MultiplyElementwise((0.5, 1.5))
```

Example. Multiply in 50% of all images each pixel with random values between 0.5 and 1.5 and multiply in the remaining 50% of all images the pixels channel-wise, i.e. sample one multiplier independently per channel and pixel:

```python
aug = iaa.MultiplyElementwise((0.5, 1.5), per_channel=0.5)
```
9.2.8 Cutout

Fill one or more rectangular areas in an image using a fill mode.

See paper “Improved Regularization of Convolutional Neural Networks with Cutout” by DeVries and Taylor.

In contrast to the paper, this implementation also supports replacing image sub-areas with gaussian noise, random intensities or random RGB colors. It also supports non-squared areas. While the paper uses absolute pixel values for the size and position, this implementation uses relative values, which seems more appropriate for mixed-size datasets. The position parameter furthermore allows more flexibility, e.g. gaussian distributions around the center.

Note: This augmenter affects only image data. Other datatypes (e.g. segmentation map pixels or keypoints within the filled areas) are not affected.

Note: Gaussian fill mode will assume that float input images contain values in the interval [0.0, 1.0] and hence sample values from a gaussian within that interval, i.e. from $N(0.5, \text{std}=0.5/3)$.

API link: MultiplyElementwise

Example. Fill per image two random areas, by default with grayish pixels:

```python
import imgaug.augmenters as iaa
aug = iaa.Cutout(nb_iterations=2)
```

Example. Fill per image between one and five areas, each having 20% of the corresponding size of the height and width (for non-square images this results in non-square areas to be filled).

```python
aug = iaa.Cutout(nb_iterations=(1, 5), size=0.2, squared=False)
```

Example. Fill all areas with white pixels:

```python
aug = iaa.Cutout(fill_mode="constant", cval=255)
```
Example. Fill 50% of all areas with a random intensity value between 0 and 256. Fill the other 50% of all areas with random colors.

```python
aug = iaa.Cutout(fill_mode="constant", cval=(0, 255), fill_per_channel=0.5)
```

Example. Fill areas with gaussian channelwise noise (i.e. usually RGB).

```python
aug = iaa.Cutout(fill_mode="gaussian", fill_per_channel=True)
```
9.2.9 Dropout

Augmenter that sets a certain fraction of pixels in images to zero.

API link: `Dropout()`

**Example.** Sample per image a value \( p \) from the range \( 0 \leq p \leq 0.2 \) and then drop \( p \) percent of all pixels in the image (i.e. convert them to black pixels):

```python
import imgaug.augmenters as iaa
aug = iaa.Dropout(p=(0, 0.2))
```

**Example.** Sample per image a value \( p \) from the range \( 0 \leq p \leq 0.2 \) and then drop \( p \) percent of all pixels in the image (i.e. convert them to black pixels), but do this independently per channel in 50% of all images:

```python
aug = iaa.Dropout(p=(0, 0.2), per_channel=0.5)
```

9.2.10 CoarseDropout

Augmenter that sets rectangular areas within images to zero.

API link: `CoarseDropout()`

**Example.** Drop 2% of all pixels by converting them to black pixels, but do that on a lower-resolution version of the image that has 50% of the original size, leading to 2x2 squares being dropped:

```python
import imgaug.augmenters as iaa
aug = iaa.CoarseDropout(0.02, size_percent=0.5)
```

**Example.** Drop 0 to 5% of all pixels by converting them to black pixels, but do that on a lower-resolution version of the image that has 5% to 50% of the original size, leading to large rectangular areas being dropped:

```python
import imgaug.augmenters as iaa
aug = iaa.CoarseDropout((0.0, 0.05), size_percent=(0.02, 0.25))
```
Example. Drop 2% of all pixels by converting them to black pixels, but do that on a lower-resolution version of the image that has 50% of the original size, leading to 2x2 squares being dropped. Also do this in 50% of all images channel-wise, so that only the information of some channels in set to 0 while others remain untouched:

```python
aug = iaa.CoarseDropout(0.02, size_percent=0.15, per_channel=0.5)
```

9.2.11 Dropout2D

Drop random channels from images.

For image data, dropped channels will be filled with zeros.
**Note:** This augmenter may also set the arrays of heatmaps and segmentation maps to zero and remove all coordinate-based data (e.g., it removes all bounding boxes on images that were filled with zeros). It does so if and only if all channels of an image are dropped. If \( nb\_keep\_channels \geq 1 \) then that never happens.

API link: `Dropout2d()`

**Example.** Create a dropout augmenter that drops on average half of all image channels. Dropped channels will be filled with zeros. At least one channel is kept unaltered in each image (default setting).

```
import imgaug.augmenters as iaa
aug = iaa.Dropout2d(p=0.5)
```

**Example.** Create a dropout augmenter that drops on average half of all image channels and may drop all channels in
an image (i.e. images may contain nothing but zeros):

```python
import imgaug.augmenters as iaa
aug = iaa.Dropout2d(p=0.5, nb_keep_channels=0)
```

---

**9.2.12 TotalDropout**

Drop all channels of a defined fraction of all images.
For image data, all components of dropped images will be filled with zeros.

---

**Note:** This augmenter also sets the arrays of heatmaps and segmentation maps to zero and removes all coordinate-
based data (e.g. it removes all bounding boxes on images that were filled with zeros).

API link: `TotalDropout()`

**Example.** Create an augmenter that sets all components of all images to zero:

```python
import imgaug.augmenters as iaa
aug = iaa.TotalDropout(1.0)
```

**Example.** Create an augmenter that sets all components of 50% of all images to zero:

```python
aug = iaa.TotalDropout(0.5)
```

### 9.2.13 ReplaceElementwise

Replace pixels in an image with new values.

API link: `ReplaceElementwise`

**Example.** Replace 10% of all pixels with either the value 0 or the value 255:
import imgaug.augmenters as iaa

aug = ReplaceElementwise(0.1, [0, 255])

Example. For 50% of all images, replace 10% of all pixels with either the value 0 or the value 255 (same as in the previous example). For the other 50% of all images, replace channelwise 10% of all pixels with either the value 0 or the value 255. So, it will be very rare for each pixel to have all channels replaced by 255 or 0.

aug = ReplaceElementwise(0.1, [0, 255], per_channel=0.5)

Example. Replace 10% of all pixels by gaussian noise centered around 128. Both the replacement mask and the gaussian noise are sampled for 50% of all images.
Example. Replace 10% of all pixels by gaussian noise centered around 128. Sample the replacement mask at a lower resolution (8x8 pixels) and upscale it to the image size, resulting in coarse areas being replaced by gaussian noise.
9.2.14 ImpulseNoise

Add impulse noise to images.
This is identical to SaltAndPepper, except that per_channel is always set to True.
API link: ImpulseNoise()

Example. Replace 10% of all pixels with impulse noise:

```python
import imgaug.augmenters as iaa
daug = iaa.ImpulseNoise(0.1)
```

9.2.15 SaltAndPepper

Replace pixels in images with salt/pepper noise (white/black-ish colors).
API link: SaltAndPepper()

Example. Replace 10% of all pixels with salt and pepper noise:

```python
import imgaug.augmenters as iaa
daug = iaa.SaltAndPepper(0.1)
```

Example. Replace channelwise 10% of all pixels with salt and pepper noise:

```python
daug = iaa.SaltAndPepper(0.1, per_channel=True)
```

9.2.16 CoarseSaltAndPepper

Replace rectangular areas in images with white/black-ish pixel noise.
API link: CoarseSaltAndPepper()
Example. Mark 5% of all pixels in a mask to be replaced by salt/pepper noise. The mask has 1% to 10% the size of the input image. The mask is then upsampled to the input image size, leading to large rectangular areas being marked as to be replaced. These areas are then replaced in the input image by salt/pepper noise.

```python
import imgaug.augmenters as iaa
aug = iaa.CoarseSaltAndPepper(0.05, size_percent=(0.01, 0.1))
```

Example. Same as in the previous example, but the replacement mask before upscaling has a size between 4×4 and 16×16 pixels (the axis sizes are sampled independently, i.e. the mask may be rectangular).

```python
aug = iaa.CoarseSaltAndPepper(0.05, size_px=(4, 16))
```

Example. Same as in the first example, but mask and replacement are each sampled independently per image channel.
9.2.17 Salt

Replace pixels in images with salt noise, i.e. white-ish pixels.

This augmenter is similar to SaltAndPepper, but adds no pepper noise to images.

API link: `Salt()`

Example. Replace 10% of all pixels with salt noise (white-ish colors):

```python
import imgaug.augmenters as iaa
aug = iaa.Salt(0.1)
```

Example. Similar to SaltAndPepper, this augmenter also supports the `per_channel` argument, which is skipped here for brevity.

9.2.18 CoarseSalt

Replace rectangular areas in images with white-ish pixel noise.

This augmenter is similar to CoarseSaltAndPepper, but adds no pepper noise to images.

API link: `CoarseSalt()`

Example. Mark 5% of all pixels in a mask to be replaced by salt noise. The mask has 1% to 10% the size of the input image. The mask is then upscaled to the input image size, leading to large rectangular areas being marked as to be replaced. These areas are then replaced in the input image by salt noise.

```python
import imgaug.augmenters as iaa
aug = iaa.CoarseSalt(0.05, size_percent=(0.01, 0.1))
```
9.2. augmenters.arithmetic

[Images of animal images with various arithmetic augmentations applied.]
Similar to CoarseSaltAndPepper, this augmenter also supports the per_channel argument, which is skipped here for brevity.

### 9.2.19 Pepper

Replace pixels in images with pepper noise, i.e. black-ish pixels.

This augmenter is similar to SaltAndPepper, but adds no salt noise to images.

This augmenter is similar to Dropout, but slower and the black pixels are not uniformly black.

API link: [Pepper()](#)

**Example.** Replace 10% of all pixels with pepper noise (black-ish colors):

```python
import imgaug.augmenters as iaa
aug = iaa.Pepper(0.1)
```

Similar to SaltAndPepper, this augmenter also supports the per_channel argument, which is skipped here for brevity.

### 9.2.20 CoarsePepper

Replace rectangular areas in images with black-ish pixel noise.

This augmenter is similar to CoarseSaltAndPepper, but adds no salt noise to images.

API link: [CoarsePepper()](#)

**Example.** Mark 5% of all pixels in a mask to be replaced by pepper noise. The mask has 1% to 10% the size of the input image. The mask is then upsampled to the input image size, leading to large rectangular areas being marked as to be replaced. These areas are then replaced in the input image by pepper noise.

```python
import imgaug.augmenters as iaa
aug = iaa.CoarsePepper(0.05, size_percent=(0.01, 0.1))
```
Similar to `CoarseSaltAndPepper`, this augmenter also supports the `per_channel` argument, which is skipped here for brevity.

### 9.2.21 Invert

Augmenter that inverts all values in images, i.e. sets a pixel from value $v$ to $255-v$.

API link: [Invert](https://imgaug.readthedocs.io/en/stable/api/augmenters/arithmetic/Invert/)

**Example.** Invert in 50% of all images all pixels:

```python
import imgaug.augmenters as iaa
aug = iaa.Invert(0.5)
```

**Example.** For 50% of all images, invert all pixels in these images with 25% probability (per image). In the remaining 50% of all images, invert 25% of all channels:

```python
aug = iaa.Invert(0.25, per_channel=0.5)
```
### 9.2.22 Solarize

Invert all values above a threshold in images.

This is the same as Invert, but sets a default threshold around 128 (+/- 64, decided per image) and default `invert_above_threshold` to True (i.e. only values above the threshold will be inverted).

API link: Solarize

**Example.** Invert the colors in 50 percent of all images for pixels with a value between 32 and 128 or more. The threshold is sampled once per image. The thresholding operation happens per channel.

```python
import imgaug.augmenters as iaa
aug = iaa.Solarize(0.5, threshold=(32, 128))
```

### 9.2.23 JpegCompression

Degrade the quality of images by JPEG-compressing them.

API link: JpegCompression

**Example.** Remove high frequency components in images via JPEG compression with a compression strength between 80 and 95 (randomly and uniformly sampled per image). This corresponds to a (very low) quality setting of 5 to 20.

```python
import imgaug.augmenters as iaa
aug = iaa.JpegCompression(compression=(70, 99))
```
9.3 augmenters.artistic

9.3.1 Cartoon

Convert the style of images to a more cartoonish one.

This augmenter was primarily designed for images with a size of 200 to 800 pixels. Smaller or larger images may cause issues.

Note that the quality of the results can currently not compete with learned style transfer, let alone human-made images. A lack of detected edges or also too many detected edges are probably the most significant drawbacks.

API link: Cartoon

Example. Create an example image, then apply a cartoon filter to it:

```python
import imgaug.augmenters as iaa
aug = iaa.Cartoon()
```

Example. Create a non-stochastic cartoon augmenter that produces decent-looking images:

```python
aug = iaa.Cartoon(blur_ksize=3, segmentation_size=1.0,
saturation=2.0, edge_prevalence=1.0)
```

9.4 augmenters.blend

Note: It is not recommended to use blending augmenter with child augmenters that change the geometry of images (e.g. horizontal flips, affine transformations) if you also want to augment coordinates (e.g. keypoints, bounding boxes, polygons, ...), as it is not clear which of the two coordinate results (first or second branch) should be used as the
coordinates after augmentation. Currently, all blending augmenters try to use the augmented coordinates of the branch that makes up most of the augmented image.

### 9.4.1 BlendAlpha

Alpha-blend two image sources using an alpha/opacity value.

The two image sources can be imagined as branches. If a source is not given, it is automatically the same as the input. Let $FG$ be the foreground branch and $BG$ be the background branch. Then the result images are defined as $factor \times FG + (1-factor) \times BG$, where $factor$ is an overlay factor.

API link: BlendAlpha

**Example.** Convert each image to pure grayscale and alpha-blend the result with the original image using an alpha of 50%, thereby removing about 50% of all color. This is equivalent to `iaa.Grayscale(0.5)`.

```python
import imgaug.augmenters as iaa
daug = iaa.BlendAlpha(0.5, iaa.Grayscale(1.0))
```

**Example.** Same as in the previous example, but the alpha factor is sampled uniformly from the interval $[0.0, 1.0]$ once per image, thereby removing a random fraction of all colors. This is equivalent to `iaa.Grayscale((0.0, 1.0))`.

```python
aug = iaa.BlendAlpha((0.0, 1.0), iaa.Grayscale(1.0))
```

**Example.** First, rotate each image by a random degree sampled uniformly from the interval $[-20, 20]$. Then, alpha-blend that new image with the original one using a random factor sampled uniformly from the interval $[0.0, 1.0]$. For 50% of all images, the blending happens channel-wise and the factor is sampled independently per channel (`per_channel=0.5`). As a result, e.g. the red channel may look visibly rotated (factor near 1.0), while the green and blue channels may not look rotated (factors near 0.0).
Example. Apply two branches of augmenters – A and B – *independently* to input images and alpha-blend the results of these branches using a factor $f$. Branch A increases image pixel intensities by 100 and B multiplies the pixel intensities by 0.2. $f$ is sampled uniformly from the interval $[0.0, 1.0]$ per image. The resulting images contain a bit of A and a bit of B.

```python
aug = iaa.BlendAlpha(
    (0.0, 1.0),
    iaa.Affine(rotate=(-20, 20)),
    per_channel=0.5)
```

Example. Apply median blur to each image and alpha-blend the result with the original image using an alpha factor of either exactly 0.25 or exactly 0.75 (sampled once per image).

```python
aug = iaa.BlendAlpha([0.25, 0.75], iaa.MedianBlur(13))
```

### 9.4.2 BlendAlphaMask

Alpha-blend two image sources using non-binary masks generated per image.

This augmenter queries for each image a mask generator to generate a $(H, W)$ or $(H, W, C)$ channelwise mask $[0.0, 1.0]$, where $H$ is the image height and $W$ the width. The mask will then be used to alpha-blend pixel- and possibly channel-wise between a foreground branch of augmenters and a background branch. (Both branches default to the identity operation if not provided.)

See also *BlendAlpha*.

API link: [BlendAlphaMask](#)

Example. Create an augmenter that sometimes adds clouds at the bottom and sometimes at the top of the image:
9.4.3 BlendAlphaElementwise

Alpha-blend two image sources using alpha/opacity values sampled per pixel.

This is the same as BlendAlpha, except that the opacity factor is sampled once per pixel instead of once per image (or a few times per image, if BlendAlpha.per_channel is set to True).

See BlendAlpha for more details.

This class is a wrapper around BlendAlphaMask.

API link: BlendAlphaElementwise

Example. Convert each image to pure grayscale and alpha-blend the result with the original image using an alpha of 50% for all pixels, thereby removing about 50% of all color. This is equivalent to iaa.Grayscale(0.5). This is also equivalent to iaa.Alpha(0.5, iaa.Grayscale(1.0)), as the opacity has a fixed value of 0.5 and is hence identical for all pixels.

```python
import imgaug.augmenters as iaa
aug = iaa.BlendAlphaElementwise(0.5, iaa.Grayscale(1.0))
```

Example. Same as in the previous example, but here with hue-shift instead of grayscaling and additionally the alpha factor is sampled uniformly from the interval [0.0, 1.0] once per pixel, thereby shifting the hue by a random fraction for each pixel.

```python
aug = iaa.BlendAlphaElementwise((0, 1.0), iaa.AddToHue(100))
```

Example. First, rotate each image by a random degree sampled uniformly from the interval [-20, 20]. Then, alpha-blend that new image with the original one using a random factor sampled uniformly from the interval [0.0,
1.0] per pixel. For 50% of all images, the blending happens channel-wise and the factor is sampled independently per pixel and channel (per_channel=0.5). As a result, e.g. the red channel may look visibly rotated (factor near 1.0), while the green and blue channels may not look rotated (factors near 0.0).

```python
aug = iaa.BlendAlphaElementwise(  
    (0.0, 1.0),  
    iaa.Affine(rotate=(-20, 20)),  
    per_channel=0.5)
```

Example. Apply two branches of augmenters – A and B – independently to input images and alpha-blend the results of these branches using a factor f. Branch A increases image pixel intensities by 100 and B multiplies the pixel intensities by 0.2. f is sampled uniformly from the interval [0.0, 1.0] per pixel. The resulting images contain a bit of A and a bit of B.

```python
aug = iaa.BlendAlphaElementwise(  
    (0.0, 1.0),  
    foreground=iaa.Add(100),  
    background=iaa.Multiply(0.2))
```

Example. Apply median blur to each image and alpha-blend the result with the original image using an alpha factor of either exactly 0.25 or exactly 0.75 (sampled once per pixel).

```python
aug = iaa.BlendAlphaElementwise([0.25, 0.75], iaa.MedianBlur(13))
```

### 9.4.4 BlendAlphaSimplexNoise

Alpha-blend two image sources using simplex noise alpha masks.

The alpha masks are sampled using a simplex noise method, roughly creating connected blobs of 1s surrounded by 0s. If nearest neighbour upsampling is used, these blobs can be rectangular with sharp edges.

API link: BlendAlphaSimplexNoise

Example. Detect per image all edges, mark them in a black and white image and then alpha-blend the result with the original image using simplex noise masks.
import imgaug.augmenters as iaa

```python
aug = iaa.BlendAlphaSimplexNoise(iaa.EdgeDetect(1.0))
```

Example. Same as in the previous example, but using only nearest neighbour upscaling to scale the simplex noise masks to the final image sizes, i.e. no nearest linear upsampling is used. This leads to rectangles with sharp edges.

```python
aug = iaa.BlendAlphaSimplexNoise(
    iaa.EdgeDetect(1.0),
    upscale_method="nearest")
```

Example. Same as in the previous example, but using only linear upscaling to scale the simplex noise masks to the final image sizes, i.e. no nearest neighbour upsampling is used. This leads to rectangles with smooth edges.
imgaug Documentation, Release 0.4.0

```python
aug = iaa.BlendAlphaSimplexNoise(
    iaa.EdgeDetect(1.0),
    upscale_method="linear")
```

**Example.** Same as in the first example, but using a threshold for the sigmoid function that is further to the right. This is more conservative, i.e. the generated noise masks will be mostly black (values around 0.0), which means that most of the original images (parameter/branch `second`) will be kept, rather than using the results of the augmentation (parameter/branch `first`).

```python
import imgaug.parameters as iap
aug = iaa.BlendAlphaSimplexNoise(
    iaa.EdgeDetect(1.0),
    sigmoid_thresh=iap.Normal(10.0, 5.0))
```

### 9.4.5 BlendAlphaFrequencyNoise

Alpha-blend two image sources using frequency noise masks.

The alpha masks are sampled using frequency noise of varying scales, which can sometimes create large connected blobs of 1s surrounded by 0s and other times results in smaller patterns. If nearest neighbour upsampling is used, these blobs can be rectangular with sharp edges.

API link: `BlendAlphaFrequencyNoise`

**Example.** Detect per image all edges, mark them in a black and white image and then alpha-blend the result with the original image using frequency noise masks.

```python
import imgaug.augmenters as iaa
aug = iaa.BlendAlphaFrequencyNoise(first=iaa.EdgeDetect(1.0))
```

**Example.** Same as the first example, but using only linear upscaling to scale the frequency noise masks to the final image sizes, i.e. no nearest neighbour upsampling is used. This results in smooth edges.
Example. Same as the first example, but using only linear upscaling to scale the frequency noise masks to the final image sizes, i.e. no nearest neighbour upsampling is used. This results in smooth edges.

Example. Same as in the previous example, but with the exponent set to a constant $-2$ and the sigmoid deactivated, resulting in cloud-like patterns without sharp edges.
Example. Same as the first example, but using a threshold for the sigmoid function that is further to the right. This is more conservative, i.e. the generated noise masks will be mostly black (values around 0.0), which means that most of the original images (parameter/branch second) will be kept, rather than using the results of the augmentation (parameter/branch first).

```python
import imgaug.parameters as iap
aug = iaa.BlendAlphaFrequencyNoise(
    first=iaa.EdgeDetect(1.0),
    sigmoid_thresh=iap.Normal(10.0, 5.0))
```

### 9.4.6 BlendAlphaSomeColors

Blend images from two branches using colorwise masks.

This class generates masks that “mark” a few colors and replace the pixels within these colors with the results of the foreground branch. The remaining pixels are replaced with the results of the background branch (usually the identity function). That allows to e.g. selectively grayscale a few colors, while keeping other colors unchanged.

This class is a thin wrapper around `BlendAlphaMask` together with `SomeColorsMaskGen`.

API link: [BlendAlphaSomeColors](#)

Example. Create an augmenter that turns randomly removes some colors in images by grayscaling them:

```python
import imgaug.augmenters as iaa
aug = iaa.BlendAlphaSomeColors(iaa.Grayscale(1.0))
```

Example. Create an augmenter that removes some colors in images by replacing them with black pixels:

```python
import imgaug.augmenters as iaa
aug = iaa.BlendAlphaSomeColors(iaa.Grayscale(1.0))
```
Example. Create an augmenter that desaturates some colors and increases the saturation of the remaining ones:

```python
aug = iaa.BlendAlphaSomeColors(iaa.TotalDropout(1.0))
```

Example. Create an augmenter that applies average pooling to some colors. Each color tune is either selected (alpha of 1.0) or not selected (0.0). There is no gradual change between similar colors.

```python
aug = iaa.BlendAlphaSomeColors(
    iaa.AveragePooling(7), alpha=[0.0, 1.0], smoothness=0.0)
```

Example. Create an augmenter that applies average pooling to some colors. Choose on average half of all colors in images for the blending operation.

```python
aug = iaa.BlendAlphaSomeColors(
    iaa.AveragePooling(7), nb_bins=2, smoothness=0.0)
```

Example. Create an augmenter that applies average pooling to some colors with input images being in BGR colorspace.

```python
aug = iaa.BlendAlphaSomeColors(
    iaa.AveragePooling(7), from_colorspace="BGR")
```
9.4.7 BlendAlphaHorizontalLinearGradient

Blend images from two branches along a horizontal linear gradient.

This class generates a horizontal linear gradient mask (i.e. usually a mask with low values on the left and high values on the right) and alphas-blends between foreground and background branch using that mask.

This class is a thin wrapper around BlendAlphaMask together with HorizontalLinearGradientMaskGen.

API link: BlendAlphaHorizontalLinearGradient

Example. Create an augmenter that removes more color towards the right of the image:

```python
import imgaug.augmenters as iaa
aug = iaa.BlendAlphaHorizontalLinearGradient(iaa.AddToHue((-100, 100)))
```

Example. Create an augmenter that replaces pixels towards the right with darker and darker values. However it always keeps at least 20% (1.0 - max_value) of the original pixel value on the far right and always replaces at least 20% on the far left (min_value=0.2).

```python
aug = iaa.BlendAlphaHorizontalLinearGradient(
    iaa.TotalDropout(1.0),
    min_value=0.2, max_value=0.8)
```

Example. Create an augmenter that blends with an average-pooled image according to a horizontal gradient that starts at a random x-coordinate and reaches its maximum at another random x-coordinate. Due to that randomness, the gradient may increase towards the left or right.

```python
aug = iaa.BlendAlphaHorizontalLinearGradient(
    iaa.AveragePooling(11),
    start_at=(0.0, 1.0), end_at=(0.0, 1.0))
```

9.4.8 BlendAlphaVerticalLinearGradient

Blend images from two branches along a vertical linear gradient.
This class generates a vertical linear gradient mask (i.e. usually a mask with low values on the left and high values on the right) and alphas-blends between foreground and background branch using that mask.

This class is a thin wrapper around `BlendAlphaMask` together with `VerticalLinearGradientMaskGen`.

**API link:** `BlendAlphaVerticalLinearGradient`

**Example.** Create an augmenter that removes more color towards the bottom of the image:

```python
import imgaug.augmenters as iaa
aug = iaa.BlendAlphaVerticalLinearGradient(iaa.AddToHue((-100, 100)))
```

**Example.** Create an augmenter that replaces pixels towards the bottom with darker and darker values. However it always keeps at least 20% (1.0 - `max_value`) of the original pixel value on the far bottom and always replaces at least 20% on the far top (`min_value=0.2`).

```python
aug = iaa.BlendAlphaVerticalLinearGradient(  
    iaa.TotalDropout(1.0),  
    min_value=0.2, max_value=0.8)
```

**Example.** Create an augmenter that blends with an average-pooled image according to a vertical gradient that starts at a random y-coordinate and reaches its maximum at another random y-coordinate. Due to that randomness, the gradient may increase towards the bottom or top.

```python
aug = iaa.BlendAlphaVerticalLinearGradient(  
    iaa.AveragePooling(11),  
    start_at=(0.0, 1.0), end_at=(0.0, 1.0))
```

**Example.** Create an augmenter that draws clouds in roughly the top quarter of the image:

```python
aug = iaa.BlendAlphaVerticalLinearGradient(  
    iaa.Clouds(),  
    start_at=(0.15, 0.35), end_at=0.0)
```
9.4.9 BlendAlphaRegularGrid

Blend images from two branches according to a regular grid.

This class generates for each image a mask that splits the image into a grid-like pattern of $H$ rows and $W$ columns. Each cell is then filled with an alpha value, sampled randomly per cell.

The difference to AlphaBlendCheckerboard is that this class samples random alpha values per grid cell, while in the checkerboard the alpha values follow a fixed pattern.

This class is a thin wrapper around BlendAlphaMask together with RegularGridMaskGen.

API link: BlendAlphaRegularGrid

Example. Create an augmenter that places a $H \times W$ grid on each image, where $H$ (rows) is randomly and uniformly sampled from the interval [4, 6] and $W$ is analogously sampled from the interval [1, 4]. Roughly half of the cells in the grid are filled with 0.0, the remaining ones are unaltered. Which cells exactly are “dropped” is randomly decided per image. The resulting effect is similar to CoarseDropout.

```python
import imgaug.augmenters as iaa
aug = iaa.BlendAlphaRegularGrid(nb_rows=(4, 6), nb_cols=(1, 4),
                                 foreground=iaa.Multiply(0.0))
```

Example. Create an augmenter that always placed $2 \times 2$ cells on each image and sets about 1/3 of them to zero (foreground branch) and the remaining 2/3 to a pixelated version (background branch).

```python
aug = iaa.BlendAlphaRegularGrid(nb_rows=2, nb_cols=2,
                                 foreground=iaa.Multiply(0.0),
                                 background=iaa.AveragePooling(8),
                                 alpha=[0.0, 0.0, 1.0])
```

9.4.10 BlendAlphaCheckerboard

Blend images from two branches according to a checkerboard pattern.
This class generates for each image a mask following a checkboard layout of \( H \) rows and \( W \) columns. Each cell is then filled with either 1.0 or 0.0. The cell at the top-left is always 1.0. Its right and bottom neighbour cells are 0.0. The 4-neighbours of any cell always have a value opposite to the cell’s value (0.0 vs. 1.0).

This class is a thin wrapper around `BlendAlphaMask` together with `CheckerboardMaskGen`.

**API link:** `BlendAlphaCheckerboard`

**Example.** Create an augmenter that places a \( H \times W \) grid on each image, where \( H \) (rows) is always 2 and \( W \) is randomly and uniformly sampled from the interval \([1, 4]\). Half of the cells in the grid are grayscaled, the other half is unaltered.

```python
import imgaug.augmenters as iaa
aug = iaa.BlendAlphaCheckerboard(nb_rows=2, nb_cols=(1, 4),
                                   foreground=iaa.AddToHue((-100, 100)))
```

## 9.4.11 BlendAlphaSegMapClassIds

Blend images from two branches based on segmentation map ids.

This class generates masks that are 1.0 at pixel locations covered by specific classes in segmentation maps.

This class is a thin wrapper around `BlendAlphaMask` together with `SegMapClassIdsMaskGen`.

**Note:** Segmentation maps can have multiple channels. If that is the case then for each position \((x, y)\) it is sufficient that any class id in any channel matches one of the desired class ids.

**Note:** This class will produce an `AssertionError` if there are no segmentation maps in a batch.

**API link:** `BlendAlphaSegMapClassIds`

**Example.** Create an augmenter that removes color wherever the segmentation maps contain the classes 1 or 3:

```python
import imgaug.augmenters as iaa
aug = iaa.BlendAlphaSegMapClassIds([1, 3],
                                   foreground=iaa.AddToHue((-100, 100)))
```

**Example.** Create an augmenter that randomly picks 2 classes from the list \([1, 2, 3, 4]\) and blurs the image content wherever these classes appear in the segmentation map. Note that as the sampling of class ids happens with replacement, it is not guaranteed to sample two unique class ids.

```python
aug = iaa.BlendAlphaSegMapClassIds([1, 2, 3, 4],
                                   nb_sample_classes=2,
                                   foreground=iaa.GaussianBlur(3.0))
```

**Example.** Create an augmenter that zeros for roughly every fifth image all image pixels that do not belong to class id 2 (note that the background branch was used, not the foreground branch). Example use case: Human body landmark detection where both the landmarks/keypoints and the body segmentation map are known. Train the model to detect landmarks and sometimes remove all non-body information to force the model to become more independent of the background.
9.4.12 BlendAlphaBoundingBoxes

Blend images from two branches based on areas enclosed in bounding boxes.

This class generates masks that are 1.0 within bounding boxes of given labels. A mask pixel will be set to 1.0 if at least one bounding box covers the area and has one of the requested labels.

This class is a thin wrapper around BlendAlphaMask together with BoundingBoxesMaskGen.

**Note:** Avoid using augmenters as children that affect pixel locations (e.g. horizontal flips). See BlendAlphaMask for details.

**Note:** This class will produce an AssertionError if there are no bounding boxes in a batch.

**API link:** BlendAlphaBoundingBoxes

**Example.** Create an augmenter that removes color within bounding boxes having the label person:

```python
import imgaug.augmenters as iaa
aug = iaa.BlendAlphaBoundingBoxes("person",
    foreground=iaa.Grayscale(1.0))
```

**Example.** Create an augmenter that randomizes the hue within bounding boxes that have the label person or car:

```python
aug = iaa.Sometimes(0.2,
    iaa.BlendAlphaSegMapClassIds(2,
        background=iaa.TotalDropout(1.0)))
```
aug = iaa.BlendAlphaBoundingBoxes(["person", "car"],
                                    foreground=iaa.AddToHue((-255, 255)))

Example. Create an augmenter that randomizes the hue within bounding boxes that have either the label
person or car. Only one label is picked per image. Note that the sampling happens with replacement, so if
nb_sample_classes would be >1, it could still lead to only one unique label being sampled.

aug = iaa.BlendAlphaBoundingBoxes(["person", "car"],
                                    foreground=iaa.AddToHue((-255, 255)),
                                    nb_sample_labels=1)

Example. Create an augmenter that zeros all pixels (Multiply(0.0)) that are not (background branch) within
bounding boxes of any (None) label. In other words, all pixels outside of bounding boxes become black. Note that
we don’t use TotalDropout here, because by default it will also remove all coordinate-based augmentables, which
will break the blending of such inputs.

aug = iaa.BlendAlphaBoundingBoxes(None,
                                    background=iaa.Multiply(0.0))

9.5 augmenters.blur

9.5.1 GaussianBlur

Augmenter to blur images using gaussian kernels.

API link: GaussianBlur

Example. Blur each image with a gaussian kernel with a sigma of 3.0:

```python
import imgaug.augmenters as iaa
aug = iaa.GaussianBlur(sigma=(0.0, 3.0))
```

9.5.2 AverageBlur

Blur an image by computing simple means over neighbourhoods.

API link: AverageBlur

Example. Blur each image using a mean over neighbourhoods that have a random size between 2x2 and 11x11:

```python
import imgaug.augmenters as iaa
aug = iaa.AverageBlur(k=(2, 11))
```
**Example.** Blur each image using a mean over neighbourhoods that have random sizes, which can vary between 5 and 11 in height and 1 and 3 in width:

```
aug = iaa.AverageBlur(k=((5, 11), (1, 3)))
```

9.5.3 **MedianBlur**

Blur an image by computing median values over neighbourhoods.

API link: [MedianBlur](https://github.com/aleju/imgaug#medianblur)

**Example.** Blur each image using a median over neighbourhoods that have a random size between 3x3 and 11x11:
import imgaug.augmenters as iaa
aug = iaa.MedianBlur(k=(3, 11))

9.5.4 BilateralBlur

Blur/Denoise an image using a bilateral filter.

Bilateral filters blur homogenous and textured areas, while trying to preserve edges.

API link: `BilateralBlur`

Example. Blur all images using a bilateral filter with a `max distance` sampled uniformly from the interval $[3, 10]$ and wide ranges for `sigma_color` and `sigma_space`:
import imgaug.augmenters as iaa
aug = iaa.BilateralBlur(
    d=(3, 10), sigma_color=(10, 250), sigma_space=(10, 250))

9.5.5 MotionBlur

Blur images in a way that fakes camera or object movements.

API link: MotionBlur

Example. Apply motion blur with a kernel size of 15x15 pixels to images:
import imgaug.augmenters as iaa
aug = iaa.MotionBlur(k=15)

Example. Apply motion blur with a kernel size of 15x15 pixels and a blur angle of either -45 or 45 degrees (randomly picked per image):

aug = iaa.MotionBlur(k=15, angle=[-45, 45])

9.5.6 MeanShiftBlur

Apply a pyramidal mean shift filter to each image.

See also `blur_mean_shift_()` for details.
This augmenter expects input images of shape \((H, W)\) or \((H, W, 1)\) or \((H, W, 3)\).

**Note:** This augmenter is quite slow.

API link: `MeanShiftBlur`

**Example.** Create a mean shift blur augmenter:

```python
import imgaug.augmenters as iaa
aug = iaa.MeanShiftBlur()
```
9.6 augmenters.collections

9.6.1 RandAugment

Apply RandAugment to inputs as described in the corresponding paper.

See paper:

Cubuk et al.
RandAugment: Practical automated data augmentation with a reduced search space

Note: The paper contains essentially no hyperparameters for the individual augmentation techniques. The hyperparameters used here come mostly from the official code repository, which however seems to only contain code for CIFAR10 and SVHN, not for ImageNet. So some guesswork was involved and a few of the hyperparameters were also taken from https://github.com/ildoonet/pytorch-randaugment/blob/master/RandAugment/augmentations.py. This implementation deviates from the code repository for all PIL enhance operations. In the repository these use a factor of $0.1 + M \times 1.8/M_{\text{max}}$, which would lead to a factor of 0.1 for the weakest M of M=0. For e.g. Brightness that would result in a basically black image. This definition is fine for AutoAugment (from where the code and hyperparameters are copied), which optimizes each transformation’s M individually, but not for RandAugment, which uses a single fixed M. We hence redefine these hyperparameters to $1.0 + S \times M \times 0.9/M_{\text{max}}$, where S is randomly either 1 or -1.

We also note that it is not entirely clear which transformations were used in the ImageNet experiments. The paper lists some transformations in Figure 2, but names others in the text too (e.g. crops, flips, cutout). While Figure 2 lists the Identity function, this transformation seems to not appear in the repository (and in fact, the function randaugment(N, M) doesn’t seem to exist in the repository either). So we also make a best guess here about what transformations might have been used.

Warning: This augmenter only works with image data, not e.g. bounding boxes. The used PIL-based affine transformations are not yet able to process non-image data. (This augmenter uses PIL-based affine transformations to ensure that outputs are as similar as possible to the paper’s implementation.)

API link: RandAugment

Example. Create a RandAugment augmenter similar to the suggested hyperparameters in the paper:

```python
import imgaug.augmenters as iaa
aug = iaa.RandAugment(n=2, m=9)
```

Example. Create a RandAugment augmenter with maximum magnitude/strength:

```python
aug = iaa.RandAugment(m=30)
```

Example. Create a RandAugment augmenter that applies its transformations with a random magnitude between 0 (very weak) and 9 (recommended for ImageNet and ResNet-50). $m$ is sampled per transformation:

```python
aug = iaa.RandAugment(m=(0, 9))
```

Example. Create a RandAugment augmenter that applies 0 to 3 of its child transformations to images. Horizontal flips (p=50%) and crops are always applied.
9.7 augmenters.color

9.7.1 WithColorspace

Apply child augmenters within a specific colorspace.

This augmenter takes a source colorspace A and a target colorspace B as well as children C. It changes images from A to B, then applies the child augmenters C and finally changes the colorspace back from B to A. See also ChangeColorspace() for more.

API link: WithColorspace

Example. Convert to HSV colorspace, add a value between 0 and 50 (uniformly sampled per image) to the Hue channel, then convert back to the input colorspace (RGB).

```
import imgaug.augmenters as iaa
aug = iaa.WithColorspace(
    to_colorspace="HSV",
    from_colorspace="RGB",
    children=iaa.WithChannels(
```
9.7.2 WithBrightnessChannels

Augmenter to apply child augmenters to brightness-related image channels.

This augmenter first converts an image to a random colorspace containing a brightness-related channel (e.g. V in HSV), then extracts that channel and applies its child augmenters to this one channel. Afterwards, it reintegrates the augmented channel into the full image and converts back to the input colorspace.

API link: WithBrightnessChannels

Example. Add \(-50\) to \(50\) to the brightness-related channels of each image:

```python
import imgaug.augmenters as iaa
aug = iaa.WithBrightnessChannels(iaa.Add((-50, 50)))
```

Example. Add \(-50\) to \(50\) to the brightness-related channels of each image, but pick those brightness-related channels only from Lab (L) and HSV (V) colorspaces.

```python
aug = iaa.WithBrightnessChannels(
    iaa.Add((-50, 50)), to_colorspace=[iaa.CSPACE_Lab, iaa.CSPACE_HSV])
```

Example. Add \(-50\) to \(50\) to the brightness-related channels of each image, where the images are provided in BGR colorspace instead of the standard RGB.

```python
aug = iaa.WithBrightnessChannels(
    iaa.Add((-50, 50)), from_colorspace=iaa.CSPACE_BGR)
```
9.7.3 MultiplyAndAddToBrightness

Multiply and add to the brightness channels of input images.

This is a wrapper around WithBrightnessChannels and hence performs internally the same projection to random colorspace.

API link: MultiplyAndAddToBrightness

Example. Convert each image to a colorspace with a brightness-related channel, extract that channel, multiply it by a factor between 0.5 and 1.5, add a value between −30 and 30 and convert back to the original colorspace.

```python
import imgaug.augmenters as iaa
aug = iaa.MultiplyAndAddToBrightness(mul=(0.5, 1.5), add=(-30, 30))
```

9.7.4 MultiplyBrightness

Multiply the brightness channels of input images.

This is a wrapper around WithBrightnessChannels and hence performs internally the same projection to random colorspace.

API link: MultiplyBrightness

Example. Convert each image to a colorspace with a brightness-related channel, extract that channel, multiply it by a factor between 0.5 and 1.5, and convert back to the original colorspace.

```python
import imgaug.augmenters as iaa
aug = iaa.MultiplyBrightness((0.5, 1.5))
```

9.7.5 AddToBrightness

Add to the brightness channels of input images.
This is a wrapper around `WithBrightnessChannels` and hence performs internally the same projection to random colorspaces.

API link: `AddToBrightness`

**Example.** Convert each image to a colorspace with a brightness-related channel, extract that channel, add between $-30$ and $30$ and convert back to the original colorspace:

```python
import imgaug.augmenters as iaa
aug = iaa.AddToBrightness((-30, 30))
```
9.7.6 WithHueAndSaturation

Apply child augmenters to hue and saturation channels.

This augmenter takes an image in a source colorspace, converts it to HSV, extracts the H (hue) and S (saturation) channels, applies the provided child augmenters to these channels and finally converts back to the original colorspace. The image array generated by this augmenter and provided to its children is in int16 (sic! only augmenters that can handle int16 arrays can be children!). The hue channel is mapped to the value range [0, 255]. Before converting back to the source colorspace, the saturation channel’s values are clipped to [0, 255]. A modulo operation is applied to the hue channel’s values, followed by a mapping from [0, 255] to [0, 180] (and finally the colorspace conversion).

API link: WithHueAndSaturation

Example. Create an augmenter that will add a random value between 0 and 50 (uniformly sampled per image) hue channel in HSV colorspace. It automatically accounts for the hue being in angular representation, i.e. if the angle goes beyond 360 degrees, it will start again at 0 degrees. The colorspace is finally converted back to RGB (default setting).

```
import imgaug.augmenters as iaa
aug = iaa.WithHueAndSaturation(
    iaa.WithChannels(0, iaa.Add((0, 50)))
)
```

Example. Create an augmenter that adds a random value sampled uniformly from the range [-30, 10] to the hue and multiplies the saturation by a random factor sampled uniformly from [0.5, 1.5]. It also modifies the contrast of the saturation channel. After these steps, the HSV image is converted back to RGB.

```
aug = iaa.WithHueAndSaturation([
    iaa.WithChannels(0, iaa.Add((-30, 10))),
    iaa.WithChannels(1, [
      iaa.Multiply((0.5, 1.5)),
      iaa.LinearContrast((0.75, 1.25))
    ])
])
```
9.7.7 MultiplyHueAndSaturation

Multiply hue and saturation by random values.

The augmenter first transforms images to HSV colorspace, then multiplies the pixel values in the H and S channels and afterwards converts back to RGB.

This augmenter is a wrapper around WithHueAndSaturation.

API link: MultiplyHueAndSaturation()

Example. Multiply hue and saturation by random values between 0.5 and 1.5 (independently per channel and the same value for all pixels within that channel). The hue will be automatically projected to an angular representation.

```python
import imgaug.augmenters as iaa
aug = iaa.MultiplyHueAndSaturation((0.5, 1.5), per_channel=True)
```

Example. Multiply only the hue by random values between 0.5 and 1.5.

```python
aug = iaa.MultiplyHueAndSaturation(mul_hue=(0.5, 1.5))
```

Example. Multiply only the saturation by random values between 0.5 and 1.5.

```python
aug = iaa.MultiplyHueAndSaturation(mul_saturation=(0.5, 1.5))
```

9.7.8 MultiplyHue

Multiply the hue of images by random values.

The augmenter first transforms images to HSV colorspace, then multiplies the pixel values in the H channel and afterwards converts back to RGB.

This augmenter is a shortcut for MultiplyHueAndSaturation(mul_hue=...).

API link: MultiplyHue()
Example. Multiply the hue channel of images using random values between 0.5 and 1.5:

```python
import imgaug.augmenters as iaa
aug = iaa.MultiplyHue((0.5, 1.5))
```

9.7.9 MultiplySaturation

Multiply the saturation of images by random values.

The augmenter first transforms images to HSV colorspace, then multiplies the pixel values in the H channel and afterwards converts back to RGB.
This augmenter is a shortcut for `MultiplyHueAndSaturation(mul_saturation=...)`.  
API link: `MultiplySaturation()`  
**Example.** Multiply the saturation channel of images using random values between 0.5 and 1.5:

```python
import imgaug.augmenters as iaa
aug = iaa.MultiplySaturation((0.5, 1.5))
```

---

### 9.7.10 RemoveSaturation

Decrease the saturation of images by varying degrees.  
This creates images looking similar to `Grayscale`.  
This augmenter is the same as `MultiplySaturation((0.0, 1.0))`.  
API link: `RemoveSaturation()`  
**Example.** Create an augmenter that decreases saturation by varying degrees:

```python
import imgaug.augmenters as iaa
aug = iaa.RemoveSaturation()
```

**Example.** Create an augmenter that removes all saturation from input images. This is similar to `imgaug.augmenters.color.Grayscale`.

```python
aug = iaa.RemoveSaturation(1.0)
```

**Example.** Create an augmenter that decreases saturation of images in BGR colorspace by varying degrees.

```python
aug = iaa.RemoveSaturation(from_colorspace=iaa.CSPACE_BGR)
```
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### 9.7.11 AddToHueAndSaturation

Increases or decreases hue and saturation by random values.

The augmenter first transforms images to HSV colorspace, then adds random values to the H and S channels and afterwards converts back to RGB.

This augmenter is faster than using `WithHueAndSaturation` in combination with `Add`.

API link: `AddToHueAndSaturation`

**Example.** Add random values between -50 and 50 to the hue and saturation (independently per channel and the same value for all pixels within that channel):

```python
import imgaug.augmenters as iaa
aug = iaa.AddToHueAndSaturation((-50, 50), per_channel=True)
```

---

### 9.7.12 AddToHue

Add random values to the hue of images.

The augmenter first transforms images to HSV colorspace, then adds random values to the H channel and afterwards converts back to RGB.

If you want to change both the hue and the saturation, it is recommended to use `AddToHueAndSaturation` as otherwise the image will be converted twice to HSV and back to RGB.

This augmenter is a shortcut for `AddToHueAndSaturation(value_hue=...)`.

API link: `AddToHue()`

**Example.** Sample random values from the discrete uniform range [-50..50], convert them to angular representation and add them to the hue, i.e. to the H channel in HSV colorspace:

```python
import imgaug.augmenters as iaa
aug = iaa.AddToHue((-50, 50))
```
9.7.13 AddToSaturation

Add random values to the saturation of images.

The augmenter first transforms images to HSV colorspace, then adds random values to the S channel and afterwards converts back to RGB.

If you want to change both the hue and the saturation, it is recommended to use AddToHueAndSaturation as otherwise the image will be converted twice to HSV and back to RGB.

This augmenter is a shortcut for AddToHueAndSaturation(value_saturation=...).

API link: AddToSaturation()

Example. Sample random values from the discrete uniform range [-50..50], and add them to the saturation, i.e. to the S channel in HSV colorspace:

```python
import imgaug.augmenters as iaa
daug = iaa.AddToSaturation((-50, 50))
```

9.7.14 ChangeColorspace

Augmenter to change the colorspace of images.

API link: ChangeColorspace

Example. The following example shows how to change the colorspace from RGB to HSV, then add 50-100 to the first channel, then convert back to RGB. This increases the hue value of each image.

```python
import imgaug.augmenters as iaa
daug = iaa.Sequential([    iaa.ChangeColorspace(from_colorspace="RGB", to_colorspace="HSV"),    iaa.WithChannels(0, iaa.Add((50, 100))),    iaa.ChangeColorspace(from_colorspace="HSV", to_colorspace="RGB")])
```
### 9.7.15 Grayscale

Augmenter to convert images to their grayscale versions.

**API link:** [Grayscale](#)

**Example.** Change images to grayscale and overlay them with the original image by varying strengths, effectively removing 0 to 100% of the color:

```python
import imgaug.augmenters as iaa
aug = iaa.Grayscale(alpha=(0.0, 1.0))
```

![Grayscale examples](image)

**Example.** Visualization of increasing alpha from 0.0 to 1.0 in eight steps:

![Grayscale alpha visualization](image)

### 9.7.16 ChangeColorTemperature

Change the temperature to a provided Kelvin value.

Low Kelvin values around 1000 to 4000 will result in red, yellow or orange images. Kelvin values around 10000 to 40000 will result in progressively darker blue tones.

**API link:** [ChangeColorTemperature](#)

**Example.** Create an augmenter that changes the color temperature of images to a random value between 1100 and 10000 Kelvin:

```python
import imgaug.augmenters as iaa
aug = iaa.ChangeColorTemperature((1100, 10000))
```
Quantize colors using k-Means clustering.

This “collects” the colors from the input image, groups them into \( k \) clusters using k-Means clustering and replaces the colors in the input image using the cluster centroids.

This is slower than UniformColorQuantization, but adapts dynamically to the color range in the input image.

**Note:** This augmenter expects input images to be either grayscale or to have 3 or 4 channels and use colorspace `from_colorspace`. If images have 4 channels, it is assumed that the 4th channel is an alpha channel and it will not be quantized.

**API link:** KMeansColorQuantization

**Example.** Create an augmenter to apply k-Means color quantization to images using a random amount of colors, sampled uniformly from the interval \([2..16]\). It assumes the input image colorspace to be RGB and clusters colors randomly in RGB or Lab colorspace.

```python
import imgaug.augmenters as iaa
aug = iaa.KMeansColorQuantization()
```

---

**Example:**

```
import imgaug.augmenters as iaa
aug = iaa.KMeansColorQuantization()
```
**Example.** Create an augmenter that quantizes images to (up to) eight colors:

```python
aug = iaa.KMeansColorQuantization(n_colors=8)
```

**Example.** Create an augmenter that quantizes images to (up to) \( n \) colors, where \( n \) is randomly and uniformly sampled from the discrete interval \([4..32]\):

```python
aug = iaa.KMeansColorQuantization(n_colors=(4, 16))
```

**Example.** Create an augmenter that quantizes input images that are in BGR colorspace. The quantization happens in RGB or Lab colorspace, into which the images are temporarily converted.
Example. Create an augmenter that quantizes images by clustering colors randomly in either RGB or HSV colorspace. The assumed input colorspace of images is RGB.

```python
aug = iaa.KMeansColorQuantization(
    from_colorspace=iaa.ChangeColorspace.BGR)
```

```python
aug = iaa.KMeansColorQuantization(
    to_colorspace=[iaa.ChangeColorspace.RGB, iaa.ChangeColorspace.HSV])
```
9.7.18 UniformColorQuantization

Quantize colors into N bins with regular distance.

For uint8 images the equation is \( \text{floor}(v/q) \times q + q/2 \) with \( q = 256/N \), where \( v \) is a pixel intensity value and \( N \) is the target number of colors after quantization.

This augmenter is faster than KMeansColorQuantization, but the set of possible output colors is constant (i.e. independent of the input images). It may produce unsatisfying outputs for input images that are made up of very similar colors.

**Note:** This augmenter expects input images to be either grayscale or to have 3 or 4 channels and use colorspace from colorspace. If images have 4 channels, it is assumed that the 4th channel is an alpha channel and it will not be quantized.

API link: UniformColorQuantization

**Example.** Create an augmenter to apply uniform color quantization to images using a random amount of colors, sampled uniformly from the discrete interval \([2..16]\):

```python
import imgaug.augmenters as iaa
aug = iaa.UniformColorQuantization()
```

**Example.** Create an augmenter that quantizes images to (up to) eight colors:

```python
aug = iaa.UniformColorQuantization(n_colors=8)
```

**Example.** Create an augmenter that quantizes images to (up to) \( n \) colors, where \( n \) is randomly and uniformly sampled from the discrete interval \([4..32]\):

```python
aug = iaa.UniformColorQuantization(n_colors=(4, 16))
```

**Example.** Create an augmenter that uniformly quantizes images in either RGB or HSV colorspace (randomly picked per image). The input colorspace of all images has to be BGR.
9.7.19 UniformColorQuantizationToNBits

Quantize images by setting 8–B bits of each component to zero.

This augmenter sets the 8–B highest frequency (rightmost) bits of each array component to zero. For B bits this is equivalent to changing each component’s intensity value v to v’ = v & (2**(8–B) – 1), e.g. for B=3 this results in v’ = c & ~(2**(3–1) – 1) = c & ~3 = c & ~0000 0011 = c & 1111 1100.

This augmenter behaves for B similarly to UniformColorQuantization(2**B), but quantizes each bin with interval (a, b) to a instead of to a + (b–a)/2.

This augmenter is comparable to posterize().

Note: This augmenter expects input images to be either grayscale or to have 3 or 4 channels and use colorspace from_colorspace. If images have 4 channels, it is assumed that the 4th channel is an alpha channel and it will not be quantized.

API link: UniformColorQuantizationToNBits

Example. Create an augmenter to apply uniform color quantization to images using a random amount of bits to remove, sampled uniformly from the discrete interval [1..8]:

```python
import imgaug.augmenters as iaa
aug = iaa.UniformColorQuantizationToNBits()
```

Example. Create an augmenter that quantizes images by removing 8–B rightmost bits from each component, where B is uniformly sampled from the discrete interval [2..8]:

```python
import imgaug.augmenters as iaa
aug = iaa.UniformColorQuantizationToNBits()
```
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Example. Create an augmenter that uniformly quantizes images in either RGB or HSV colorspace (randomly picked per image). The input colorspace of all images has to be BGR:

```python
aug = iaa.UniformColorQuantizationToNBits(from_colorspace=iaa.CSPACE_BGR,
                                          to_colorspace=[iaa.CSPACE_RGB, iaa.CSPACE_HSV])
```

9.7.20 Posterize

Alias for `imgaug.augmenters.color.UniformColorQuantizationToNBits`.

API link: [Posterize](#)

9.8 augmenters.contrast

9.8.1 GammaContrast

Adjust image contrast by scaling pixel values to `255*((v/255)**gamma)`.
Values in the range $\gamma = (0.5, 2.0)$ seem to be sensible.

API link: `GammaContrast()`

**Example.** Modify the contrast of images according to $255 \times \left(\frac{v}{255}\right)^{\gamma}$, where $v$ is a pixel value and $\gamma$ is sampled uniformly from the interval $[0.5, 2.0]$ (once per image):

```python
import imgaug.augmenters as iaa
aug = iaa.GammaContrast((0.5, 2.0))
```

**Example.** Same as in the previous example, but $\gamma$ is sampled once per image and channel:

```python
aug = iaa.GammaContrast((0.5, 2.0), per_channel=True)
```
### 9.8.2 SigmoidContrast

Adjust image contrast to $255 \times \frac{1}{1 + \exp(gain \cdot (cutoff - I_{ij}/255))}$.

Values in the range $gain=(5, 20)$ and $cutoff=(0.25, 0.75)$ seem to be sensible.

API link: `SigmoidContrast()`

**Example.** Modify the contrast of images according to $255 \times \frac{1}{1 + \exp(gain \cdot (cutoff - v/255))}$, where $v$ is a pixel value, $gain$ is sampled uniformly from the interval $[3, 10]$ (once per image) and $cutoff$ is sampled uniformly from the interval $[0.4, 0.6]$ (also once per image).

```python
import imgaug.augmenters as iaa
aug = iaa.SigmoidContrast(gain=(3, 10), cutoff=(0.4, 0.6))
```

**Example.** Same as in the previous example, but $gain$ and $cutoff$ are each sampled once per image and channel:

```python
aug = iaa.SigmoidContrast(    gain=(3, 10), cutoff=(0.4, 0.6), per_channel=True)
```

### 9.8.3 LogContrast

Adjust image contrast by scaling pixels to $255 \times \text{gain} \times \log_2(1 + v/255)$.

This augmenter is fairly similar to `imgaug.augmenters.arithmetic.Multiply`.

API link: `LogContrast()`

**Example.** Modify the contrast of images according to $255 \times \text{gain} \times \log_2(1 + v/255)$, where $v$ is a pixel value and $gain$ is sampled uniformly from the interval $[0.6, 1.4]$ (once per image):

```python
import imgaug.augmenters as iaa
aug = iaa.LogContrast(gain=(0.6, 1.4))
```

**Example.** Same as in the previous example, but $gain$ is sampled once per image and channel:
9.8.4 LinearContrast

Adjust contrast by scaling each pixel to \(127 + \alpha \times (v-127)\).

API link: LinearContrast()

Example. Modify the contrast of images according to \(127 + \alpha \times (v-127)\), where \(v\) is a pixel value and \(\alpha\) is sampled uniformly from the interval \([0.4, 1.6]\) (once per image):

```python
import imgaug.augmenters as iaa
aug = iaa.LinearContrast((0.4, 1.6))
```

Example. Same as in the previous example, but \(\alpha\) is sampled once per image and channel:

```python
aug = iaa.LinearContrast((0.4, 1.6), per_channel=True)
```

9.8.5 AllChannelsCLAHE

Apply CLAHE to all channels of images in their original colorspace.

CLAHE (Contrast Limited Adaptive Histogram Equalization) performs histogram equilization within image patches, i.e. over local neighbourhoods.

In contrast to imgaug.augmenters.contrast.CLAHE, this augmenter operates directly on all channels of the input images. It does not perform any colorspace transformations and does not focus on specific channels (e.g. \(L\) in Lab colorspace).

API link: AllChannelsCLAHE

Example. Create an augmenter that applies CLAHE to all channels of input images:
import imgaug.augmenters as iaa

aug = iaa.AllChannelsCLAHE()

Example. Same as in the previous example, but the clip_limit used by CLAHE is uniformly sampled per image from the interval $[1, 10]$. Some images will therefore have stronger contrast than others (i.e. higher clip limit values).

```python
aug = iaa.AllChannelsCLAHE(clip_limit=(1, 10))
```

Example. Same as in the previous example, but the clip_limit is sampled per image and channel, leading to different levels of contrast for each channel:
Apply CLAHE to L/V/L channels in HLS/HSV/Lab colorspaces.

This augmenter applies CLAHE (Contrast Limited Adaptive Histogram Equalization) to images, a form of histogram equalization that normalizes within local image patches. The augmenter transforms input images to a target colorspace (e.g. Lab), extracts an intensity-related channel from the converted images (e.g. L for Lab), applies CLAHE to the channel and then converts the resulting image back to the original colorspace.

Grayscale images (images without channel axis or with only one channel axis) are automatically handled, from_colorspace does not have to be adjusted for them. For images with four channels (e.g. RGBA), the fourth channel is ignored in the colorspace conversion (e.g. from an RGBA image, only the RGB part is converted, normalized, converted back and concatenated with the input A channel). Images with unusual channel numbers (2, 5 or more than 5) are normalized channel-by-channel (same behaviour as AllChannelsCLAHE, though a warning will be raised).

If you want to apply CLAHE to each channel of the original input image’s colorspace (without any colorspace conversion), use imgaug.augmenters.contrast.AllChannelsCLAHE instead.

API link: CLAHE

**Example.** Create a standard CLAHE augmenter:

```
import imgaug.augmenters as iaa
aug = iaa.CLAHE()
```

**Example.** Create a CLAHE augmenter with a clip limit uniformly sampled from [1..10], where 1 is rather low contrast and 10 is rather high contrast:

```
aug = iaa.CLAHE(clip_limit=(1, 10))
```

**Example.** Create a CLAHE augmenter with kernel sizes of SxS, where S is uniformly sampled from [3..21]. Sampling happens once per image.
Example. Create a CLAHE augmenter with kernel sizes of $S \times S$, where $S$ is sampled from $N(7, 2)$, but does not go below 3:

```python
import imgaug.parameters as iap
aug = iaa.CLAHE(
    tile_grid_size_px=iap.Discretize(iap.Normal(loc=7, scale=2)),
    tile_grid_size_px_min=3)
```

Example. Create a CLAHE augmenter with kernel sizes of $H \times W$, where $H$ is uniformly sampled from $[3..21]$ and $W$ is randomly picked from the list $[3, 5, 7]$:
Example. Create a CLAHE augmenter that converts images from BGR colorspace to HSV colorspace and then applies the local histogram equalization to the \( V \) channel of the images (before converting back to BGR). Alternatively, Lab (default) or HLS can be used as the target colorspace. Grayscale images (no channels / one channel) are never converted and are instead directly normalized (i.e. `from_colorspace` does not have to be changed for them).

```python
aug = iaa.CLAHE(from_colorspace=iaa.CLAHE.BGR,
                to_colorspace=iaa.CLAHE.HSV)
```
9.8.7 AllChannelsHistogramEqualization

Apply Histogram Eq. to all channels of images in their original colorspaces.

In contrast to `imgaug.augmenters.contrast.HistogramEqualization`, this augmenter operates directly on all channels of the input images. It does not perform any colorspace transformations and does not focus on specific channels (e.g. $L$ in Lab colorspace).

API link: AllChannelsHistogramEqualization

Example. Create an augmenter that applies histogram equalization to all channels of input images in the original colorspaces:

```python
import imgaug.augmenters as iaa
aug = iaa.AllChannelsHistogramEqualization()
```

Example. Same as in the previous example, but alpha-blends the contrast-enhanced augmented images with the original input images using random blend strengths. This leads to random strengths of the contrast adjustment.

```python
aug = iaa.Alpha((0.0, 1.0), iaa.AllChannelsHistogramEqualization())
```

9.8.8 HistogramEqualization

Apply Histogram Eq. to L/V/L channels of images in HLS/HSV/Lab colorspaces.

This augmenter is similar to `imgaug.augmenters.contrast.CLAHE`.

The augmenter transforms input images to a target colorspace (e.g. Lab), extracts an intensity-related channel from the converted images (e.g. $L$ for Lab), applies Histogram Equalization to the channel and then converts the resulting image back to the original colorspace.

Grayscale images (images without channel axis or with only one channel axis) are automatically handled, `from_colorspace` does not have to be adjusted for them. For images with four channels (e.g. RGBA), the fourth channel is ignored in the colorspace conversion (e.g. from an RGBA image, only the RGB part is converted, normalized, converted back and concatenated with the input $A$ channel). Images with unusual channel numbers (2, 5 or more than 5) are normalized channel-by-channel (same behaviour as AllChannelsHistogramEqualization, though a warning will be raised).

If you want to apply HistoryEqualization to each channel of the original input image’s colorspace (without any colorspace conversion), use `imgaug.augmenters.contrast.AllChannelsHistogramEqualization` instead.

API link: HistogramEqualization

Example. Create an augmenter that converts images to HLS/HSV/Lab colorspaces, extracts intensity-related channels (i.e. $L/V/L$), applies histogram equalization to these channels and converts back to the input colorspace:
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Example. Same as in the previous example, but alpha blends the result, leading to various strengths of contrast normalization:

```python
aug = iaa.Alpha((0.0, 1.0), iaa.HistogramEqualization())
```

Example. Same as in the first example, but the colorspace of input images has to be BGR (instead of default RGB) and the histogram equalization is applied to the V channel in HSV colorspace:

```python
aug = iaa.HistogramEqualization(
    from_colorspace=iaa.HistogramEqualization.BGR,
    to_colorspace=iaa.HistogramEqualization.HSV)
```

### 9.9 augmenters.convolutional

#### 9.9.1 Convolve

Apply a Convolution to input images.

API link: [Convolve](#)

**Example.** Convolve each image with a 3x3 kernel:

```python
import imgaug.augmenters as iaa
matrix = np.array([[0, -1, 0],
                   [-1, 4, -1],
                   [0, -1, 0]])
 aug = iaa.Convolve(matrix=matrix)
```

**Example.** Convolve each image with a 3x3 kernel, which is chosen dynamically per image:

```python
def gen_matrix(image, nb_channels, random_state):
    matrix_A = np.array([[0, -1, 0],
                         [-1, 4, -1],
                         [0, -1, 0]])
    matrix_B = np.array([[0, 0, 0],
                         [0, -4, 1],
                         [0, 2, 1]])
    if random_state.rand() < 0.5:
        return [matrix_A] * nb_channels
```
else:
    return [matrix_B] * nb_channels

aug = iaa.Convolve(matrix=gen_matrix)

---

9.9.2 Sharpen

Augmenter that sharpens images and overlays the result with the original image.

API link: `Sharpen()`

Example. Sharpen an image, then overlay the results with the original using an alpha between 0.0 and 1.0:
**9.9.3 Emboss**

Augmenter that embosses images and overlays the result with the original image.

API link: `Emboss()`

**Example.** Emboss an image, then overlay the results with the original using an alpha between 0.0 and 1.0:

```python
import imgaug.augmenters as iaa
aug = iaa.Emboss(alpha=(0.0, 1.0), strength=(0.5, 1.5))
```

**Example.** Effects of keeping strength fixed at 1.0 and then varying alpha between 0.0 and 1.0 in eight steps:

**Example.** Effects of keeping alpha fixed at 1.0 and then varying strength between 0.5 and 1.5 in eight steps:

---

**9.9.4 EdgeDetect**

Augmenter that detects all edges in images, marks them in a black and white image and then overlays the result with the original image.

API link: `EdgeDetect()`
Example. Detect edges in images, turning them into black and white images and then overlay these with the original images using random alphas between 0.0 and 1.0:

```python
import imgaug.augmenters as iaa
aug = iaa.EdgeDetect(alpha=(0.0, 1.0))
```

Example. Effect of increasing alpha from 0.0 to 1.0 in eight steps:

9.9.5 DirectedEdgeDetect

Augmenter that detects edges that have certain directions and marks them in a black and white image and then overlays the result with the original image.

API link: `DirectedEdgeDetect()`

Example. Detect edges having random directions (0 to 360 degrees) in images, turning the images into black and white versions and then overlay these with the original images using random alphas between 0.0 and 1.0:

```python
import imgaug.augmenters as iaa
aug = iaa.DirectedEdgeDetect(alpha=(0.0, 1.0), direction=(0.0, 1.0))
```

Example. Effect of fixing direction to 0.0 and then increasing alpha from 0.0 to 1.0 in eight steps:

Example. Effect of fixing alpha to 1.0 and then increasing direction from 0.0 to 1.0 (0 to 360 degrees) in eight steps:
9.10 augmenters.debug

9.10.1 SaveDebugImageEveryNBatches

Visualize data in batches and save corresponding plots to a folder.

API link: `SaveDebugImageEveryNBatches()`

**Example.** Save a debug plot to a temporary folder every 100 batches. Set `folder_path` to a string, e.g. `/tmp/experiments/debug-images`, in order to save to that filepath instead of the temporary folder.

```python
import imgaug.augmenters as iaa
import tempfile
with tempfile.TemporaryDirectory() as folder_path:
    seq = iaa.Sequential(
        iaa.Sequential(
            iaa.Fliplr(0.5),
            iaa.Crop(px=(0, 16))
        ), random_order=True),
        iaa.SaveDebugImageEveryNBatches(folder_path, 100)
    )
```

9.11 augmenters.edges

9.11.1 Canny

Apply a canny edge detector to input images.

API link: `Canny`

**Example.** Create an augmenter that generates random blends between images and their canny edge representations:

```python
import imgaug.augmenters as iaa
daug = iaa.Canny()
```
<table>
<thead>
<tr>
<th>Images</th>
<th>SegMaps</th>
<th>Bounding Boxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>list of 4 arrays all shape (128, 128, 3) all dtype uint8 value range: 0 to 249</td>
<td>Channel 1 of 1 items for 4 images all arrays of shape (128, 128, 1) all on image shape (128, 128, 3) value range: 0 to 1 number of unique classes: 2</td>
<td>items for 4 images fewest items on image: 1 most items on image: 1 total items: 4 smallest area: 10466.9590 largest area: 11922.3184 unique labels: 1 most common labels: - None (4, 100.00%) coords out of image: 4 (50.00%) most extreme coord: (98.1, 144.1) all on image shape (128, 128, 3)</td>
</tr>
</tbody>
</table>
Example. Create a canny edge augmenter that generates edge images with a blending factor of max 50%, i.e. the original (non-edge) image is always at least partially visible:

```python
aug = iaa.Canny(alpha=(0.0, 0.5))
```

Example. Same as in the previous example, but the edge image always uses the color white for edges and black for the background:

```python
aug = iaa.Canny(
    alpha=(0.0, 0.5),
    colorizer=iaa.RandomColorsBinaryImageColorizer(
        color_true=255,
```
Example. Create a canny edge augmenter that initially preprocesses images using a sobel filter with kernel size of either 3x3 or 13x13 and alpha-blends with result using a strength of 50% (both images equally visible) to 100% (only edge image visible).

```
aug = iaa.Canny(alpha=(0.5, 1.0), sobel_kernel_size=[3, 7])
```

Example. Create an augmenter that blends a canny edge image with a median-blurred version of the input image. The median blur uses a fixed kernel size of 13x13 pixels.
aug = iaa.Alpha(
    (0.0, 1.0),
    iaa.Canny(alpha=1),
    iaa.MedianBlur(13)
)

9.12 augmenters.flip

9.12.1 HorizontalFlip

Alias for `Fliplr`.

API link: `HorizontalFlip`

9.12.2 VerticalFlip

Alias for `Flipud`.

API link: `VerticalFlip`

9.12.3 Fliplr

Flip/mirror input images horizontally.

**Note**: The default value for the probability is `1.0`, i.e. all images will be flipped.

API link: `Fliplr`

**Example**: Flip 50% of all images horizontally:
9.12.4 Flipud

Flip/mirror input images vertically.

**Note:** The default value for the probability is 1.0, i.e. all images will be flipped.

API link: [Flipud](https://python-3-4.readthedocs.io/en/latest/augmenters/flip.html)

**Example.** Flip 50% of all images vertically:

```python
aug = iaa.Flipud(0.5)
```

9.13 augmenters.geometric

9.13.1 Affine

Augmenter to apply affine transformations to images.

API link: [Affine](https://python-3-4.readthedocs.io/en/latest/augmenters/affine.html)

**Example.** Scale images to a value of 50 to 150% of their original size:

```python
import imgaug.augmenters as iaa
aug = iaa.Affine(scale=(0.5, 1.5))
```
**Example.** Scale images to a value of 50 to 150% of their original size, but do this independently per axis (i.e. sample two values per image):

```python
aug = iaa.Affine(scale={"x": (0.5, 1.5), "y": (0.5, 1.5)})
```

**Example.** Translate images by -20 to +20% on x- and y-axis independently:

```python
aug = iaa.Affine(translate_percent={"x": (-0.2, 0.2), "y": (-0.2, 0.2)})
```

**Example.** Translate images by -20 to 20 pixels on x- and y-axis independently:

```python
aug = iaa.Affine(translate_px={"x": (-20, 20), "y": (-20, 20)})
```

**Example.** Rotate images by -45 to 45 degrees:

```python
aug = iaa.Affine(rotate=(-45, 45))
```

**Example.** Shear images by -16 to 16 degrees:

```python
aug = iaa.Affine(shear=(-16, 16))
```
Example. When applying affine transformations, new pixels are often generated, e.g. when translating to the left, pixels are generated on the right. Various modes exist to set how these pixels are ought to be filled. Below code shows an example that uses all modes, sampled randomly per image. If the mode is constant (fill all with one constant value), then a random brightness between 0 and 255 is used:

```
aug = iaa.Affine(translate_percent="x": -0.20, mode=ia.ALL, cval=(0, 255))
```

9.13.2 ScaleX

Apply affine scaling on the x-axis to input data.

This is a wrapper around `imgaug.augmenters.geometric.Affine`.

API link: `ScaleX`

Example. Create an augmenter that scales images along the width to sizes between 50% and 150%. This does not change the image shape (i.e. height and width), only the pixels within the image are remapped and potentially new ones are filled in.

```
import imgaug.augmenters as iaa
aug = iaa.ScaleX((0.5, 1.5))
```
9.13.3 ScaleY

Apply affine scaling on the y-axis to input data.
This is a wrapper around `imgaug.augmenters.geometric.Affine`.
API link: `ScaleY`

Example. Create an augmenter that scales images along the height to sizes between 50% and 150%. This does not change the image shape (i.e. height and width), only the pixels within the image are remapped and potentially new ones are filled in.

```python
import imgaug.augmenters as iaa
aug = iaa.ScaleY((0.5, 1.5))
```

9.13.4 TranslateX

Apply affine translation on the x-axis to input data.
This is a wrapper around `imgaug.augmenters.geometric.Affine`.
API link: `TranslateX`

Example. Create an augmenter that translates images along the x-axis by -20 to 20 pixels:

```python
import imgaug.augmenters as iaa
aug = iaa.TranslateX(px=(-20, 20))
```

Example. Create an augmenter that translates images along the x-axis by -10% to 10% (relative to the x-axis size):

```python
aug = iaa.TranslateX(percent=(-0.1, 0.1))
```

9.13.5 TranslateY

Apply affine translation on the y-axis to input data.
This is a wrapper around `imgaug.augmenters.geometric.Affine`.

**Example.** Create an augmenter that translates images along the y-axis by −20 to 20 pixels:

```python
import imgaug.augmenters as iaa
aug = iaa.TranslateY(px=(-20, 20))
```

**Example.** Create an augmenter that translates images along the y-axis by −10% to 10% (relative to the y-axis size):

```python
aug = iaa.TranslateY(percent=(-0.1, 0.1))
```

### 9.13.6 Rotate

Apply affine rotation on the y-axis to input data.

This is a wrapper around `imgaug.augmenters.geometric.Affine`. It is the same as `Affine(rotate=<value>)`.

**API link:** Rotate

**Example.** Create an augmenter that rotates images by a random value between −45 and 45 degrees:

```python
import imgaug.augmenters as iaa
aug = iaa.Rotate((-45, 45))
```

### 9.13.7 ShearX

Apply affine shear on the x-axis to input data.

This is a wrapper around `Affine`. 
9.13. augmenters.geometric
API link: *ShearX*

**Example.** Create an augmenter that shears images along the x-axis by random amounts between $-20$ and $20$ degrees:

```python
import imgaug.augmenters as iaa
aug = iaa.ShearX((-20, 20))
```

![ShearX examples](image)

### 9.13.8 ShearY

Apply affine shear on the y-axis to input data.

This is a wrapper around `Affine`.

API link: *ShearY*

**Example.** Create an augmenter that shears images along the y-axis by random amounts between $-20$ and $20$ degrees:

```python
import imgaug.augmenters as iaa
aug = iaa.ShearY((-20, 20))
```

### 9.13.9 PiecewiseAffine

Apply affine transformations that differ between local neighbourhoods.

This augmenter places a regular grid of points on an image and randomly moves the neighbourhood of these points around via affine transformations. This leads to local distortions.

This is mostly a wrapper around scikit-image’s `PiecewiseAffine`. See also `Affine` for a similar technique.

**Note:** This augmenter is very slow. See Performance. Try to use `ElasticTransformation` instead, which is at least 10x faster.
Note: For coordinate-based inputs (keypoints, bounding boxes, polygons, ...), this augmenter still has to perform an image-based augmentation, which will make it significantly slower for such inputs than other augmenters. See Performance.

API link: PiecewiseAffine

Example. Distort images locally by moving points around, each with a distance $v$ (percent relative to image size), where $v$ is sampled per point from $\mathcal{N}(0, \ z)$ $z$ is sampled per image from the range 0.01 to 0.05:

```python
import imgaug.augmenters as iaa
aug = iaa.PiecewiseAffine(scale=(0.01, 0.05))
```
Example. Effect of increasing scale from 0.01 to 0.3 in eight steps:

Example. PiecewiseAffine works by placing a regular grid of points on the image and moving them around. By default this grid consists of 4x4 points. The below image shows the effect of increasing that value from 2x2 to 16x16 in 8 steps:

9.13.10 PerspectiveTransform

Apply random four point perspective transformations to images.

Each of the four points is placed on the image using a random distance from its respective corner. The distance is sampled from a normal distribution. As a result, most transformations don’t change the image very much, while some “focus” on polygons far inside the image.

The results of this augmenter have some similarity with Crop.

API link: PerspectiveTransform

Example. Apply perspective transformations using a random scale between 0.01 and 0.15 per image, where the scale is roughly a measure of how far the perspective transformation’s corner points may be distanced from the image’s corner points:
import imgaug.augmenters as iaa
aug = iaa.PerspectiveTransform(scale=(0.01, 0.15))

Example. Same as in the previous example, but images are not resized back to the input image size after augmentation. This will lead to smaller output images.

aug = iaa.PerspectiveTransform(scale=(0.01, 0.15), keep_size=False)

9.13.11 ElasticTransformation

Transform images by moving pixels locally around using displacement fields.

The augmenter has the parameters alpha and sigma. alpha controls the strength of the displacement: higher values mean that pixels are moved further. sigma controls the smoothness of the displacement: higher values lead to smoother patterns – as if the image was below water – while low values will cause individual pixels to be moved very differently from their neighbours, leading to noisy and pixelated images.

A relation of 10:1 seems to be good for alpha and sigma, e.g. alpha=10 and sigma=1 or alpha=50, sigma=5. For 128x128 a setting of alpha=(0, 70.0), sigma=(4.0, 6.0) may be a good choice and will lead to a water-like effect.

For a detailed explanation, see

9.13. augmenters.geometric
Fig. 1: PerspectiveTransform with keep_size set to False. Note that the individual images are here padded after augmentation in order to align them in a grid (i.e. purely for visualization purposes).
Simard, Steinkraus and Platt
Best Practices for Convolutional Neural Networks applied to Visual Document Analysis
in Proc. of the International Conference on Document Analysis and Recognition, 2003

Note: For coordinate-based inputs (keypoints, bounding boxes, polygons, ...), this augmenter still has to perform an image-based augmentation, which will make it significantly slower for such inputs than other augmenters. See Performance.

API link: ElasticTransformation

Example. Distort images locally by moving individual pixels around following a distortions field with strength 0.25. The strength of the movement is sampled per pixel from the range 0 to 5.0:

```python
import imgaug.augmenters as iaa
aug = iaa.ElasticTransformation(alpha=0.0 to 5.0), sigma=0.25)
```

Example. Effect of keeping sigma fixed at 0.25 and increasing alpha from 0 to 5.0 in eight steps:

Example. Effect of keeping alpha fixed at 2.5 and increasing sigma from 0.01 to 1.0 in eight steps:

9.13.12 Rot90

Rotate images clockwise by multiples of 90 degrees.
This could also be achieved using `Affine`, but `Rot90` is significantly more efficient.

API link: `Rot90`

---

**Example.** Rotate all images by 90 degrees. Resize these images afterwards to keep the size that they had before augmentation. This may cause the images to look distorted.

```python
import imgaug.augmenters as iaa
aug = iaa.Rot90(1)
```

**Example.** Rotate all images by 90 or 270 degrees. Resize these images afterwards to keep the size that they had before augmentation. This may cause the images to look distorted.

```python
aug = iaa.Rot90([1, 3])
```

**Example.** Rotate all images by 90, 180 or 270 degrees. Resize these images afterwards to keep the size that they had before augmentation. This may cause the images to look distorted.

```python
aug = iaa.Rot90((1, 3))
```

**Example.** Rotate all images by 90, 180 or 270 degrees. Does not resize to the original image size afterwards, i.e. each image’s size may change.
Augmenter that applies other augmenters in a polar-transformed space.

This augmenter first transforms an image into a polar representation, then applies its child augmenter, then transforms back to cartesian space. The polar representation is still in the image’s input dtype (i.e. uint8 stays uint8) and can be visualized. It can be thought of as an “unrolled” version of the image, where previously circular lines appear straight. Hence, applying child augmenters in that space can lead to circular effects. E.g. replacing rectangular pixel areas in the polar representation with black pixels will lead to curved black areas in the cartesian result.

This augmenter can create new pixels in the image. It will fill these with black pixels. For segmentation maps it will fill with class id 0. For heatmaps it will fill with 0.0.

This augmenter is limited to arrays with a height and/or width of 32767 or less.

**Warning:** When augmenting coordinates in polar representation, it is possible that these are shifted outside of the polar image, but are inside the image plane after transforming back to cartesian representation, usually on newly created pixels (i.e. black backgrounds). These coordinates are currently not removed. It is recommended to not use very strong child transformations when also augmenting coordinate-based augmentables.

**Warning:** For bounding boxes, this augmenter suffers from the same problem as affine rotations applied to bounding boxes, i.e. the resulting bounding boxes can have unintuitive (seemingly wrong) appearance. This is due to coordinates being “rotated” that are inside the bounding box, but do not fall on the object and actually are background. It is recommended to use this augmenter with caution when augmenting bounding boxes.
**Warning:** For polygons, this augmenter should not be combined with augmenters that perform automatic polygon recovery for invalid polygons, as the polygons will frequently appear broken in polar representation and their “fixed” version will be very broken in cartesian representation. Augmenters that perform such polygon recovery are currently `PerspectiveTransform`, `PiecewiseAffine` and `ElasticTransformation`.

API link: `WithPolarWarping`

**Example.** Apply cropping and padding in polar representation, then warp back to cartesian representation:

```python
import imgaug.augmenters as iaa
aug = iaa.WithPolarWarping(iaa.CropAndPad(percent=(-0.1, 0.1)))
```

**Example.** Apply affine translations in polar representation:

```python
aug = iaa.WithPolarWarping(
    iaa.Affine(
        translate_percent={"x": (-0.1, 0.1), "y": (-0.1, 0.1)}
    )
)
```

**Example.** Apply average pooling in polar representation. This leads to circular bins:

```python
aug = iaa.WithPolarWarping(iaa.AveragePooling((2, 8)))
```

### 9.13.14 Jigsaw

Move cells within images similar to jigsaw patterns.

**Note:** This augmenter will by default pad images until their height is a multiple of `nb_rows`. Analogous for `nb_cols`.

**Note:** This augmenter will resize heatmaps and segmentation maps to the image size, then apply similar padding as for the corresponding images and resize back to the original map size. That also means that images may change in shape (due to padding), but heatmaps/segmaps will not change. For heatmaps/segmaps, this deviates from pad augmenters that will change images and heatmaps/segmaps in corresponding ways and then keep the heatmaps/segmaps at the new size.

**Warning:** This augmenter currently only supports augmentation of images, heatmaps, segmentation maps and keypoints. Other augmentables, i.e. bounding boxes, polygons and line strings, will result in errors.
Example. Create a jigsaw augmenter that splits images into 10x10 cells and shifts them around by 0 to 2 steps (default setting):

```python
import imgaug.augmenters as iaa
aug = iaa.Jigsaw(nb_rows=10, nb_cols=10)
```

Example. Create a jigsaw augmenter that splits each image into 1 to 4 cells along each axis:

```python
aug = iaa.Jigsaw(nb_rows=(1, 4), nb_cols=(1, 4))
```

Example. Create a jigsaw augmenter that moves the cells in each image by a random amount between 1 and 5 times (decided per image). Some images will be barely changed, some will be fairly distorted.

```python
aug = iaa.Jigsaw(nb_rows=10, nb_cols=10, max_steps=(1, 5))
```
9.14 augmenters.imgcorruptlike

9.14.1 GaussianNoise

Wrapper around `gaussian_noise()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: *GaussianNoise*

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `gaussian_noise()`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`:

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.GaussianNoise(severity=2)
```

9.14.2 ShotNoise

Wrapper around `shot_noise()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: *ShotNoise*

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `shot_noise()`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`:

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.ShotNoise(severity=2)
```

9.14.3 ImpulseNoise

Wrapper around `impulse_noise()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: *ImpulseNoise*

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `impulse_noise()`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`:

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.ImpulseNoise(severity=2)
```
9.14.4 SpeckleNoise

Wrapper around `speckle_noise()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: [SpeckleNoise](#)

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `speckle_noise()`. Apply it to images using e.g.

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.SpeckleNoise(severity=2)
```

9.14.5 GaussianBlur

Wrapper around `gaussian_blur()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: [GaussianBlur](#)

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `gaussian_blur()`. Apply it to images using e.g.

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.GaussianBlur(severity=2)
```

9.14.6 GlassBlur

Wrapper around `glass_blur()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: [GlassBlur](#)

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `glass_blur()`. Apply it to images using e.g.

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.GlassBlur(severity=2)
```
9.14.7 DefocusBlur

Wrapper around `defocus_blur()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: [DefocusBlur](https://github.com/aleju/imgaug/blob/master/docs/api/augmenters/imgcorruptlike/DefocusBlur.html)

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `defocus_blur()`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`:

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.DefocusBlur(severity=2)
```

9.14.8 MotionBlur

Wrapper around `motion_blur()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: [MotionBlur](https://github.com/aleju/imgaug/blob/master/docs/api/augmenters/imgcorruptlike/MotionBlur.html)

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `motion_blur()`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`:

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.MotionBlur(severity=2)
```

9.14.9 ZoomBlur

Wrapper around `zoom_blur()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: [ZoomBlur](https://github.com/aleju/imgaug/blob/master/docs/api/augmenters/imgcorruptlike/ZoomBlur.html)

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `zoom_blur()`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`:

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.ZoomBlur(severity=2)
```
9.14.10 Fog

Wrapper around `fog()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: [Fog](#)

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `fog()`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`:

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.Fog(severity=2)
```

9.14.11 Frost

Wrapper around `frost()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: [Frost](#)

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `frost()`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`:

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.Frost(severity=2)
```

9.14.12 Snow

Wrapper around `snow()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: [Snow](#)

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `snow()`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`:

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.Snow(severity=2)
```
9.14.13 Spatter

Wrapper around `spatter()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: [Spatter](#)

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `spatter()`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`:

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.Spatter(severity=2)
```

9.14.14 Contrast

Wrapper around `contrast()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: [Contrast](#)

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `contrast()`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`:

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.Contrast(severity=2)
```

9.14.15 Brightness

Wrapper around `brightness()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: [Brightness](#)

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `brightness()`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`:

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.Brightness(severity=2)
```
9.14.16 Saturate

Wrapper around `saturate()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: [Saturate](#)

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `saturate()`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`:

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.Saturate(severity=2)
```

9.14.17 JpegCompression

Wrapper around `jpeg_compression()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: [JpegCompression](#)

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `jpeg_compression()`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`:

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.JpegCompression(severity=2)
```

9.14.18 Pixelate

Wrapper around `jpeg_compression()`.

**Note:** This augmenter only affects images. Other data is not changed.

Wrapper around `pixelate()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: [Pixelate](#)

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `pixelate()`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`:

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.Pixelate(severity=2)
```
9.14.19 ElasticTransform

Wrapper around `elastic_transform()`.

**Note:** This augmenter only affects images. Other data is not changed.

API link: [ElasticTransform](https://www imgaug.de/docs/en/api/augmenters/pillike/

The image below visualizes severities 1 to 5 – one severity per row:

**Example.** Create an augmenter around `elastic_transform()`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`:

```python
import imgaug.augmenters as iaa
aug = iaa.imgcorruptlike.ElasticTransform(severity=2)
```

9.15 augmenters.pillike

9.15.1 Solarize

Augmenter with identical outputs to PIL’s `solarize()` function.

This augmenter inverts all pixel values above a threshold.

The outputs are identical to PIL’s `solarize()`.

API link: [Solarize()](https://www.imgaug.de/docs/en/api/augmenters/pillike/

**Example.** Invert the colors in 50 percent of all images for pixels with a value between 32 and 128 or more. The threshold is sampled once per image. The thresholding operation happens per channel.

```python
import imgaug.augmenters as iaa
aug = iaa.Solarize(0.5, threshold=(32, 128))
```

9.15.2 Posterize

Augmenter with identical outputs to PIL’s `posterize()` function.

This augmenter quantizes each array component to `N` bits.

This class is currently an alias for `Posterize`, which again is an alias for `UniformColorQuantizationToNBits`, i.e. all three classes are right now guaranteed to have the same outputs as PIL’s function.

API link: [Posterize()](https://www.imgaug.de/docs/en/api/augmenters/pillike/

9.15.3 Equalize

Equalize the image histogram.

This augmenter has identical outputs to `equalize()`.

API link: [Equalize()](https://www.imgaug.de/docs/en/api/augmenters/pillike/

**Example.** Equalize the histograms of all input images:
9.15.4 Autocontrast

Adjust contrast by cutting off p% of lowest/highest histogram values.

This augmenter has identical outputs to `autocontrast()`.

See `autocontrast()` for more details.

API link: `Autocontrast()`

Example. Modify the contrast of images by cutting off the 0 to 20% lowest and highest values from the histogram, then stretching it to full length:

```python
aug = iaa.pillike.Autocontrast()
```

Example. Modify the contrast of images by cutting off the 10 to 20% lowest and highest values from the histogram, then stretching it to full length. The cutoff value is sampled per channel instead of per image.

```python
aug = iaa.pillike.Autocontrast((10, 20), per_channel=True)
```

9.15.5 EnhanceColor

Convert images to grayscale.

This augmenter has identical outputs to `Color`.

API link: `EnhanceColor()`

Example. Create an augmenter to remove a random fraction of color from input images:
9.15.6 EnhanceContrast

Change the contrast of images.

This augmenter has identical outputs to Contrast.

API link: `EnhanceContrast()`

Example. Create an augmenter that worsens the contrast of an image by a random factor:

```python
import imgaug.augmenters as iaa
aug = iaa.pillike.EnhanceContrast()
```

9.15.7 EnhanceBrightness

Change the brightness of images.

This augmenter has identical outputs to Brightness.

API link: `EnhanceBrightness()`

Example. Create an augmenter that worsens the brightness of an image by a random factor:

```python
import imgaug.augmenters as iaa
aug = iaa.pillike.EnhanceBrightness()
```

9.15.8 EnhanceSharpness

Change the sharpness of images.
This augmenter has identical outputs to Sharpness.

API link: `EnhanceSharpness()`

**Example.** Create an augmenter that randomly decreases or increases the sharpness of an image:

```python
import imgaug.augmenters as iaa
aug = iaa.pillike.EnhanceSharpness()
```

9.15.9 **FilterBlur**

Apply a blur filter kernel to images.

This augmenter has identical outputs to calling `filter()` with kernel `PIL.ImageFilter.BLUR`.

API link: `FilterBlur()`

**Example.** Create an augmenter that applies a blur filter kernel to images:

```python
import imgaug.augmenters as iaa
aug = iaa.pillike.FilterBlur()
```
9.15.10 FilterSmooth

Apply a smoothening filter kernel to images.

This augmenter has identical outputs to calling `filter()` with kernel `PIL.ImageFilter.SMOOTH`.

API link: `FilterSmooth()`

Example. Create an augmenter that applies a smoothening filter kernel to images:

```python
import imgaug.augmenters as iaa
aug = iaa.pillike.FilterSmooth()
```

9.15.11 FilterSmoothMore

Apply a strong smoothening filter kernel to images.

This augmenter has identical outputs to calling `filter()` with kernel `PIL.ImageFilter.BLUR`.

API link: `FilterSmoothMore()`

Example. Create an augmenter that applies a strong smoothening filter kernel to images:

```python
import imgaug.augmenters as iaa
aug = iaa.pillike.FilterSmoothMore()
```

9.15.12 FilterEdgeEnhance

Apply an edge enhance filter kernel to images.

This augmenter has identical outputs to calling `filter()` with kernel `PIL.ImageFilter.EDGE_ENHANCE`.

API link: `FilterEdgeEnhance()`
Example. Create an augmenter that applies a edge enhancement filter kernel to images:

```python
import imgaug.augmenters as iaa
aug = iaa.pillike.FilterEdgeEnhance()
```

9.15.13 FilterEdgeEnhanceMore

Apply a strong edge enhancement filter kernel to images.

This augmenter has identical outputs to calling `filter()` with kernel `PIL.ImageFilter.EDGE_ENHANCE_MORE`.

API link: `FilterEdgeEnhanceMore()`

Example. Create an augmenter that applies a strong edge enhancement filter kernel to images:

```python
import imgaug.augmenters as iaa
aug = iaa.pillike.FilterEdgeEnhanceMore()
```
9.15.14 FilterFindEdges

Apply a edge detection kernel to images.
This augmenter has identical outputs to calling `filter()` with kernel `PIL.ImageFilter.FIND_EDGES`.
API link: `FilterFindEdges()`
Example. Create an augmenter that applies an edge detection filter kernel to images:

```python
import imgaug.augmenters as iaa
aug = iaa.pillike.FilterFindEdges()
```

9.15.15 FilterContour

Apply a contour detection filter kernel to images.
This augmenter has identical outputs to calling `filter()` with kernel `PIL.ImageFilter.CONTOUR`.
API link: `FilterContour()`
Example. Create an augmenter that applies a contour detection filter kernel to images:

```python
import imgaug.augmenters as iaa
aug = iaa.pillike.FilterContour()
```

9.15.16 FilterEmboss

Apply an emboss filter kernel to images.
This augmenter has identical outputs to calling `filter()` with kernel `PIL.ImageFilter.EMBOSS`.
API link: `FilterEmboss()`
Example. Create an augmenter that applies an emboss filter kernel to images:
9.15.17 FilterSharpen

Apply a sharpening filter kernel to images.

This augmenter has identical outputs to calling \texttt{filter()} with kernel \texttt{PIL.ImageFilter.SHARPEN}.

API link: \texttt{FilterSharpen()}

Example. Create an augmenter that applies a sharpening filter kernel to images:

```python
import imgaug.augmenters as iaa
aug = iaa.pillike.FilterSharpen()
```

9.15.18 FilterDetail

Apply a detail enhancement filter kernel to images.

This augmenter has identical outputs to calling \texttt{filter()} with kernel \texttt{PIL.ImageFilter.DETAIL}.

API link: \texttt{FilterDetail()}

Example. Create an augmenter that applies a detail enhancement filter kernel to images:

```python
import imgaug.augmenters as iaa
aug = iaa.pillike.FilterDetail()
```
9.15.19 Affine

Apply PIL-like affine transformations to images.

This augmenter has identical outputs to `transform()` with parameter `method=PIL.Image.AFFINE`.

**Note:** This augmenter can currently only transform image-data. Batches containing heatmaps, segmentation maps and coordinate-based augmentables will be rejected with an error. Use `Affine` if you have to transform such inputs.

**Note:** This augmenter uses the image center as the transformation center. This has to be explicitly enforced in PIL using corresponding translation matrices. Without such translation, PIL uses the image top left corner as the transformation center. To mirror that behaviour, use `center=(0.0, 0.0)`.

API link: `Affine()`

**Example.** Create an augmenter that applies affine scaling (zoom in/out) to images. Along the x-axis they are scaled to 80-120% of their size, along the y-axis to 50-150% (both values randomly and uniformly chosen per image).

```python
import imgaug.augmenters as iaa
aug = iaa.pillike.Affine(scale={"x": (0.8, 1.2), "y": (0.5, 1.5)})
```
**Example.** Create an augmenter that translates images along the y-axis by either -10px or 10px. Newly created pixels are always filled with the value 128 (along all channels).

```python
aug = iaa.pillike.Affine(translate_px={"x": 0, "y": [-10, 10]},
                            fillcolor=128)
```

**Example.** Rotate an image by -20 to 20 degrees and fill up all newly created pixels with a random RGB color:

```python
aug = iaa.pillike.Affine(rotate=(-20, 20), fillcolor=(0, 256))
```

See the similar augmenter *Affine* for more examples.
9.16 augmenters.pooling

9.16.1 AveragePooling

Apply average pooling to images.

This augmenter pools images with kernel sizes \( H \times W \) by averaging the pixel values within these windows. For e.g. \( 2 \times 2 \) this halves the image size. Optionally, the augmenter will automatically re-upscale the image to the input size (by default this is activated).

This augmenter does not affect heatmaps, segmentation maps or coordinates-based augmentables (e.g. keypoints, bounding boxes, ...).

Note that this augmenter is very similar to AverageBlur. AverageBlur applies averaging within windows of given kernel size \textit{without} striding, while AveragePooling applies striding corresponding to the kernel size, with optional upscaling afterwards. The upscaling is configured to create “pixelated”/“blocky” images by default.

API link: AveragePooling

**Example.** Create an augmenter that always pools with a kernel size of \( 2 \times 2 \):

```python
import imgaug.augmenters as iaa
aug = iaa.AveragePooling(2)
```

![Image](image_url)

**Example.** Create an augmenter that always pools with a kernel size of \( 2 \times 2 \) and does \textit{not} resize back to the input image size, i.e. the resulting images have half the resolution:

```python
aug = iaa.AveragePooling(2, keep_size=False)
```

![Image](image_url)

**Example.** Create an augmenter that always pools either with a kernel size of \( 2 \times 2 \) or \( 8 \times 8 \):

```python
aug = iaa.AveragePooling([2, 8])
```

**Example.** Create an augmenter that always pools with a kernel size of \( 1 \times 1 \) (does nothing) to \( 7 \times 7 \). The kernel sizes are always symmetric.

```python
aug = iaa.AveragePooling([1, 7])
```
9.16. augmenters.pooling
Example. Create an augmenter that always pools with a kernel size of \( H \times W \) where \( H \) and \( W \) are both sampled independently from the range \([1..7]\). E.g. resulting kernel sizes could be \( 3 \times 7 \) or \( 5 \times 1 \).

\[
\texttt{aug = iaa.AveragePooling(((1, 7), (1, 7)))}
\]

9.16.2 MaxPooling

Apply max pooling to images.

This augmenter pools images with kernel sizes \( H \times W \) by taking the maximum pixel value over windows. For e.g. \( 2 \times 2 \) this halves the image size. Optionally, the augmenter will automatically re-upscale the image to the input size (by default this is activated).

The maximum within each pixel window is always taken channelwise.

This augmenter does not affect heatmaps, segmentation maps or coordinates-based augmentables (e.g. keypoints, bounding boxes, ...).

API link: MaxPooling

Example. Create an augmenter that always pools with a kernel size of \( 2 \times 2 \):

\[
\texttt{import imgaug.augmenters as iaa}
\texttt{aug = iaa.MaxPooling(2)}
\]

Example. Create an augmenter that always pools with a kernel size of \( 2 \times 2 \) and does not resize back to the input image size, i.e. the resulting images have half the resolution:

\[
\texttt{aug = iaa.MaxPooling(2, keep_size=False)}
\]

Example. Create an augmenter that always pools either with a kernel size of \( 2 \times 2 \) or \( 8 \times 8 \):

\[
\texttt{aug = iaa.MaxPooling([2, 8])}
\]

Example. Create an augmenter that always pools with a kernel size of \( 1 \times 1 \) (does nothing) to \( 7 \times 7 \). The kernel sizes are always symmetric.
Example. Create an augmenter that always pools with a kernel size of $H \times W$ where $H$ and $W$ are both sampled independently from the range $[1..7]$. E.g. resulting kernel sizes could be $3 \times 7$ or $5 \times 1$.

```
aug = iaa.MaxPooling(((1, 7), (1, 7)))
```

### 9.16.3 MinPooling

Apply minimum pooling to images.
This augmenter pools images with kernel sizes $H \times W$ by taking the minimum pixel value over windows. For e.g. $2 \times 2$ this halves the image size. Optionally, the augmenter will automatically re-upscale the image to the input size (by default this is activated).

The minimum within each pixel window is always taken channelwise.

This augmenter does not affect heatmaps, segmentation maps or coordinates-based augmentables (e.g. keypoints, bounding boxes, ...).

API link: `MinPooling`

**Example.** Create an augmenter that always pools with a kernel size of $2 \times 2$:

```python
import imgaug.augmenters as iaa
aug = iaa.MinPooling(2)
```

**Example.** Create an augmenter that always pools with a kernel size of $2 \times 2$ and does not resize back to the input image size, i.e. the resulting images have half the resolution.

```python
aug = iaa.MinPooling(2, keep_size=False)
```

**Example.** Create an augmenter that always pools either with a kernel size of $2 \times 2$ or $8 \times 8$:

```python
aug = iaa.MinPooling([2, 8])
```

**Example.** Create an augmenter that always pools with a kernel size of $1 \times 1$ (does nothing) to $7 \times 7$. The kernel sizes are always symmetric.

```python
aug = iaa.MinPooling((1, 7))
```

**Example.** Create an augmenter that always pools with a kernel size of $H \times W$ where $H$ and $W$ are both sampled independently from the range $[1..7]$. E.g. resulting kernel sizes could be $3 \times 7$ or $5 \times 1$.

```python
aug = iaa.MinPooling(((1, 7), (1, 7)))
```

### 9.16.4 MedianPooling

Apply median pooling to images.
This augmenter pools images with kernel sizes $H \times W$ by taking the median pixel value over windows. For e.g. $2 \times 2$ this halves the image size. Optionally, the augmenter will automatically re-upscale the image to the input size (by default this is activated).

The median within each pixel window is always taken channelwise.

This augmenter does not affect heatmaps, segmentation maps or coordinates-based augmentables (e.g. keypoints, bounding boxes, ...).

API link: `MedianPooling`

**Example.** Create an augmenter that always pools with a kernel size of $2 \times 2$:

```python
import imgaug.augmenters as iaa
aug = iaa.MedianPooling(2)
```

**Example.** Create an augmenter that always pools with a kernel size of $2 \times 2$ and does *not* resize back to the input image size, i.e. the resulting images have half the resolution:

```python
aug = iaa.MedianPooling(2, keep_size=False)
```

**Example.** Create an augmenter that always pools either with a kernel size of $2 \times 2$ or $8 \times 8$:
Example. Create an augmenter that always pools with a kernel size of \(1 \times 1\) (does nothing) to \(7 \times 7\). The kernel sizes are always symmetric.

```python
aug = iaa.MedianPooling([2, 8])
```

Example. Create an augmenter that always pools with a kernel size of \(H \times W\) where \(H\) and \(W\) are both sampled independently from the range \([1..7]\). E.g. resulting kernel sizes could be \(3 \times 7\) or \(5 \times 1\).

```python
aug = iaa.MedianPooling(((1, 7), (1, 7)))
```

# 9.17 augmenters.segmentation

## 9.17.1 Superpixels

Completely or partially transform images to their superpixel representation.

Note: This augmenter is fairly slow. See Performance.

API link: Superpixels
Example. Generate about 64 superpixels per image. Replace each one with a probability of 50% by its average pixel color.

```python
import imgaug.augmenters as iaa
aug = iaa.Superpixels(p_replace=0.5, n_segments=64)
```

Example. Generate 16 to 128 superpixels per image. Replace each superpixel with a probability between 10 and 100% (sampled once per image) by its average pixel color.

```python
aug = iaa.Superpixels(p_replace=(0.1, 1.0), n_segments=(16, 128))
```

Example. Effect of setting n_segments to a fixed value of 64 and then increasing p_replace from 0.0 and 1.0:
Example. Effect of setting \( p_{\text{replace}} \) to a fixed value of 1.0 and then increasing \( n_{\text{segments}} \) from \( 1 \times 16 \) to \( 9 \times 16 = 144 \):

9.17.2 Voronoi

Average colors of an image within Voronoi cells.

This augmenter performs the following steps:

1. Query \( \text{points\_sampler} \) to sample random coordinates of cell centers. On the image.
2. Estimate for each pixel to which voronoi cell (i.e. segment) it belongs. Each pixel belongs to the cell with the closest center coordinate (euclidean distance).
3. Compute for each cell the average color of the pixels within it.
4. Replace the pixels of \( p_{\text{replace}} \) percent of all cells by their average color. Do not change the pixels of \( (1 - p_{\text{replace}}) \) percent of all cells. (The percentages are average values over many images. Some images may get more/less cells replaced by their average color.)

Example. Create an augmenter that places a \( 20 \times 40 \) \((H \times W)\) grid of cells on the image and replaces all pixels within each cell by the cell’s average color. The process is performed at an image size not exceeding 128px on any side. If necessary, the downscaling is performed using linear interpolation.

```python
import imgaug.augmenters as iaa
points_sampler = iaa.RegularGridPointsSampler(n_cols=20, n_rows=40)
aug = iaa.Voronoi(points_sampler)
```

Example. Create a voronoi augmenter that generates a grid of cells dynamically adapted to the image size. Larger images get more cells. On the x-axis, the distance between two cells is \( w \times W \) pixels, where \( W \) is the width of the image and \( w \) is always 0.1. On the y-axis, the distance between two cells is \( h \times H \) pixels, where \( H \) is the height of the image and \( h \) is sampled uniformly from the interval \([0.05, 0.2]\). To make the voronoi pattern less regular, about 20 percent of the cell coordinates are randomly dropped (i.e. the remaining cells grow in size). In contrast to the first example, the image is not resized (if it was, the sampling would happen \textit{after} the resizing, which would affect \( W \) and \( H \)). Not all voronoi cells are replaced by their average color, only around 90 percent of them. The remaining 10 percent’s pixels remain unchanged.

```python
points_sampler = iaa.DropoutPointsSampler(
    iaa.RelativeRegularGridPointsSampler(
        n_cols_frac=(0.05, 0.2),
        n_rows_frac=0.1),
    )
```

(continues on next page)
aug = iaa.Voronoi(points_sampler, p_replace=0.9, max_size=None)

9.17.3 UniformVoronoi

Uniformly sample Voronoi cells on images and average colors within them.

This augmenter is a shortcut for the combination of Voronoi with UniformPointsSampler. Hence, it generates a fixed amount of $N$ random coordinates of voronoi cells on each image. The cell coordinates are sampled uniformly using the image height and width as maxima.
API link: `UniformVoronoi`

**Example.** Sample for each image uniformly the number of voronoi cells $N$ from the interval $[100, 500]$. Then generates $N$ coordinates by sampling uniformly the $x$-coordinates from $[0, W]$ and the $y$-coordinates from $[0, H]$, where $H$ is the image height and $W$ the image width. Then uses these coordinates to group the image pixels into voronoi cells and averages the colors within them. The process is performed at an image size not exceeding 128px on any side. If necessary, the downscaling is performed using linear interpolation.

```python
import imgaug.augmenters as iaa
aug = iaa.UniformVoronoi((100, 500))
```

![Example images](image)

**Example.** Same as above, but always samples $N=250$ cells, replaces only 90 percent of them with their average color (the pixels of the remaining 10 percent are not changed) and performs the transformation at the original image size.

```python
aug = iaa.UniformVoronoi(250, p_replace=0.9, max_size=None)
```

### 9.17.4 RegularGridVoronoi

Sample Voronoi cells from regular grids and color-average them.

This augmenter is a shortcut for the combination of `Voronoi`, `RegularGridPointsSampler` and `DropoutPointsSampler`. Hence, it generates a regular grid with $R$ rows and $C$ columns of coordinates on each image. Then, it drops $p$ percent of the $R \times C$ coordinates to randomize the grid. Each image pixel then belongs to the voronoi cell with the closest coordinate.

API link: `RegularGridVoronoi`

**Example.** Place a regular grid of 10x20 (height x width) coordinates on each image. Randomly drop on average 20 percent of these points to create a less regular pattern. Then use the remaining coordinates to group the image pixels into voronoi cells and average the colors within them. The process is performed at an image size not exceeding 128px on any side. If necessary, the downscaling is performed using linear interpolation.

```python
import imgaug.augmenters as iaa
aug = iaa.RegularGridVoronoi(10, 20)
```
Example. Same as above, generates a grid with randomly 10 to 30 rows, drops none of the generated points, replaces only 90 percent of the voronoi cells with their average color (the pixels of the remaining 10 percent are not changed) and performs the transformation at the original image size.

```python
aug = iaa.RegularGridVoronoi((10, 30), 20, p_drop_points=0.0, p_replace=0.9, max_size=None)
```

9.17.5 RelativeRegularGridVoronoi

Sample Voronoi cells from image-dependent grids and color-average them.

This augmenter is a shortcut for the combination of Voronoi, RegularGridPointsSampler and DropoutPointsSampler. Hence, it generates a regular grid with \( R \times C \) coordinates on each image. Then, it drops \( p \) percent of the \( R \times C \) coordinates to randomize the grid. Each image pixel then belongs to the voronoi cell with the closest coordinate.

Note: In contrast to the other Voronoi augmenters, this one uses None as the default value for max_size, i.e. the color averaging is always performed at full resolution. This enables the augmenter to make most use of the added points for larger images. It does however slow down the augmentation process.

API link: RelativeRegularGridVoronoi

Example. Place a regular grid of \( R \times C \) coordinates on each image, where \( R \) is the number of rows and computed as \( R = 0.1 \times H \) with \( H \) being the height of the input image. \( C \) is the number of columns and analogously estimated from the image width \( W \) as \( C = 0.25 \times W \). Larger images will lead to larger \( R \) and \( C \) values. On average, 20 percent of these grid coordinates are randomly dropped to create a less regular pattern. Then, the remaining coordinates are used to group the image pixels into voronoi cells and the colors within them are averaged.

```python
import imgaug.augmenters as iaa
aug = iaa.RelativeRegularGridVoronoi(0.1, 0.25)
```

Example. Same as above, generates a grid with randomly \( R = r \times H \) rows, where \( r \) is sampled uniformly from the interval \([0.03, 0.1]\) and \( C = 0.1 \times W \) rows. No points are dropped. The augmenter replaces only 90 percent of the
voronoi cells with their average color (the pixels of the remaining 10 percent are not changed). Images larger than 512px are temporarily downscaled (before sampling the grid points) so that no side exceeds 512px. This improves performance, but degrades the quality of the resulting image.

```python
aug = iaa.RelativeRegularGridVoronoi((0.03, 0.1), 0.1, p_drop_points=0.0, p_replace=0.9, max_size=512)
```
9.18 augmenters.size

9.18.1 Resize

Augmenter that resizes images to specified heights and widths.

API link: Resize

Example. Resize each image to height=32 and width=64:

```python
import imgaug.augmenters as iaa
aug = iaa.Resize({"height": 32, "width": 64})
```

Example. Resize each image to height=32 and keep the aspect ratio for width the same:

```python
aug = iaa.Resize({"height": 32, "width": "keep-aspect-ratio"})
```

Example. Resize each image to something between 50 and 100% of its original size:

```python
aug = iaa.Resize((0.5, 1.0))
```
Example. Resize each image’s height to 50-75% of its original size and width to either 16px or 32px or 64px:

\[
\text{aug = iaa.Resize\{"height": (0.5, 0.75), "width": [16, 32, 64]\}}
\]

9.18.2 CropAndPad

Crop/pad images by pixel amounts or fractions of image sizes.

Cropping removes pixels at the sides (i.e. extracts a subimage from a given full image). Padding adds pixels to the sides (e.g. black pixels).

Note: This augmenter automatically resizes images back to their original size after it has augmented them. To deactivate this, add the parameter keep_size=False.

API link: CropAndPad

Example. Crop or pad each side by up to 10 percent relative to its original size (negative values result in cropping, positive in padding):

```
import imgaug.augmenters as iaa
aug = iaa.CropAndPad(\{percent=(-0.25, 0.25)\})
```

Example. Pad each side by 0 to 20 percent. This adds new pixels to the sides. These pixels will either be filled with a constant value (mode=constant) or filled with the value on the closest edge (mode=edge). If a constant value is used, it will be a random value between 0 and 128 (sampled per image).

```
aug = iaa.CropAndPad(
    \{percent=(0, 0.2),
    pad_mode=['constant', 'edge'],
    pad_cval=(0, 128)
\})
```

Example. Pad the top side of each image by 0 to 30 pixels, the right side by 0-10px, bottom side by 0-30px and left side by 0-10px. Use any of the available modes to fill new pixels and if the mode is constant then use a constant value between 0 and 128.
Example. Crop/pad each side by up to 10px. The value will be sampled once per image and used for all sides (i.e. all sides gain/lose the same number of rows/columns).

```python
aug = iaa.CropAndPad(
    px=((0, 30), (0, 10), (0, 30), (0, 10)),
    pad_mode=ia.ALL,
    pad_cval=(0, 128)
)
```

9.18.3 Pad

Pad images, i.e. adds columns/rows of pixels to them.

This is a shortcut for CropAndPad. It only accepts positive pixel/percent values.

API link: Pad
9.18.4 Crop

Crop images, i.e. remove columns/rows of pixels at the sides of images.

This is a shortcut for CropAndPad. It only accepts positive pixel/percent values and transfers them as negative values to CropAndPad.

API link: Crop

9.18.5 PadToFixedSize

Pad images to minimum width/height.

If images are already at the minimum width/height or are larger, they will not be padded. Note that this also means that images will not be cropped if they exceed the required width/height.

The augmenter randomly decides per image how to distribute the required padding amounts over the image axis. E.g. if 2px have to be padded on the left or right to reach the required width, the augmenter will sometimes add 2px to the left and 0px to the right, sometimes add 2px to the right and 0px to the left and sometimes add 1px to both sides. Set position to center to prevent that.

API link: PadToFixedSize

Example. For image sides smaller than 100 pixels, pad to 100 pixels. Do nothing for the other edges. The padding is randomly (uniformly) distributed over the sides, so that e.g. sometimes most of the required padding is applied to the left, sometimes to the right (analogous top/bottom). The input image here has a size of 80x80.

```python
import imgaug.augmenters as iaa
aug = iaa.PadToFixedSize(width=100, height=100)
```

Example. For image sides smaller than 100 pixels, pad to 100 pixels. Do nothing for the other image sides. The padding is always equally distributed over the left/right and top/bottom sides. The input image here has a size of 80x80.

```python
aug = iaa.PadToFixedSize(width=100, height=100, position="center")
```

Example. For image sides smaller than 100 pixels, pad to 100 pixels and use any possible padding mode for that. Do nothing for the other image sides. The padding is always equally distributed over the left/right and top/bottom sides. The input image here has a size of 80x80.

```python
aug = iaa.PadToFixedSize(width=100, height=100, position="center")
```
Example. Pad images smaller than 100x100 until they reach 100x100. Analogously, crop images larger than 100x100 until they reach 100x100. The output images therefore have a fixed size of 100x100. The input image here has a size of 80x120, so that the top/bottom sides have to be cropped and the left/right sides have to be padded. Note that the original image was resized to 80x120, leading to a bit of an distorted appearance.

```
aug = iaa.Sequential([iah.PadToFixedSize(width=100, height=100),  
                      iaa.CropToFixedSize(width=100, height=100)])
```

9.18.6 CropToFixedSize

Crop images down to a fixed maximum width/height.

If images are already at the maximum width/height or are smaller, they will not be cropped. Note that this also means that images will not be padded if they are below the required width/height.

The augmenter randomly decides per image how to distribute the required cropping amounts over the image axis. E.g. if 2px have to be cropped on the left or right to reach the required width, the augmenter will sometimes remove 2px from the left and 0px from the right, sometimes remove 2px from the right and 0px from the left and sometimes remove 1px from both sides. Set position to center to prevent that.

API link: CropToFixedSize
Example. For image sides larger than 100 pixels, crop to 100 pixels. Do nothing for the other sides. The cropping amounts are randomly (and uniformly) distributed over the sides of the image. The input image here has a size of 120x120.

```python
import imgaug.augmenters as iaa
aug = iaa.CropToFixedSize(width=100, height=100)
```

Example. For sides larger than 100 pixels, crop to 100 pixels. Do nothing for the other sides. The cropping amounts are always equally distributed over the left/right sides of the image (and analogously for top/bottom). The input image here has a size of 120x120.

```python
aug = iaa.CropToFixedSize(width=100, height=100, position="center")
```

Example. Pad images smaller than 100x100 until they reach 100x100. Analogously, crop images larger than 100x100 until they reach 100x100. The output images therefore have a fixed size of 100x100. The input image here has a size of 80x120, so that the top/bottom sides have to be cropped and the left/right sides have to be padded. Note that the original image was resized to 80x120, leading to a bit of an distorted appearance.
9.18.7 PadToMultiplesOf

Pad images until their height/width is a multiple of a value.

API link: PadToMultiplesOf

Example. Create an augmenter that pads images to multiples of 10 along the y-axis (i.e. 10, 20, 30, ...) and to multiples of 6 along the x-axis (i.e. 6, 12, 18, ...). The rows to be padded will be spread randomly over the top and bottom sides (analogous for the left/right sides).

```python
import imgaug.augmenters as iaa
aug = iaa.PadToMultiplesOf(height_multiple=10, width_multiple=6)
```

9.18.8 CropToMultiplesOf

Crop images down until their height/width is a multiple of a value.

```python
aug = iaa.Sequential([iaa.PadToFixedSize(width=100, height=100),
                      iaa.CropToFixedSize(width=100, height=100)])
```
Note: For a given axis size $A$ and multiple $M$, if $A$ is in the interval $[0 .. M]$, the axis will not be changed. As a result, this augmenter can still produce axis sizes that are not multiples of the given values.

API link: `CropToMultiplesOf`

Example. Create an augmenter that crops images to multiples of 10 along the y-axis (i.e. 10, 20, 30, ...) and to multiples of 6 along the x-axis (i.e. 6, 12, 18, ...). The rows to be cropped will be spread randomly over the top and bottom sides (analogous for the left/right sides).

```python
import imgaug.augmenters as iaa
aug = iaa.CropToMultiplesOf(height_multiple=10, width_multiple=6)
```

### 9.18.9 CropToPowersOf

Crop images until their height/width is a power of a base.

This augmenter removes pixels from an axis with size $S$ leading to the new size $S'$ until $S' = B^E$ is fulfilled, where $B$ is a provided base (e.g. 2) and $E$ is an exponent from the discrete interval $[1 .. \infty)$.

Note: This augmenter does nothing for axes with size less than $B^1 = B$. If you have images with $S < B^1$, it is recommended to combine this augmenter with a padding augmenter that pads each axis up to $B$.

API link: `CropToPowersOf`

Example. Create an augmenter that crops each image down to powers of 3 along the y-axis (i.e. 3, 9, 27, ...) and powers of 2 along the x-axis (i.e. 2, 4, 8, 16, ...). The rows to be cropped will be spread randomly over the top and bottom sides (analogous for the left/right sides).

```python
import imgaug.augmenters as iaa
aug = iaa.CropToPowersOf(height_base=3, width_base=2)
```

### 9.18.10 PadToPowersOf

Pad images until their height/width is a power of a base.

This augmenter adds pixels to an axis with size $S$ leading to the new size $S'$ until $S' = B^E$ is fulfilled, where $B$ is a provided base (e.g. 2) and $E$ is an exponent from the discrete interval $[1 .. \infty)$.

API link: `PadToPowersOf`

Example. Create an augmenter that pads each image to powers of 3 along the y-axis (i.e. 3, 9, 27, ...) and powers of 2 along the x-axis (i.e. 2, 4, 8, 16, ...). The rows to be padded will be spread randomly over the top and bottom sides (analogous for the left/right sides).

```python
import imgaug.augmenters as iaa
aug = iaa.PadToPowersOf(height_base=3, width_base=2)
```

### 9.18.11 CropToAspectRatio

Crop images until their width/height matches an aspect ratio.
This augmenter removes either rows or columns until the image reaches the desired aspect ratio given in \( \text{width} / \text{height} \). The cropping operation is stopped once the desired aspect ratio is reached or the image side to crop reaches a size of 1. If any side of the image starts with a size of 0, the image will not be changed.

API link: \texttt{CropToAspectRatio}

**Example.** Create an augmenter that crops each image until its aspect ratio is as close as possible to 2.0 (i.e. two times as many pixels along the x-axis than the y-axis). The rows to be cropped will be spread \textit{randomly} over the top and bottom sides (analogous for the left/right sides).

```python
import imgaug.augmenters as iaa
aug = iaa.CropToAspectRatio(2.0)
```

### 9.18.12 PadToAspectRatio

Pad images until their \text{width}/\text{height} matches an aspect ratio.

This augmenter adds either rows or columns until the image reaches the desired aspect ratio given in \( \text{width} / \text{height} \).

API link: \texttt{PadToAspectRatio}

**Example.** Create an augmenter that pads each image until its aspect ratio is as close as possible to 2.0 (i.e. two times as many pixels along the x-axis than the y-axis). The rows to be padded will be spread \textit{randomly} over the top and bottom sides (analogous for the left/right sides).

```python
import imgaug.augmenters as iaa
aug = iaa.PadToAspectRatio(2.0)
```

### 9.18.13 CropToSquare

Crop images until their width and height are identical.

This is identical to \texttt{imgaug.augmenters.size.CropToAspectRatio} with \texttt{aspect\_ratio}=1.0.

Images with axis sizes of 0 will not be altered.

API link: \texttt{CropToSquare}

**Example.** Create an augmenter that crops each image until its square, i.e. height and width match. The rows to be cropped will be spread \textit{randomly} over the top and bottom sides (analogous for the left/right sides).

```python
import imgaug.augmenters as iaa
aug = iaa.CropToSquare()
```

### 9.18.14 PadToSquare

Pad images until their height and width are identical.

This augmenter is identical to \texttt{imgaug.augmenters.size.PadToAspectRatio} with \texttt{aspect\_ratio}=1.0.

API link: \texttt{PadToSquare}

**Example.** Create an augmenter that pads each image until its square, i.e. height and width match. The rows to be padded will be spread \textit{randomly} over the top and bottom sides (analogous for the left/right sides).
import imgaug.augmenters as iaa
aug = iaa.PadToSquare()

9.18.15 CenterPadToFixedSize

Pad images equally on all sides up to given minimum heights/widths.

This is an alias for `imgaug.augmenters.size.PadToFixedSize` with `position="center"`. It spreads the pad amounts equally over all image sides, while `imgaug.augmenters.size.PadToFixedSize` by defaults spreads them randomly.

API link: `CenterPadToFixedSize`

**Example.** Create an augmenter that pads images up to 20x30, with the padded rows added *equally* on the top and bottom (analogous for the padded columns).

```python
import imgaug.augmenters as iaa
aug = iaa.CenterPadToFixedSize(height=20, width=30)
```

9.18.16 CenterCropToFixedSize

Take a crop from the center of each image.

This is an alias for `imgaug.augmenters.size.CropToFixedSize` with `position="center"`.

**Note:** If images already have a width and/or height below the provided width and/or height then this augmenter will do nothing for the respective axis. Hence, resulting images can be smaller than the provided axis sizes.

API link: `CenterCropToFixedSize`

**Example.** Create an augmenter that takes 20x10 sized crops from the center of images:

```python
import imgaug.augmenters as iaa
crop = iaa.CenterCropToFixedSize(height=20, width=10)
```

9.18.17 CenterCropToMultiplesOf

Crop images equally on all sides until H/W are multiples of given values.

This is the same as `imgaug.augmenters.size.CropToMultiplesOf`, but uses `position="center"` by default, which spreads the crop amounts equally over all image sides, while `imgaug.augmenters.size.CropToMultiplesOf` by default spreads them randomly.

API link: `CenterCropToMultiplesOf`

**Example.** Create an augmenter that crops images to multiples of 10 along the y-axis (i.e. 10, 20, 30, ...) and to multiples of 6 along the x-axis (i.e. 6, 12, 18, ...). The rows to be cropped will be spread *equally* over the top and bottom sides (analogous for the left/right sides).

```python
import imgaug.augmenters as iaa
aug = iaa.CenterCropToMultiplesOf(height_multiple=10, width_multiple=6)
```
9.18.18 CenterPadToMultiplesOf

Pad images equally on all sides until H/W are multiples of given values.

This is the same as `imgaug.augmenters.size.PadToMultiplesOf`, but uses `position="center"` by default, which spreads the pad amounts equally over all image sides, while `imgaug.augmenters.size.PadToMultiplesOf` by default spreads them randomly.

API link: CenterPadToMultiplesOf

Example. Create an augmenter that pads images to multiples of 10 along the y-axis (i.e. 10, 20, 30, ...) and to multiples of 6 along the x-axis (i.e. 6, 12, 18, ...). The rows to be padded will be spread equally over the top and bottom sides (analogous for the left/right sides).

```python
import imgaug.augmenters as iaa
aug = iaa.CenterPadToMultiplesOf(height_multiple=10, width_multiple=6)
```

9.18.19 CenterCropToPowersOf

Crop images equally on all sides until H/W is a power of a base.

This is the same as `imgaug.augmenters.size.CropToPowersOf`, but uses `position="center"` by default, which spreads the crop amounts equally over all image sides, while `imgaug.augmenters.size.CropToPowersOf` by default spreads them randomly.

API link: CenterCropToPowersOf

Example. Create an augmenter that crops each image down to powers of 3 along the y-axis (i.e. 3, 9, 27, ...) and powers of 2 along the x-axis (i.e. 2, 4, 8, 16, ...). The rows to be cropped will be spread equally over the top and bottom sides (analogous for the left/right sides).

```python
import imgaug.augmenters as iaa
aug = iaa.CropToPowersOf(height_base=3, width_base=2)
```

9.18.20 CenterPadToPowersOf

Pad images equally on all sides until H/W is a power of a base.

This is the same as `imgaug.augmenters.size.PadToPowersOf`, but uses `position="center"` by default, which spreads the pad amounts equally over all image sides, while `imgaug.augmenters.size.PadToPowersOf` by default spreads them randomly.

API link: CenterPadToPowersOf

Example. Create an augmenter that pads each image to powers of 3 along the y-axis (i.e. 3, 9, 27, ...) and powers of 2 along the x-axis (i.e. 2, 4, 8, 16, ...). The rows to be padded will be spread equally over the top and bottom sides (analogous for the left/right sides).

```python
import imgaug.augmenters as iaa
aug = iaa.CenterPadToPowersOf(height_base=3, width_base=2)
```

9.18.21 CenterCropToAspectRatio

Crop images equally on all sides until they reach an aspect ratio.
This is the same as `imgaug.augmenters.size.CropToAspectRatio`, but uses `position="center"` by default, which spreads the crop amounts equally over all image sides, while `imgaug.augmenters.size.CropToAspectRatio` by default spreads them randomly.

API link: `CenterCropToAspectRatio`

**Example.** Create an augmenter that crops each image until its aspect ratio is as close as possible to 2.0 (i.e. two times as many pixels along the x-axis than the y-axis). The rows to be cropped will be spread *equally* over the top and bottom sides (analogous for the left/right sides).

```python
import imgaug.augmenters as iaa
aug = iaa.CenterCropToAspectRatio(2.0)
```

### 9.18.22 CenterPadToAspectRatio

Pad images equally on all sides until H/W matches an aspect ratio.

This is the same as `imgaug.augmenters.size.PadToAspectRatio`, but uses `position="center"` by default, which spreads the pad amounts equally over all image sides, while `imgaug.augmenters.size.PadToAspectRatio` by default spreads them randomly.

API link: `CenterPadToAspectRatio`

**Example.** Create an augmenter that pads each image until its aspect ratio is as close as possible to 2.0 (i.e. two times as many pixels along the x-axis than the y-axis). The rows to be padded will be spread *equally* over the top and bottom sides (analogous for the left/right sides).

```python
import imgaug.augmenters as iaa
aug = iaa.PadToAspectRatio(2.0)
```

### 9.18.23 CenterCropToSquare

Crop images equally on all sides until their height/width are identical.

In contrast to `imgaug.augmenters.size.CropToSquare`, this augmenter always tries to spread the columns/rows to remove equally over both sides of the respective axis to be cropped. `imgaug.augmenters.size.CropToAspectRatio` by default spreads the cropings randomly.

This augmenter is identical to `imgaug.augmenters.size.CropToSquare` with `position="center"`, and thereby the same as `imgaug.augmenters.size.CropToAspectRatio` with `aspect_ratio=1.0`, `position="center"`.

Images with axis sizes of 0 will not be altered.

API link: `CenterCropToSquare`

**Example.** Create an augmenter that crops each image until its square, i.e. height and width match. The rows to be cropped will be spread *equally* over the top and bottom sides (analogous for the left/right sides).

```python
import imgaug.augmenters as iaa
aug = iaa.CenterCropToSquare()
```

### 9.18.24 CenterPadToSquare

Pad images equally on all sides until their height & width are identical.
This is the same as `imgaug.augmenters.size.PadToSquare`, but uses `position="center"` by default, which spreads the pad amounts equally over all image sides, while `imgaug.augmenters.size.PadToSquare` by default spreads them randomly. This augmenter is thus also identical to `imgaug.augmenters.size.PadToAspectRatio` with `aspect_ratio=1.0`, `position="center"`.

API link: `CenterPadToSquare`

**Example.** Create an augmenter that pads each image until its square, i.e. height and width match. The rows to be padded will be spread *equally* over the top and bottom sides (analogous for the left/right sides).

```python
import imgaug.augmenters as iaa
aug = iaa.CenterPadToSquare()
```

### 9.18.25 KeepSizeByResize

Resize images back to their input sizes after applying child augmenters.

Combining this with e.g. a cropping augmenter as the child will lead to images being resized back to the input size after the crop operation was applied. Some augmenters have a `keep_size` argument that achieves the same goal (if set to `True`), though this augmenter offers control over the interpolation mode and which augmentables to resize (images, heatmaps, segmentation maps).

API link: `KeepSizeByResize`

**Example.** Apply random cropping to input images, then resize them back to their original input sizes. The resizing is done using this augmenter instead of the corresponding internal resizing operation in `Crop`.

```python
import imgaug.augmenters as iaa
aug = iaa.KeepSizeByResize(
    iaa.Crop((20, 40), keep_size=False)
)
```

**Example.** Same as in the previous example, but images are now always resized using nearest neighbour interpolation.
Example. Similar to the previous example, but images are now sometimes resized using linear interpolation and sometimes using nearest neighbour interpolation. Heatmaps are resized using the same interpolation as was used for the corresponding image. Segmentation maps are not resized and will therefore remain at their size after cropping.

```python
aug = iaa.KeepSizeByResize(
    iaa.Crop((20, 40), keep_size=False),
    interpolation=\"nearest\"
)
```

9.19 augmenters.weather

Note: All examples below use the following input image:

9.19.1 FastSnowyLandscape

Convert non-snowy landscapes to snowy ones.
This augmenter expects to get an image that roughly shows a landscape.
API link: FastSnowyLandscape

Example. Search for all pixels in the image with a lightness value in HLS colorspace of less than 140 and increase their lightness by a factor of 2.5.

```python
aug = iaa.KeepSizeByResize(
    iaa.Crop((20, 40), keep_size=False),
    interpolation=[\"nearest\", \"cubic\"],
    interpolation_heatmaps=iaa.KeepSizeByResize.SAME_AS_IMAGES,
    interpolation_segmaps=iaa.KeepSizeByResize.NO_RESIZE
)
```
```python
import imgaug.augmenters as iaa

aug = iaa.FastSnowyLandscape(
    lightness_threshold=140,
    lightness_multiplier=2.5
)
```

**Example.** Search for all pixels in the image with a lightness value in HLS colorspace of less than 128 or less than 200 (one of these values is picked per image) and multiply their lightness by a factor of \(x\) with \(x\) being sampled from uniform(1.5, 3.5) (once per image).

```python
aug = iaa.FastSnowyLandscape(
    lightness_threshold=[128, 200],
    lightness_multiplier=(1.5, 3.5)
)
```

**Example.** Similar to the previous example, but the lightness threshold is sampled from uniform(100, 255) (per image) and the multiplier from uniform(1.0, 4.0) (per image). This seems to produce good and varied results.

```python
aug = iaa.FastSnowyLandscape(
    lightness_threshold=(100, 255),
    lightness_multiplier=(1.0, 4.0)
)
```
9.19.2 Clouds

Add clouds to images.

This is a wrapper around CloudLayer. It executes 1 to 2 layers per image, leading to varying densities and frequency patterns of clouds.

This augmenter seems to be fairly robust w.r.t. the image size. Tested with 96x128, 192x256 and 960x1280.

API link: Clouds()

Example. Create an augmenter that adds clouds to images:

```python
import imgaug.augmenters as iaa
aug = iaa.Clouds()
```

9.19.3 Fog

Add fog to images.

This is a wrapper around CloudLayer. It executes a single layer per image with a configuration leading to fairly dense clouds with low-frequency patterns.
This augmenter seems to be fairly robust w.r.t. the image size. Tested with 96x128, 192x256 and 960x1280.

API link: *Fog()*

**Example.** Create an augmenter that adds fog to images:

```python
import imgaug.augmenters as iaa
aug = iaa.Fog()
```

---

### 9.19.4 CloudLayer

Add a single layer of clouds to an image.

API link: *CloudLayer*

### 9.19.5 Snowflakes

Add falling snowflakes to images.

This is a wrapper around *SnowflakesLayer*. It executes 1 to 3 layers per image.

API link: *Snowflakes()*

**Example.** Add snowflakes to small images (around 96x128):

```python
import imgaug.augmenters as iaa
aug = iaa.Snowflakes(flake_size=(0.1, 0.4), speed=(0.01, 0.05))
```

**Example.** Add snowflakes to medium-sized images (around 192x256):

```python
aug = iaa.Snowflakes(flake_size=(0.2, 0.7), speed=(0.007, 0.03))
```

**Example.** Add snowflakes to large images (around 960x1280):

```python
aug = iaa.Snowflakes(flake_size=(0.7, 0.95), speed=(0.001, 0.03))
```
9.19.6 SnowflakesLayer

Add a single layer of falling snowflakes to images.

API link: SnowflakesLayer

9.19.7 Rain

Add falling snowflakes to images.

This is a wrapper around RainLayer. It executes 1 to 3 layers per image.

Note: This augmenter currently seems to work best for medium-sized images around 192x256. For smaller images, you may want to increase the speed value to e.g. (0.1, 0.3), otherwise the drops tend to look like snowflakes. For larger images, you may want to increase the drop_size to e.g. (0.10, 0.20).

API link: Rain

Example. Add rain to small images (around 96x128):

```python
import imgaug.augmenters as iaa
daug = iaa.Rain(speed=(0.1, 0.3))
```

Example. Add rain to medium sized images (around 192x256):

```python
daug = iaa.Rain()
```

Example. Add rain to large images (around 960x1280):

```python
aug = iaa.Rain(drop_size=(0.10, 0.20))
```

9.19.8 RainLayer

Add a single layer of falling raindrops to images.

API link: RainLayer
CHAPTER 10

Performance

Below are performance measurements of each augmenter for image augmentation (augment_images()), heatmap augmentation (augment_heatmaps()) and keypoint/landmark augmentation (augment_keypoints()). (Last updated for 0.3.0)

System: The numbers were computed based on a haswell-generation i7 3.2Ghz CPU with DDR3 memory. That is a rather dated system by today’s standards. A modern, high-end system should achieve higher bandwidths.

All experiments were conducted using python 3.7 and numpy 1.17.0. Note that the precise python/numpy version can have significant impact on your performance.

Experiments Settings: All augmenters were run with reasonable parameter choices that should reflect expected real-world usage, while avoiding too simple parameter values that would lead to inflated scores. Some parameter choices are listed below, the remaining ones can be looked up in measure_performance.py. Kernel sizes were all set to 3x3, unless otherwise mentioned. The inputs focused on a small and large image-size setting, using 64x64x3 and 224x224x3 as the respective sizes. The base image was taken from skimage.data.astronaut, which should be a representative real-world image. Batch sizes of 1 and 128 were tested. Each augmenter was run at least 40 times on the generated input and the average of the measured runtimes was computed to derive bandwidth in mbit per second and th raw number of augmented items (e.g. images) per second.

10.1 Results Overview

From the results, the following points can be derived.

Inputs:

• Use large batch sizes whenever possible. Many augmenters are significantly faster with these.

• Large image sizes lead to higher throughput based on mbit/sec. Smaller images lead to lower throughput, but significantly more items/sec (roughly 4-10x more). Use small images whenever possible.

• For keypoint-based and heatmap-based augmentation, try to increase the number of items per augmented instance. E.g. augment_keypoints() accepts a list of KeypointsOnImage instances, with each such instance representing the keypoints on an image. Try to place for each image all keypoints in the respective
KeypointsOnImage instance instead of splitting them into multiple such instances (which would be more work anyways). The same is true for bounding boxes, heatmaps and segmentation maps.

- Keypoint- and heatmap-based inputs are only affected by augmenters that change the geometry of the image (e.g. Crop or Affine). Other augmenters are essentially free to execute as they do not perform any changes.
- Keypoint-based augmentation is very fast for almost all augmenters, reaching several 100k keypoints per second. Slower augmenters are ElasticTransformation and PiecewiseAffine, as these currently have to fall back to image-based algorithms.

Parameter choices:

- When possible, nearest neighbour interpolation or linear interpolation should be used as these are significantly faster than other options. Most augmenters that use interpolation offer either an order parameter (0=nearest neighbour, 1=linear) or an interpolation parameter (”nearest”, “linear”).

- Using keep_size=True is the default setting in all augmenters that change image sizes. It is convenient, as it ensures that image sizes are not altered by the augmentation. It does however incur a significant performance penalty, often more than halving the bandwidth. Try keep_size=False when possible. You can still resize images manually after augmentation or by using KeepSizeByResize(Sequential(<augmenters>)).

- When augmenters offer modes to fill newly created pixels in user-defined ways (e.g. pad_mode=constant in Pad to fill up all padded pixels with a specified constant color), using edge instead of constant will usually not incur a significant performance penalty.

Specific Augmenter suggestions:

- For augmenters where an elementwise sibling exists (e.g. Multiply and MultiplyElementwise), the elementwise augmenter is usually significantly slower than the non-elementwise one.

- If blurring is required, AverageBlur is the fastest choice, followed by GaussianBlur.

- Augmenters that operate on coarser images (e.g. CoarseDropout vs Dropout) can be significantly faster than their non-coarse siblings.

- Contrast normalizing augmenters are all comparable in performance, except for histogram-based ones, which are significantly slower.

- PiecewiseAffine is a very slow augmenter and should usually be replaced by ElasticTransformation, which achieves similar outputs and is quite a bit faster.

- Superpixels is a fairly slow augmenter and should usually be wrapped in e.g. Sometimes to not apply it very often and reduce its performance impact.

- Weather augmenters other than FastSnowyLandscape are rather slow and should only be used when sensible.

10.2 Images

Numbers below are for small images (64x64x3) and large images (224x224x3). B=1 denotes a batch size of 1, B=128 one of 128.

In mbit/sec:

<table>
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| Operation                           | Add       | AddElementwise | AdditiveGaussianNoise | AdditiveLaplaceNoise | AdditivePoissonNoise | Multiply | MultiplyElementwise | Cutout (1 iter, constant fill) | Dropout (1-5%) | CoarseDropout (1-5%, size=1-10%) | Dropout2d (10%) | TotalDropout (10%) | ReplaceElementwise | ImpulseNoise | SaltAndPepper | CoarseSaltAndPepper | Salt | CoarseSalt | Pepper | CoarsePepper | Invert (10%) | JpegCompression (50-99%) | Cartoon | BlendAlpha (Identity) | BlendAlphaElementwise (Identity) | BlendAlphaSimplexNoise (Identity) | BlendAlphaFrequencyNoise (Identity) | BlendAlphaSomeColors (Identity) | BlendAlphaHorizontalL.Grad. (Identity) | BlendAlphaVerticalL.Grad. (Identity) | BlendAlphaRegularGrid (Identity) | BlendAlphaCheckerboard (Identity) | GaussianBlur (sigma=(1,5)) | AverageBlur | MedianBlur | BilateralBlur | MotionBlur | MeanShiftBlur | RandAugment (n=2, m=(6,12)) | WithColorspace (HSV, Identity) | WithBrightnessChannels (Identity) | MultiplyAndAddToBrightness | MultiplyByBrightness | AddToBrightness | WithHueAndSaturation | MultiplyHueAndSaturation | MultiplyHue | MultiplySaturation | RemoveSaturation | AddToHueAndSaturation |
|------------------------------------|-----------|----------------|---------------------|---------------------|----------------------|----------|---------------------|--------------------------------|----------------|----------------------------|----------------|----------------|----------------|-------------|-------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
|                                   | 1468.7    | 2147.0         | 1787.2              | 1570.5              | 1306.5               | 2563.5   | 2005.8              | 1611.1                          | 2409.4          | 1423.1                      | 3457.4          | 4804.7          | 1385.7          | 1199.5      | 1267.9      | 926.8        | 1064.4       | 838.3        | 1043.9           | 839.9   | 2842.5        | 873.3         | 64.0          | 1373.3       | 1393.6        | 263.7        | 354.2        | 684.8        | 933.1        | 937.3        | 906.5        | 917.6        | 2045.3        | 2617.3        | 1384.8        | 1080.3        | 599.6        | 15.3         | 255.7         | 3110.5       | 464.3        | 761.1        | 1209.1        | 1165.7       | 1793.2       | 880.0        | 792.7        | 614.6        | 756.1        | 1398.0       |
|                                   | 6351.5    | 3279.9         | 2330.6              | 1975.4              | 1610.3               | 8217.8   | 2953.5              | 13745.5                         | 3771.3          | 1840.8                      | 60765.5         | 212745.7       | 1727.3          | 1442.0      | 1504.9      | 1051.4       | 1218.0       | 923.2        | 1127.7           | 918.5    | 58334.2       | 1106.0        | 4288.0        | 4207.6       | 2207.5        | 389.8         | 1717.7        | 2539.4        | 2473.5        | 2539.4        | 15727.3       | 2745.8        | 2872.0        | 683.8         | 14.5         | 1366.3        | 10389.9       | 7860.5       | 2682.0       | 4232.3        | 3710.0       | 3568.3       | 1622.2       | 1601.0       | 1604.2       | 1606.7       | 4726.3       |

10.2. Images
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10.2. Images

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### Table 2 – continued from previous page

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<th>Augmenter</th>
<th>64x64x5 on 224x224x3</th>
<th>224x224x5 on 224x224x3</th>
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<td>Noop</td>
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<td>Lambda (return input)</td>
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<td>AssertLambda (return True)</td>
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<td>AdditiveLaplaceNoise</td>
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#### 10.3 Heatmaps

Numbers below are for heatmaps on large images, i.e. 224x224x3. Smaller images were skipped for brevity. The heatmaps themselves can be small (64x64xN) or large (224x224xN), with N denoting the number of heatmaps per `HeatmapsOnImage` instance (i.e. the number of channels in the heatmaps array), for which below 1 and 5 are used. B=1 denotes a batch size of 1, B=128 one of 128.

`mbit/sec` for 64x64x5 or 224x224x5 heatmaps on 224x224x3 images:
## imgaug Documentation, Release 0.4.0

Table 3 – continued from previous page

<table>
<thead>
<tr>
<th>Function</th>
<th>Mean 1</th>
<th>Std 1</th>
<th>Mean 2</th>
<th>Std 2</th>
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<td>Dropout (1-5%)</td>
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<td>10357.0</td>
<td>18710.0</td>
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<td>CoarseDropout (1-5%, size=1-10%)</td>
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### 10.3. Heatmaps

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<th>Function</th>
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<th>Memory (MB)</th>
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<td>Affine (order=1, constant, skimage)</td>
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<td>PiecewiseAffine (4x4, order=1, constant)</td>
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<td>ElasticTransformation (order=1, reflect)</td>
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<tr>
<td>Jigsaw (rows/cols=(3,8), 1 step)</td>
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10.3. Heatmaps

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Chapter 10. Performance
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**10.3. Heatmaps**
### 10.4 Keypoints and Bounding Boxes

Numbers below are for keypoints on small and large images. Each KeypointsOnImage instance contained 10 Keypoint instances. B=1 denotes a batch size of 1, B=128 one of 128.

The numbers for bounding boxes can be derived by dividing each value by 4.

**Number of augmented Keypoint instances per sec (divide by 10 for KeypointsOnImage instances):**

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<td>818134.7</td>
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<td>WithChannels ([1,2], Identity)</td>
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<td>569703.3</td>
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<td>Identity</td>
<td>42157.2</td>
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<td>Noop</td>
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<td>Lambda (return input)</td>
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<td>AssertLambda (return True)</td>
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Continued on next page
| Invert (10%) | 41179.3 | 1013027.7 |
| JpegCompression (50-99%) | 41222.5 | 1002183.3 |
| Cartoon | 41742.7 | 1016170.7 |
| BlendAlpha (Identity) | 13638.3 | 231006.1 |
| BlendAlphaElementwise (Identity) | 7628.0 | 15529.5 |
| BlendAlphaSimplexNoise (Identity) | 1805.8 | 2281.7 |
| BlendAlphaFrequencyNoise (Identity) | 2417.1 | 2942.4 |
| BlendAlphaSomeColors (Identity) | n/a | n/a |
| BlendAlphaHorizontalL.Grad. (Identity) | 6762.3 | 24122.5 |
| BlendAlphaVerticalL.Grad. (Identity) | 6420.3 | 19841.8 |
| BlendAlphaRegularGrid (Identity) | 6007.6 | 18590.6 |
| BlendAlphaCheckerboard (Identity) | 6039.8 | 16668.2 |
| GaussianBlur (sigma=(1,5)) | 40927.0 | 1086402.0 |
| AverageBlur | 41359.6 | 1067578.3 |
| MedianBlur | 41554.1 | 1071704.2 |
| BilateralBlur | 41461.5 | 1077808.8 |
| MotionBlur | 41110.4 | 1076676.1 |
| MeanShiftBlur | 41129.7 | 1062169.5 |
| RandAugment (n=2, m=(6,12)) | n/a | n/a |
| WithColorspace (HSV, Identity) | 36815.8 | 1046132.3 |
| WithBrightnessChannels (Identity) | 36561.2 | 1039062.1 |
| MultiplyAndAddToBrightness | 28022.1 | 964196.3 |
| MultiplyBrightness | 35559.8 | 1017404.7 |
| AddToBrightness | 35527.7 | 1022234.8 |
| WithHueAndSaturation | 35777.0 | 1024870.5 |
| MultiplyHueAndSaturation | 35910.5 | 1021646.0 |
| MultiplyHue | 29659.9 | 592502.1 |
| MultiplySaturation | 28923.3 | 600158.0 |
| RemoveSaturation | 29378.7 | 598766.6 |
| AddToHueAndSaturation | 40986.2 | 1119725.2 |
| AddToHue | 41381.9 | 1103111.1 |
| AddToSaturation | 41058.4 | 1114935.0 |
| ChangeColorspace (HSV) | 40768.4 | 11179990.4 |
| Grayscale | 41099.1 | 1100846.1 |
| KMeansColorQuantization (2-16 colors) | 42215.3 | 1103010.2 |
| UniformColorQuantization (2-16 colors) | 41109.3 | 1121418.4 |
| UniformColorQuant.NBits (1-7 bits) | 41959.8 | 1096977.3 |
| Posterize (1-7 bits) | 41053.5 | 1095550.6 |
| GammaContrast | 41231.7 | 1080049.3 |
| SigmoidContrast | 40382.1 | 1100256.5 |
| LogContrast | 40291.1 | 1106150.6 |
| LinearContrast | 41104.0 | 1107891.5 |
| AllChannelsHistogramEqualization | 40714.5 | 1080249.2 |
| HistogramEqualization | 41734.9 | 1090530.2 |
| AllChannelsCLAHE | 41319.9 | 1100346.7 |
| CLAHE | 41405.8 | 1114551.1 |
| Convolve (3x3) | 41350.9 | 1102244.4 |
| Sharpen | 40292.7 | 1104893.9 |
| Emboss | 41969.9 | 1100852.1 |
| EdgeDetect | 40670.9 | 1103836.8 |

Continued on next page
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<th>Time (ms)</th>
<th>CPU (ms)</th>
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Table 5 – continued from previous page

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10.4. Keypoints and Bounding Boxes
The function `augment_images()`, which all augmenters in `imgaug` offer, works by default with numpy arrays. In most cases, these arrays will have the numpy dtype `uint8`, i.e. the images will have values in the range $[0, \ 255]$. This is the datatype returned by most image loading functions. Sometimes however you may want to augment other datatypes, e.g. `float64`. While all augmenters support `uint8`, the support for other datatypes varies. The tables further below show which datatype is supported by which augmenter (alongside the dtype support in some helper functions). The API of each augmenter may contain more details.

Note: Whenever possible it is suggested to use `uint8` as that is the most thoroughly tested dtype. In general, the use of large dtypes (i.e. `uint64`, `int64`, `float128`) is discouraged, even when they are marked as supported. That is because writing correct tests for these dtypes can be difficult as no larger dtypes are available to which values can be temporarily cast. Additionally, when using inputs for which precise discrete values are important (e.g. segmentation maps, where an accidental change by 1 would break the map), medium sized dtypes (`uint32`, `int32`) should be used with caution. This is because other libraries may convert temporarily to `float64`, which could lead to inaccuracies for some numbers.

### 11.1 Legend

Support level (color of table cells):

- **Green**: Datatype is considered supported by the augmenter.
- **Yellow**: Limited support for the datatype, e.g. due to inaccuracies around large values. See the API for the respective augmenter for more details.
- **Red**: Datatype is not supported by the augmenter.

Test level (symbols in table cells):

- `++`: Datatype support is thoroughly tested (via unittests or integration tests).
- `+`: Datatype support is tested, though not thoroughly.
- `-`: Datatype support is indirectly tested via tests for other augmenters.
- `--`: Datatype support is not tested.
• ?: Unknown support level for the datatype.

### 11.2 imgaug helper functions

![ Dtype support of helper functions in imgaug, e.g. import imgaug; imgaug.imresize_single_image(array, size).](image)
Fig. 2: Image dtypes supported by augmenters and helper functions in `imgaug.augmenters.meta`.
### dtype support

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Fig. 4: Image dtypes supported by augmenters and helper functions in `imgaug.augmenters.blend`.

### imgaug.augmenters.blur

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Fig. 5: Image dtypes supported by augmenters and helper functions in `imgaug.augmenters.blur`.

### imgaug.augmenters.collections

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Fig. 6: Image dtypes supported by augmenters and helper functions in `imgaug.augmenters.collections`.
### dtype support

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Fig. 8: Image dtypes supported by augmenters and helper functions in `imgaug.augmenters.contrast`.

Fig. 9: Image dtypes supported by augmenters and helper functions in `imgaug.augmenters.convolutional`.

Fig. 10: Image dtypes supported by augmenters and helper functions in `imgaug.augmenters.debug`.

Fig. 11: Image dtypes supported by augmenters and helper functions in `imgaug.augmenters.edges`.
11.3 imgaug.augmenters.meta
11.4 imgaug.augmenters.arithmetic
11.5 imgaug.augmenters.blend
11.6 imgaug.augmenters.blur
11.7 imgaug.augmenters.collections
11.8 imgaug.augmenters.color
11.9 imgaug.augmenters.contrast
11.10 imgaug.augmenters.convolutional
11.11 imgaug.augmenters.debug
11.12 imgaug.augmenters.edges
11.13 imgaug.augmenters.flip

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Fig. 12: Image dtypes supported by augmenters and helper functions in `imgaug.augmenters.flip`. 
Fig. 13: Image dtypes supported by augmenters and helper functions in `imgaug.augmenters.geometric`.
### Fig. 14: Image dtypes supported by augmenters and helper functions in imgaug.augmenters.

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### 11.13. `imgaug.augmenters.flip`

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Fig. 16: Image dtypes supported by augmenters and helper functions in `imgaug.augmenters.segmentation`.

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11.14 `imgaug.augmenters.geometric`
11.15 `imgaug.augmenters.imgcorruptlike`
11.16 `imgaug.augmenters.pillike`
11.17 `imgaug.augmenters.segmentation`
11.18 `imgaug.augmenters.size`
11.19 `imgaug.augmenters.weather`
### 11.19. imgaug.augmenters.weather

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</table>
Fig. 18: Image dtypes supported by augmenters and helper functions in `imgaug.augmenters.weather`.
Several Jupyter notebooks are available that provide tutorials about `imgaug`’s functionality. They are hosted at `imgaug-doc/notebooks`. The notebooks can be downloaded to interactively modify the examples.

**List of Notebooks:**

- A01 - Load and Augment an Image
- A03 - Multicore Augmentation
- B01 - Augment Keypoints (aka Landmarks)
- B02 - Augment Bounding Boxes
- B03 - Augment Polygons
- B06 - Augment Line Strings
- B04 - Augment Heatmaps
- B05 - Augment Segmentation Maps
- C01 - Using Probability Distributions as Parameters
- C02 - Using `imgaug` with more Control Flow
- C03 - Stochastic and Deterministic Augmentation
- C04 - Copying Random States and Using Multiple Augmentation Sequences
13.1 imgaug

Collection of basic functions used throughout imgaug.

```python
imgaug.imgaug.BackgroundAugmenter(*args, **kwargs)
imgaug.imgaug.Batch(*args, **kwargs)
imgaug.imgaug.BatchLoader(*args, **kwargs)
imgaug.imgaug.BoundingBox(*args, **kwargs)
imgaug.imgaug.BoundingBoxesOnImage(*args, **kwargs)
```

```python
deprecation_warning = imgaug.imgaug.DeprecationWarning
Bases: Warning
Warning for deprecated calls.
Since python 2.7 DeprecatedWarning is silent by default. So we define our own DeprecationWarning here so that it is not silent by default.
```

```python
imgaug.imgaug.HeatmapsOnImage(*args, **kwargs)
```

```python
class imgaug.imgaug.HooksHeatmaps(activator=None, propagator=None, preprocessor=None, postprocessor=None)
Bases: imgaug.imgaug.HooksImages
Class to intervene with heatmap augmentation runs.
This is e.g. useful to dynamically deactivate some augmenters.
This class is currently the same as the one for images. This may or may not change in the future.
```

Methods

```
### `HooksImages`

**Class** `imgaug.imgaug.HooksImages`  

**Bases:** `object`

Class to intervene with image augmentation runs.

This is e.g. useful to dynamically deactivate some augmenters.

**Parameters**

- **activator** *(None or callable, optional)* – A function that gives permission to execute an augmenter. The expected interface is:

  ```python
  f(images, augmenter, parents, default)
  ```

  where `images` are the input images to augment, `augmenter` is the instance of the augmenter to execute, `parents` are previously executed augmenters and `default` is an expected default value to be returned if the activator function does not plan to make a decision for the given inputs.

- **propagator** *(None or callable, optional)* – A function that gives permission to propagate the augmentation further to the children of an augmenter. This happens after the activator. In theory, an augmenter may augment images itself (if allowed by the activator) and then execute child augmenters afterwards (if allowed by the propagator). If the activator returned False, the propagation step will never be executed. The expected interface is:

  ```python
  f(images, augmenter, parents, default)
  ```

  with all arguments having identical meaning to the activator.

- **preprocessor** *(None or callable, optional)* – A function to call before an augmenter performed any augmentations. The interface is:

  ```python
  f(images, augmenter, parents)
  ```

  with all arguments having identical meaning to the activator. It is expected to return the input images, optionally modified.

- **postprocessor** *(None or callable, optional)* – A function to call after an augmenter performed augmentations. The interface is the same as for the `preprocessor`.

**Examples**

```python
>>> import numpy as np
>>> import imgaug as ia
>>> import imgaug.augmenters as iaa
>>> seq = iaa.Sequential([  
>>>   iaa.GaussianBlur(3.0, name="blur"),  
>>>   iaa.Dropout(0.05, name="dropout"),  
>>>   iaa.Affine(translate_px=-5, name="affine")
```
>>> images = [np.zeros((10, 10), dtype=np.uint8)]
>>> def activator(images, augmenter, parents, default):
...    return False if augmenter.name in "blur", "dropout"] else default
>>> seq_det = seq.to_deterministic()
>>> images_aug = seq_det.augment_images(images)
>>> heatmaps = [np.random.rand(*(3, 10, 10))]
>>> heatmaps_aug = seq_det.augment_images(
...    heatmaps,
...    hooks=ia.HooksImages(activator=activator)
...)

This augments images and their respective heatmaps in the same way. The heatmaps however are only modified by Affine, not by GaussianBlur or Dropout.

Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
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<tbody>
<tr>
<td><code>is_activated</code></td>
<td>Estimate whether an augmenter may be executed.</td>
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<tr>
<td><code>is_propagating</code></td>
<td>Estimate whether an augmenter may call its children.</td>
</tr>
<tr>
<td><code>postprocess</code></td>
<td>Postprocess input data per augmenter after augmentation.</td>
</tr>
<tr>
<td><code>preprocess</code></td>
<td>Preprocess input data per augmenter before augmentation.</td>
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</table>

**is_activated**

Estimate whether an augmenter may be executed.

This also affects propagation of data to child augmenters.

*Returns* If `True`, the augmenter may be executed. Otherwise `False`.

*Return type* `bool`

**is_propagating**

Estimate whether an augmenter may call its children.

This function decides whether an augmenter with children is allowed to call these in order to further augment the inputs. Note that if the augmenter itself performs augmentations (before/after calling its children), these may still be executed, even if this method returns `False`.

*Returns* If `True`, the augmenter may propagate data to its children. Otherwise `False`.

*Return type* `bool`

**postprocess**

Postprocess input data per augmenter after augmentation.

*Returns* The input images, optionally modified.

*Return type* `ndarray` or `list of ndarray`

**preprocess**

Preprocess input data per augmenter before augmentation.

*Returns* The input images, optionally modified.
**imgaug Documentation, Release 0.4.0**

**Return type** (N,H,W,C) ndarray or (N,H,W) ndarray or list of (H,W,C) ndarray or list of (H,W) ndarray

class `imgaug.imgaug.HooksKeypoints` (activator=None, propagator=None, preprocessor=None, postprocessor=None)

Bases: `imgaug.imgaug.HooksImages`

Class to intervene with keypoint augmentation runs.

This is e.g. useful to dynamically deactivate some augmenters.

This class is currently the same as the one for images. This may or may not change in the future.

**Methods**

- `is_activated(self, images, augmenter, ...)` Estimate whether an augmenter may be executed.
- `is_propagating(self, images, augmenter, ...)` Estimate whether an augmenter may call its children.
- `postprocess(self, images, augmenter, parents)` Postprocess input data per augmenter after augmentation.
- `preprocess(self, images, augmenter, parents)` Preprocess input data per augmenter before augmentation.

**Examples**

```python
>>> angle_between_vectors(np.float32([1, 0, 0]), np.float32([0, 1, 0]))
1.570796...

>>> angle_between_vectors(np.float32([1, 0, 0]), np.float32([1, 0, 0]))
0.0

>>> angle_between_vectors(np.float32([1, 0, 0]), np.float32([-1, 0, 0]))
3.141592...
```
**imgaug.imgaug.**\texttt{apply\_lut} \((\texttt{image}, \texttt{table})\)

Map an input image to a new one using a lookup table.

- **Added in 0.4.0.**
- **Supported dtypes:**
  - See \texttt{apply\_lut\_}()

**Parameters**
- \texttt{image} (\texttt{ndarray}) – See \texttt{apply\_lut\_}().
- \texttt{table} (\texttt{ndarray} or \texttt{list of ndarray}) – See \texttt{apply\_lut\_}().

**Returns** Image after mapping via lookup table.

**Return type** \texttt{ndarray}

**imgaug.imgaug.**\texttt{apply\_lut\_} \((\texttt{image}, \texttt{table})\)

Map an input image in-place to a new one using a lookup table.

- **Added in 0.4.0.**
- **Supported dtypes:**
  - \texttt{uint8}: yes; fully tested
  - \texttt{uint16}: no
  - \texttt{uint32}: no
  - \texttt{uint64}: no
  - \texttt{int8}: no
  - \texttt{int16}: no
  - \texttt{int32}: no
  - \texttt{int64}: no
  - \texttt{float16}: no
  - \texttt{float32}: no
  - \texttt{float64}: no
  - \texttt{float128}: no
  - \texttt{bool}: no

**Parameters**
- \texttt{image} (\texttt{ndarray}) – Image of dtype \texttt{uint8} and shape \((H, W)\) or \((H, W, C)\).
- \texttt{table} (\texttt{ndarray} or \texttt{list of ndarray}) – Table of dtype \texttt{uint8} containing the mapping from old to new values. Either a list of \(C\) \((256,)\) arrays or a single array of shape \((256,)\) or \((256, C)\) or \((1, 256, C)\). In case of \((256,)\) the same table is used for all channels, otherwise a channelwise table is used and \(C\) is expected to match the number of channels.

**Returns** Image after mapping via lookup table. This *might* be the same array instance as provided via \texttt{image}.

**Return type** \texttt{ndarray}
imgaug.imaug.**avg_pool** *(arr, block_size, pad_mode='reflect', pad_cval=128, preserve_dtype=True, cval=None)*

Resize an array using average pooling.

Defaults to pad_mode="reflect " to ensure that padded values do not affect the average.

**Supported dtypes:**

See pool().

**Parameters**

- **arr** *(H,W) ndarray or (H,W,C) ndarray* – Image-like array to pool. See pool() for details.
- **block_size** *(int or tuple of int or tuple of int)* – Size of each block of values to pool. See pool() for details.
- **pad_mode** *(str, optional)* – Padding mode to use if the array cannot be divided by block_size without remainder. See pad() for details.
- **pad_cval** *(number, optional)* – Padding value. See pool() for details.
- **preserve_dtype** *(bool, optional)* – Whether to preserve the input array dtype. See pool() for details.
- **cval** *(None or number, optional)* – Deprecated. Old name for pad_cval.

**Returns** Array after average pooling.

**Return type** *(H',W') ndarray or (H',W',C') ndarray*

imgaug.imaug.**caller_name**()

Return the name of the caller, e.g. a function.

**Returns** The name of the caller as a string

**Return type** str

imgaug.imaug.**compute_geometric_median** (*args, **kwargs)

Compute the intersection point of two lines.

**Taken from** https://stackoverflow.com/a/20679579.

**Parameters**

- **x1** *(number)* – x coordinate of the first point on line 1. (The lines extends beyond this point.)
- **y1** *(number)* – y coordinate of the first point on line 1. (The lines extends beyond this point.)
- **x2** *(number)* – x coordinate of the second point on line 1. (The lines extends beyond this point.)
- **y2** *(number)* – y coordinate of the second point on line 1. (The lines extends beyond this point.)
- **x3** *(number)* – x coordinate of the first point on line 2. (The lines extends beyond this point.)
- **y3** *(number)* – y coordinate of the first point on line 2. (The lines extends beyond this point.)
- **x4** *(number)* – x coordinate of the second point on line 2. (The lines extends beyond this point.)
- **y4** *(number)* – y coordinate of the second point on line 2. (The lines extends beyond this point.)
Returns: The coordinate of the intersection point as a tuple \((x, y)\). If the lines are parallel (no intersection point or an infinite number of them), the result is False.

Return type: tuple of number or bool

```python
imgaug.imgaug.compute_paddings_for_aspect_ratio(*args, **kwargs)
```

```python
imgaug.imgaug.compute_paddings_to_reach_exponents_of(*args, **kwargs)
```

```python
imgaug.imgaug.compute_paddings_to_reach_multiples_of(*args, **kwargs)
```

```python
imgaug.imgaug.copy_random_state(random_state, force_copy=False)
```

**Deprecated.** Use `imgaug.random.copy_generator_unless_global_rng` instead.

Copy an existing numpy (random number) generator.

**Parameters**

- `random_state (numpy.random.Generator or numpy.random.RandomState)` – The generator to copy.
- `force_copy (bool, optional)` – If True, this function will always create a copy of every random state. If False, it will not copy numpy’s default random state, but all other random states.

**Returns** `rs_copy` – The copied random state.

**Return type** `numpy.random.RandomState`

```python
imgaug.imgaug.current_random_state()```

**Deprecated.** Use `imgaug.random.get_global_rng` instead.

Get or create the current global RNG of imgaug. Note that the first call to this function will create a global RNG.

**Returns** The global RNG to use.

**Return type** `imgaug.random.RNG`

```python
class imgaug.imgaug.deprecated(alt_func=None, behavior='warn', removed_version=None, comment=None)
```

**Bases:** `object`

Decorator to mark deprecated functions with warning.

Adapted from <https://github.com/scikit-image/scikit-image/blob/master/skimage/_shared/utils.py>.

**Parameters**

- `alt_func (None or str, optional)` – If given, tell user what function to use instead.
- `behavior ({'warn', 'raise'}, optional)` – Behavior during call to deprecated function: warn means that the user is warned that the function is deprecated; raise means that an error is raised.
- `removed_version (None or str, optional)` – The package version in which the deprecated function will be removed.
- `comment (None or str, optional)` – An optional comment that will be appended to the warning message.
__call__ (self, func) Call self as a function.

imgaug.imgaug.derive_random_state (random_state)

Deprecated. Use imgaug.random.derive_generator_ instead.

Derive a child numpy random generator from another one.

Parameters random_state (numpy.random.Generator or numpy.random.RandomState) – The generator from which to derive a new child generator.

Returns In numpy <=1.16 a RandomState, in 1.17+ a Generator. In both cases a derived child generator.

Return type numpy.random.Generator or numpy.random.RandomState

imgaug.imgaug.derive_random_states (random_state, n=1)

Deprecated. Use imgaug.random.derive_generators_ instead.

Derive child numpy random generators from another one.

Parameters

• random_state (numpy.random.Generator or numpy.random.RandomState) – The generator from which to derive new child generators.

• n (int, optional) – Number of child generators to derive.

Returns In numpy <=1.16 a list of RandomStates, in 1.17+ a list of Generators. In both cases lists of derived child generators.

Return type list of numpy.random.Generator or list of numpy.random.RandomState

imgaug.imgaug.do_assert (condition, message='Assertion failed. ')

Assert that a condition holds or raise an Exception otherwise.

This was added because assert statements are removed in optimized code. It replaced assert statements throughout the library, but that was reverted again for readability and performance reasons.

Parameters

• condition (bool) – If False, an exception is raised.

• message (str, optional) – Error message.

imgaug.imgaug.draw_grid (images, rows=None, cols=None)

Combine multiple images into a single grid-like image.

Calling this function with four images of the same shape and rows=2, cols=2 will combine the four images to a single image array of shape \((2 \times H, 2 \times W, C)\), where \(H\) is the height of any of the images (analogous \(W\)) and \(C\) is the number of channels of any image.

Calling this function with four images of the same shape and rows=4, cols=1 is analogous to calling numpy. vstack() on the images.

Supported dtypes:

• uint8: yes; fully tested
• uint16: yes; fully tested
• uint32: yes; fully tested
• uint64: yes; fully tested
• int8: yes; fully tested
• int16: yes; fully tested
• int32: yes; fully tested
• int64: yes; fully tested
• float16: yes; fully tested
• float32: yes; fully tested
• float64: yes; fully tested
• float128: yes; fully tested
• bool: yes; fully tested

Parameters

- **images** ((N,H,W,3) ndarray or iterable of (H,W,3) array) – The input images to convert to a grid.

- **rows** (None or int, optional) – The number of rows to show in the grid. If None, it will be automatically derived.

- **cols** (None or int, optional) – The number of cols to show in the grid. If None, it will be automatically derived.

Returns Image of the generated grid.

Return type (H',W',3) ndarray

```
imgaug.imgaug.draw_text(img, y, x, text, color=(0, 255, 0), size=25)
```

Draw text on an image.

This uses by default DejaVuSans as its font, which is included in this library.

Supported dtypes:

- uint8: yes; fully tested
- uint16: no
- uint32: no
- uint64: no
- int8: no
- int16: no
- int32: no
- int64: no
- float16: no
- float32: yes; not tested
- float64: no
- float128: no
- bool: no

TODO check if other dtypes could be enabled
• **img** ((H,W,3) *ndarray*) – The image array to draw text on. Expected to be of dtype `uint8` or `float32` (expected value range is [0.0, 255.0]).

• **y** (*int*) – x-coordinate of the top left corner of the text.

• **x** (*int*) – y-coordinate of the top left corner of the text.

• **text** (*str*) – The text to draw.

• **color** (iterable of *int*, optional) – Color of the text to draw. For RGB-images this is expected to be an RGB color.

• **size** (*int*, optional) – Font size of the text to draw.

**Returns** Input image with text drawn on it.

**Return type** (H,W,3) *ndarray*

```
imgaug.imgaug.dummy_random_state()
```

*Deprecated.* Use `imgaug.random.convert_seed_to_rng` instead.

Create a dummy random state using a seed of 1.

**Returns** The new random state.

**Return type** `imgaug.random.RNG`

```
imgaug.imgaug.flatten(nested_iterable)
```

Flatten arbitrarily nested lists/tuples.

*Code partially taken from https://stackoverflow.com/a/10824420.*

**Parameters** nested_iterable – A list or tuple of arbitrarily nested values.

**Yields** any – All values in `nested_iterable`, flattened.

```
imgaug.imgaug.forward_random_state(random_state)
```

*Deprecated.* Use `imgaug.random.advance_generator_` instead.

Advance a numpy random generator’s internal state.

**Parameters** random_state (numpy.random.Generator or numpy.random.RandomState) – Generator of which to advance the internal state.

```
imgaug.imgaug.imresize_many_images(images, sizes=None, interpolation=None)
```

Resize each image in a list or array to a specified size.

**Supported dtypes:**

• `uint8`: yes; fully tested
• `uint16`: yes; tested
• `uint32`: no (1)
• `uint64`: no (2)
• `int8`: yes; tested (3)
• `int16`: yes; tested
• `int32`: limited; tested (4)
• `int64`: no (2)
• `float16`: yes; tested (5)
• `float32`: yes; tested
• float64: yes; tested
• float128: no (1)
• bool: yes; tested (6)
• (1) rejected by cv2.imresize
• (2) results too inaccurate
• (3) mapped internally to int16 when interpolation!="nearest"
• (4) only supported for interpolation="nearest", other interpolations lead to cv2 error
• (5) mapped internally to float32
• (6) mapped internally to uint8

Parameters

• images ((N,H,W,C) ndarray or list of (H,W,C) ndarray) – Array of the images to resize. Usually recommended to be of dtype uint8.

• sizes (float or iterable of int or iterable of float) – The new size of the images, given either as a fraction (a single float) or as a (height, width) tuple of two integers or as a (height fraction, width fraction) tuple of two floats.

• interpolation (None or str or int, optional) – The interpolation to use during resize. If int, then expected to be one of:
  – cv2.INTER_NEAREST (nearest neighbour interpolation)
  – cv2.INTER_LINEAR (linear interpolation)
  – cv2.INTER_AREA (area interpolation)
  – cv2.INTER_CUBIC (cubic interpolation)
If str, then expected to be one of:
  – nearest (identical to cv2.INTER_NEAREST)
  – linear (identical to cv2.INTER_LINEAR)
  – area (identical to cv2.INTER_AREA)
  – cubic (identical to cv2.INTER_CUBIC)
If None, the interpolation will be chosen automatically. For size increases, area interpolation will be picked and for size decreases, linear interpolation will be picked.

Returns
Array of the resized images.

Return type (N,H',W',[C]) ndarray

Examples

```python
>>> import imgaug as ia
>>> images = np.zeros((2, 8, 16, 3), dtype=np.uint8)
>>> images_resized = ia.imresize_many_images(images, 2.0)
>>> images_resized.shape
(2, 16, 32, 3)
```

Convert two RGB images of height 8 and width 16 to images of height 2*8=16 and width 2*16=32.
Convert two RGB images of height 8 and width 16 to images of height $2 \times 8 = 16$ and width $4 \times 16 = 64$.

Converts two RGB images of height 8 and width 16 to images of height 16 and width 32.

**imgaug.imresize_single_image** *(image, sizes, interpolation=None)*

Resize a single image.

**Supported dtypes:**

See **imresize_many_images()**.

**Parameters**

- **image** (*H,W,C* ndarray or *H,W* ndarray) – Array of the image to resize. Usually recommended to be of dtype *uint8*.
- **sizes** (*float* or *iterable of int* or *iterable of float*) – See **imresize_many_images()**.
- **interpolation** (*None* or *str* or *int*, optional) – See **imresize_many_images()**.

**Returns**
The resized image.

**Return type** (*H',W',C*) ndarray or (*H',W') ndarray

**imgaug.imshow** *(image, backend='matplotlib')*

Show an image in a window.

**Supported dtypes:**

- uint8: yes; not tested
- uint16: ?
- uint32: ?
- uint64: ?
- int8: ?
- int16: ?
- int32: ?
- int64: ?
- float16: ?
- float32: ?
- float64: ?
- float128: ?
- bool: ?

**Parameters**

- **image** (*H,W,3* ndarray) – Image to show.
• **backend** (`{'matplotlib', 'cv2'}, optional`) – Library to use to show the image. May be either matplotlib or OpenCV (`'cv2'`). OpenCV tends to be faster, but apparently causes more technical issues.

```python
imgaug.imgaug.is_callable(val)
```
Check whether a variable is a callable, e.g. a function.

**Parameters**
- `val` – The variable to check.

**Returns**
- `True` if the variable is a callable. Otherwise `False`.

**Return type**
- `bool`

```python
imgaug.imgaug.is_float_array(val)
```
Check whether a variable is a numpy float array.

**Parameters**
- `val` – The variable to check.

**Returns**
- `True` if the variable is a numpy float array. Otherwise `False`.

**Return type**
- `bool`

```python
imgaug.imgaug.is_generator(val)
```
Check whether a variable is a generator.

**Parameters**
- `val` – The variable to check.

**Returns**
- `True` if the variable is a generator. Otherwise `False`.

**Return type**
- `bool`

```python
imgaug.imgaug.is_integer_array(val)
```
Check whether a variable is a numpy integer array.

**Parameters**
- `val` – The variable to check.

**Returns**
- `True` if the variable is a numpy integer array. Otherwise `False`.

**Return type**
- `bool`

```python
imgaug.imgaug.is_iterable(val)
```
Checks whether a variable is iterable.

**Parameters**
- `val` – The variable to check.

**Returns**
- `True` if the variable is an iterable. Otherwise `False`.

**Return type**
- `bool`

```python
imgaug.imgaug.is_np_array(val)
```
Check whether a variable is a numpy array.

**Parameters**
- `val` – The variable to check.

**Returns**
- `True` if the variable is a numpy array. Otherwise `False`.

**Return type**
- `bool`

```python
imgaug.imgaug.is_np_scalar(val)
```
Check whether a variable is a numpy scalar.

**Parameters**
- `val` – The variable to check.

**Returns**
- `True` if the variable is a numpy scalar. Otherwise `False`.

**Return type**
- `bool`
imgaug.imgaug.is_single_bool(val)
Check whether a variable is a bool.

Parameters
val – The variable to check.

Returns
True if the variable is a bool. Otherwise False.

Return type
bool

imgaug.imgaug.is_single_float(val)
Check whether a variable is a float.

Parameters
val – The variable to check.

Returns
True if the variable is a float. Otherwise False.

Return type
bool

imgaug.imgaug.is_single_integer(val)
Check whether a variable is an int.

Parameters
val – The variable to check.

Returns
True if the variable is an int. Otherwise False.

Return type
bool

imgaug.imgaug.is_single_number(val)
Check whether a variable is a number, i.e. an int or float.

Parameters
val – The variable to check.

Returns
True if the variable is a number. Otherwise False.

Return type
bool

imgaug.imgaug.is_string(val)
Check whether a variable is a string.

Parameters
val – The variable to check.

Returns
True if the variable is a string. Otherwise False.

Return type
bool

imgaug.imgaug.max_pool(arr, block_size, pad_mode='edge', pad_cval=0, preserve_dtype=True, cval=None)
Resize an array using max-pooling.

Defaults to pad_mode="edge" to ensure that padded values do not affect the maximum, even if the dtype was something else than uint8.

Supported dtypes:
See pool().

Parameters

• arr (H,W) ndarray or (H,W,C) ndarray – Image-like array to pool. See pool() for details.

• block_size (int or tuple of int or tuple of int) – Size of each block of values to pool. See pool() for details.

• pad_mode (str, optional) – Padding mode to use if the array cannot be divided by block_size without remainder. See pad() for details.

• pad_cval (number, optional) – Padding value. See pool() for details.
• **preserve_dtype** *(bool, optional)* – Whether to preserve the input array dtype. See `pool()` for details.

• **cval** *(None or number, optional)* – Deprecated. Old name for `pad_cval`.

**Returns** Array after max-pooling.

**Return type** *(H',W')* ndarray or *(H',W',C')* ndarray

```python
imgaug.imgaug.median_pool(arr, block_size, pad_mode='reflect', pad_cval=128, preserve_dtype=True)
```

Resize an array using median-pooling.

Defaults to `pad_mode="reflect"` to ensure that padded values do not affect the average.

**Supported dtypes:**

See `pool()`.

**Parameters**

• **arr** *(((H,W) ndarray or (H,W,C) ndarray)* – Image-like array to pool. See `pool()` for details.

• **block_size** *(int or tuple of int or tuple of int)* – Size of each block of values to pool. See `pool()` for details.

• **pad_mode** *(str, optional)* – Padding mode to use if the array cannot be divided by `block_size` without remainder. See `pad()` for details.

• **pad_cval** *(number, optional)* – Padding value. See `pool()` for details.

• **preserve_dtype** *(bool, optional)* – Whether to preserve the input array dtype. See `pool()` for details.

**Returns** Array after min-pooling.

**Return type** *(H',W')* ndarray or *(H',W',C')* ndarray

```python
imgaug.imgaug.min_pool(arr, block_size, pad_mode='edge', pad_cval=255, preserve_dtype=True)
```

Resize an array using min-pooling.

Defaults to `pad_mode="edge"` to ensure that padded values do not affect the minimum, even if the dtype was something else than `uint8`.

**Supported dtypes:**

See `pool()`.

**Parameters**

• **arr** *(((H,W) ndarray or (H,W,C) ndarray)* – Image-like array to pool. See `pool()` for details.

• **block_size** *(int or tuple of int or tuple of int)* – Size of each block of values to pool. See `pool()` for details.

• **pad_mode** *(str, optional)* – Padding mode to use if the array cannot be divided by `block_size` without remainder. See `pad()` for details.

• **pad_cval** *(number, optional)* – Padding value. See `pool()` for details.

• **preserve_dtype** *(bool, optional)* – Whether to preserve the input array dtype. See `pool()` for details.
Returns  Array after min-pooling.
Return type  (H',W') ndarray or (H',W',C') ndarray

imgaug.imgaug.new_random_state(seed=None, fully_random=False)

Deprecated. Use imgaug.random.convert_seed_to_rng instead.
Create a new numpy random number generator.

Parameters
  • seed (None or int, optional) – The seed value to use. If None and fully_random is False, the seed will be derived from the global RNG. If fully_random is True, the seed will be provided by the OS.
  • fully_random (bool, optional) – Whether the seed will be provided by the OS.

Returns  In numpy <=1.16 a RandomState, in 1.17+ a Generator. Both are initialized with the provided seed.
Return type  numpy.random.Generator or numpy.random.RandomState

imgaug.imgaug.normalize_random_state(random_state)

Deprecated. Use imgaug.random.normalize_generator instead.
Normalize various inputs to a numpy random generator.

Parameters random_state  (None or int or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.bit_generator.SeedSequence or numpy.random.RandomState) – See normalize_generator().

Returns  In numpy <=1.16 a RandomState, in 1.17+ a Generator (even if the input was a RandomState).
Return type  numpy.random.Generator or numpy.random.RandomState

imgaug.imgaug.pad(*args, **kwargs)

imgaug.imgaug.pad_to_aspect_ratio(*args, **kwargs)

imgaug.imgaug.pad_to_multiples_of(*args, **kwargs)

imgaug.imgaug.pool(arr, block_size, func, pad_mode='constant', pad_cval=0, preserve_dtype=True, cval=None)

Resize an array by pooling values within blocks.

Supported dtypes:
  • uint8: yes; fully tested
  • uint16: yes; tested
  • uint32: yes; tested (2)
  • uint64: no (1)
  • int8: yes; tested
  • int16: yes; tested
  • int32: yes; tested (2)
  • int64: no (1)
  • float16: yes; tested
  • float32: yes; tested
• float64: yes; tested
• float128: yes; tested (2)
• bool: yes; tested

• (1) results too inaccurate (at least when using np.average as func)
• (2) Note that scikit-image documentation says that the wrapped pooling function converts inputs to float64. Actual tests showed no indication of that happening (at least when using preserve_dtype=True).

Parameters
• arr ((H,W) ndarray or (H,W,C) ndarray) – Image-like array to pool. Ideally of datatype float64.
• block_size (int or tuple of int) –
  Spatial size of each group of values to pool, aka kernel size.
  – If a single int, then a symmetric block of that size along height and width will be used.
  – If a tuple of two values, it is assumed to be the block size along height and width of the image-like, with pooling happening per channel.
  – If a tuple of three values, it is assumed to be the block size along height, width and channels.
• func (callable) – Function to apply to a given block in order to convert it to a single number, e.g. numpy.average(), numpy.min(), numpy.max().
• pad_mode (str, optional) – Padding mode to use if the array cannot be divided by block_size without remainder. See pad() for details.
• pad_cval (number, optional) – Value to use for padding if mode is constant. See numpy.pad() for details.
• preserve_dtype (bool, optional) – Whether to convert the array back to the input datatype if it is changed away from that in the pooling process.
• cval (None or number, optional) – Deprecated. Old name for pad_cval.

Returns Array after pooling.

Return type (H',W') ndarray or (H',W',C') ndarray

imgaug.imgaug.quokka (size=None, extract=None)
Return an image of a quokka as a numpy array.

Parameters
• size (None or float or tuple of int, optional) – Size of the output image. Input into imresize_single_image(). Usually expected to be a tuple (H, W), where H is the desired height and W is the width. If None, then the image will not be resized.
• extract (None or ‘square’ or tuple of number or imgaug.augmentables.bbs.BoundingBox or imgaug.augmentables.bbs.BoundingBoxesOnImage) –
Subarea of the quokka image to extract:
  – If None, then the whole image will be used.
  – If str square, then a squared area (x: 0 to max 643, y: 0 to max 643) will be extracted from the image.
- If a tuple, then expected to contain four numbers denoting \((x_1, y_1, x_2, y_2)\).
- If a BoundingBox, then that bounding box’s area will be extracted from the image.
- If a BoundingBoxesOnImage, then expected to contain exactly one bounding box and a shape matching the full image dimensions (i.e. \((643, 960, *)\)). Then the one bounding box will be used similar to BoundingBox above.

Returns The image array of dtype uint8.

Return type (H,W,3) ndarray

imgaug.imgaug.quokka_bounding_boxes(size=None, extract=None)
Return example bounding boxes on the standard example quokka image.
Currently only a single bounding box is returned that covers the quokka.

Parameters

- size (None or float or tuple of int or tuple of float, optional) – Size of the output image on which the BBs are placed. If None, then the BBs are not projected to any new size (positions on the original image are used). float s lead to relative size changes, int s to absolute sizes in pixels.
- extract (None or ‘square’ or tuple of number or imgaug.augmentables.bbs.BoundingBox or imgaug.augmentables.bbs.BoundingBoxesOnImage) – Subarea to extract from the image. See quokka().

Returns Example BBs on the quokka image.

Return type imgaug.augmentables.bbs.BoundingBoxesOnImage

imgaug.imgaug.quokka_heatmap(size=None, extract=None)
Return a heatmap (here: depth map) for the standard example quokka image.

Parameters

- size (None or float or tuple of int, optional) – See quokka().
- extract (None or ‘square’ or tuple of number or imgaug.augmentables.bbs.BoundingBox or imgaug.augmentables.bbs.BoundingBoxesOnImage) – See quokka().

Returns Depth map as an heatmap object. Values close to 0.0 denote objects that are close to the camera. Values close to 1.0 denote objects that are furthest away (among all shown objects).

Return type imgaug.augmentables.heatmaps.HeatmapsOnImage

imgaug.imgaug.quokka_keypoints(size=None, extract=None)
Return example keypoints on the standard example quokka image.
The keypoints cover the eyes, ears, nose and paws.

Parameters

- size (None or float or tuple of int or tuple of float, optional) – Size of the output image on which the keypoints are placed. If None, then the keypoints are not projected to any new size (positions on the original image are used). float s lead to relative size changes, int s to absolute sizes in pixels.
- extract (None or ‘square’ or tuple of number or imgaug.augmentables.bbs.BoundingBox or imgaug.augmentables.bbs.BoundingBoxesOnImage) – Subarea to extract from the image. See quokka().

Returns Example keypoints on the quokka image.

Return type imgaug.augmentables.kps.KeypointsOnImage
`imgaug.imgaug.quokka_polygons(size=None, extract=None)`  
Returns example polygons on the standard example quokka image.  
The result contains one polygon, covering the quokka’s outline.

**Parameters**
- `size` *(None or float or tuple of int or tuple of float, optional)* – Size of the output image on which the polygons are placed. If `None`, then the polygons are not projected to any new size (positions on the original image are used). `float`s lead to relative size changes, `int`s to absolute sizes in pixels.
- `extract` *(None or ‘square’ or tuple of number or imgaug.augmentables.bbs.BoundingBox or imgaug.augmentables.bbs.BoundingBoxesOnImage)* – Subarea to extract from the image. See `quokka()`.

**Returns**  
Example polygons on the quokka image.

**Return type**  
`imgaug.augmentables.polys.PolygonsOnImage`

`imgaug.imgaug.quokka_segmentation_map(size=None, extract=None)`  
Return a segmentation map for the standard example quokka image.

**Parameters**
- `size` *(None or float or tuple of int, optional)* – See `quokka()`.
- `extract` *(None or ‘square’ or tuple of number or imgaug.augmentables.bbs.BoundingBox or imgaug.augmentables.bbs.BoundingBoxesOnImage)* – See `quokka()`.

**Returns**  
Segmentation map object.

**Return type**  
`imgaug.augmentables.segmaps.SegmentationMapsOnImage`

`imgaug.imgaug.quokka_square(size=None)`  
Return an (square) image of a quokka as a numpy array.

**Parameters**
- `size` *(None or float or tuple of int, optional)* – Size of the output image. Input into `imresize_single_image()`. Usually expected to be a `tuple` `(H, W)`, where `H` is the desired height and `W` is the width. If `None`, then the image will not be resized.

**Returns**  
The image array of dtype `uint8`.

**Return type**  
`(H,W,3) ndarray`

`imgaug.imgaug.seed(entropy=None, seedval=None)`  
Set the seed of `imgaug`’s global RNG.

The global RNG controls most of the “randomness” in `imgaug`.

The global RNG is the default one used by all augmenters. Under special circumstances (e.g. when an augmenter is switched to deterministic mode), the global RNG is replaced with a local one. The state of that replacement may be dependent on the global RNG’s state at the time of creating the child RNG.

**Note:** This function is not yet marked as deprecated, but might be in the future. The preferred way to seed `imgaug` is via `seed()`.

**Parameters**
- `entropy` *(int)* – The seed value to use.
- `seedval` *(None or int, optional)* – Deprecated since 0.4.0.

13.1. `imgaug`
imgaug.imshow.show_grid(images, rows=None, cols=None)
Combine multiple images into a single image and plot the result.
This will show a window of the results of draw_grid().

Supported dtypes:
minimum of (draw_grid(), imshow())

Parameters
- images ((N,H,W,3) ndarray or iterable of (H,W,3) array) – See draw_grid().
- rows (None or int, optional) – See draw_grid().
- cols (None or int, optional) – See draw_grid().

imgaug.imshow.warn(msg, category=UserWarning, stacklevel=2)
Generate a warning with stacktrace.

Parameters
- msg (str) – The message of the warning.
- category (class) – The class of the warning to produce.
- stacklevel (int, optional) – How many steps above this function to “jump” in the stacktrace
  when displaying file and line number of the error message. Usually 2.

imgaug.imshow.warn_deprecated(msg, stacklevel=2)
Generate a non-silent deprecation warning with stacktrace.
The used warning is imgaug.imshow.DeprecationWarning.

Parameters
- msg (str) – The message of the warning.
- stacklevel (int, optional) – How many steps above this function to “jump” in the stacktrace
  when displaying file and line number of the error message. Usually 2

13.2 imgaug.parameters

Classes and methods to use for parameters of augmenters.
This module contains e.g. classes representing probability distributions (gaussian, poisson etc.), classes representing
noise sources and methods to normalize parameter-related user inputs.

class imgaug.parameters.Absolute(other_param)
    Bases: imgaug.parameters.StochasticParameter

    Convert the samples of another parameter to their absolute values.

    Parameters other_param (imgaug.parameters.StochasticParameter) – Other parameter which’s sampled values are to be modified.
### Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.Absolute(iap.Uniform(-1.0, 1.0))
```

Convert a uniform distribution from \([-1.0, 1.0)\] to \([0.0, 1.0]\).

### Methods

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</tr>
<tr>
<td><code>draw_sample(self[, random_state])</code></td>
</tr>
<tr>
<td><code>draw_samples(self, size[, random_state])</code></td>
</tr>
</tbody>
</table>

#### class `imgaug.parameters.Add`(*other_param*, *val*, *elementwise=False*)

Bases: `imgaug.parameters.StochasticParameter`

Add to the samples of another stochastic parameter.

**Parameters**

- **other_param** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter)* – Samples of *val* will be added to samples of this parameter. Let *S* be the requested shape of samples, then the datatype behaviour is as follows:
  - If a *single* number, this *number* will be used as a constant value to fill an array of shape *S*.
  - If a *tuple* of two numbers *(a, b)*, an array of shape *S* will be filled with uniformly sampled values from the continuous interval *[a, b)*.
  - If a *list* of number, an array of shape *S* will be filled with randomly picked values from the *list*.
  - If a `StochasticParameter`, that parameter will be queried once per call to generate an array of shape *S*.

  “per call” denotes a call of `Add.draw_sample()` or `Add.draw_samples()`.

- **val** *(number or tuple of two number or list of number or imgaug.parameters.StochasticParameter)* – Value to add to the samples of *other_param*. Datatype behaviour is analogous to *other_param*, though if *elementwise=False* (the default), only a single sample will be generated per call instead of *S*.

- **elementwise** *(bool, optional)* – Controls the sampling behaviour of *val*. If set to *False*, a single samples will be requested from *val* and used as the constant multiplier. If set to *True*, samples of shape *S* will be requested from *val* and added elementwise with the samples of *other_param*.

#### Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.Add(Uniform(0.0, 1.0), 1.0)
```
Convert a uniform distribution from \([0.0, 1.0)\) to \([1.0, 2.0)\).

**Methods**

<table>
<thead>
<tr>
<th>Method</th>
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</tr>
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</tr>
<tr>
<td>draw_distribution_graph(self[, title, size, ...])</td>
<td>Generate an image visualizing the parameter’s sample distribution.</td>
</tr>
<tr>
<td>draw_sample(self[, random_state])</td>
<td>Draws a single sample value from this parameter.</td>
</tr>
<tr>
<td>draw_samples(self, size[, random_state])</td>
<td>Draw one or more samples from the parameter.</td>
</tr>
</tbody>
</table>

**class imgaug.parameters.Beta(alpha, beta, epsilon=0.0001)**

Parameter that resembles a (continuous) beta distribution.

**Parameters**

- **alpha** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – alpha parameter of the beta distribution. Expected value range is \((0, \infty)\). Values below 0 are automatically clipped to \(0+\epsilon\).
  - If a single number, this number will be used as a constant value.
  - If a tuple of two numbers \((a, b)\), the value will be sampled from the continuous interval \([a, b)\) once per call.
  - If a list of numbers, a random value will be picked from the list once per call.
  - If a StochasticParameter, that parameter will be queried once per call.
  “per call” denotes a call of Beta.draw_sample() or Beta.draw_samples().

- **beta** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Beta parameter of the beta distribution. Analogous to alpha.

- **epsilon** (number) – Clipping parameter. If alpha or beta end up \(\leq 0\), they are clipped to \(0+\epsilon\).

**Examples**

```python
>>> import imgaug.parameters as iap
>>> param = iap.Beta(0.4, 0.6)
```

Create a beta distribution with alpha=0.4 and beta=0.6.

**Methods**

<table>
<thead>
<tr>
<th>Method</th>
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</tr>
</thead>
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<tr>
<td>deepcopy(self)</td>
<td>Create a deep copy of this parameter.</td>
</tr>
<tr>
<td>draw_distribution_graph(self[, title, size, ...])</td>
<td>Generate an image visualizing the parameter’s sample distribution.</td>
</tr>
<tr>
<td>draw_sample(self[, random_state])</td>
<td>Draws a single sample value from this parameter.</td>
</tr>
<tr>
<td>draw_samples(self, size[, random_state])</td>
<td>Draw one or more samples from the parameter.</td>
</tr>
</tbody>
</table>
Table 7 – continued from previous page

| draw_samples(self, size[, random_state]) | Draw one or more samples from the parameter. |

```python
class imgaug.parameters.Binomial(p)

Bases: imgaug.parameters.StochasticParameter

Binomial distribution.

Parameters:

- **p** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Probability of the binomial distribution. Expected to be in the interval [0.0, 1.0].
  
  - If a single number, this number will be used as a constant value.
  
  - If a tuple of two numbers (a, b), the value will be sampled from the continuous interval [a, b) once per call.
  
  - If a list of numbers, a random value will be picked from the list once per call.
  
  - If a StochasticParameter, that parameter will be queried once per call.

“per call” denotes a call of Binomial.draw_sample() or Binomial.draw_samples().
```

**Examples**

```python
>>> import imgaug.parameters as iap
>>> param = iap.Binomial(Uniform(0.01, 0.2))
```

Create a binomial distribution that uses a varying probability between 0.01 and 0.2, randomly and uniformly estimated once per sampling call.

**Methods**

```python
copy(self) Create a shallow copy of this parameter.
deepcopy(self) Create a deep copy of this parameter.
draw_distribution_graph(self[, title, size,...]) Generate an image visualizing the parameter’s sample distribution.
draw_sample(self[, random_state]) Draws a single sample value from this parameter.
draw_samples(self, size[, random_state]) Draw one or more samples from the parameter.
```

```python
class imgaug.parameters.ChiSquare(df)

Bases: imgaug.parameters.StochasticParameter

Parameter that resembles a (continuous) chi-square distribution.

This is a wrapper around numpy’s numpy.random.chisquare().

Parameters:

- **df** (int or tuple of two int or list of int or imgaug.parameters.StochasticParameter) – Degrees of freedom. Expected value range is [1, inf).
  
  - If a single int, this int will be used as a constant value.
  
  - If a tuple of two int s (a, b), the value will be sampled from the discrete interval [a..b) once per call.
  
  - If a list of int, a random value will be picked from the list once per call.
```

13.2. imgaug.parameters
• If a `StochasticParameter`, that parameter will be queried once per call.

  “per call” denotes a call of `ChiSquare.draw_sample()` or `ChiSquare.draw_samples()`.

**Examples**

```python
>>> import imgaug.parameters as iap
>>> param = iap.ChiSquare(df=2)
```

Create a chi-square distribution with two degrees of freedom.

**Methods**

- `copy(self)`: Create a shallow copy of this parameter.
- `deepcopy(self)`: Create a deep copy of this parameter.
- `draw_distribution_graph(self[, title, size, ...])`: Generate an image visualizing the parameter’s sample distribution.
- `draw_sample(self[, random_state])`: Draws a single sample value from this parameter.
- `draw_samples(self, size[, random_state])`: Draw one or more samples from the parameter.

**class** `imgaug.parameters.Choice(a, replace=True, p=None)`

**Bases:** `imgaug.parameters.StochasticParameter`

Parameter that samples value from a list of allowed values.

**Parameters**

- `a (iterable)` – List of allowed values. Usually expected to be `int`s, `float`s or `str`s. May also contain `StochasticParameter`s. Each `StochasticParameter` that is randomly picked will automatically be replaced by a sample of itself (or by `N` samples if the parameter was picked `N` times).
- `replace (bool, optional)` – Whether to perform sampling with or without replacing.
- `p (None or iterable of number, optional)` – Probabilities of each element in `a`. Must have the same length as `a` (if provided).

**Examples**

```python
>>> import imgaug.parameters as iap
>>> param = iap.Choice([5, 17, 25], p=[0.25, 0.5, 0.25])
>>> sample = param.draw_sample()
>>> assert sample in [5, 17, 25]
```

Create and sample from a parameter, which will produce with 50% probability the sample 17 and in the other 50% of all cases the sample 5 or 25..

**Methods**

- `copy(self)`: Create a shallow copy of this parameter.
class `imgaug.parameters.Clip` (other_param, minval=None, maxval=None)

Bases: `imgaug.parameters.StochasticParameter`

Clip another parameter to a defined value range.

**Parameters**

- **other_param** (`imgaug.parameters.StochasticParameter`) – The other parameter, which’s values are to be clipped.
- **minval** (*None or number, optional*) – The minimum value to use. If *None*, no minimum will be used.
- **maxval** (*None or number, optional*) – The maximum value to use. If *None*, no maximum will be used.

**Examples**

```python
>>> import imgaug.parameters as iap
>>> param = iap.Clip(Normal(0, 1.0), minval=-2.0, maxval=2.0)
```

Create a standard gaussian distribution, which’s values never go below −2.0 or above 2.0. Note that this will lead to small “bumps” of higher probability at −2.0 and 2.0, as values below/above these will be clipped to them. For smoother limitations on gaussian distributions, see `TruncatedNormal`.

**Methods**

- **copy(self)** Create a shallow copy of this parameter.
- **deepcopy(self)** Create a deep copy of this parameter.
- **draw_distribution_graph(self[, title, size, ...])** Generate an image visualizing the parameter’s sample distribution.
- **draw_sample(self[, random_state])** Draws a single sample value from this parameter.
- **draw_samples(self, size[, random_state])** Draw one or more samples from the parameter.

class `imgaug.parameters.Deterministic` (value)

Bases: `imgaug.parameters.StochasticParameter`

Parameter that is a constant value.

If N values are sampled from this parameter, it will return N times V, where V is the constant value.

**Parameters**

- **value** (*number or str or imgaug.parameters.StochasticParameter*) – A constant value to use. A string may be provided to generate arrays of strings. If this is a StochasticParameter, a single value will be sampled from it exactly once and then used as the constant value.
Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.Deterministic(10)
>>> param.draw_sample()
10
```

Will always sample the value 10.

Methods

```python
copy(self) Create a shallow copy of this parameter.
decoppy(self) Create a deep copy of this parameter.
draw_distribution_graph(self[, title, size, ...]) Generate an image visualizing the parameter's sample distribution.
draw_sample(self[, random_state]) Draws a single sample value from this parameter.
draw_samples(self, size[, random_state]) Draw one or more samples from the parameter.
```

class imgaug.parameters.DeterministicList(values)
Bases: imgaug.parameters.StochasticParameter

Parameter that repeats elements from a list in the given order.
E.g. of samples of shape (A, B, C) are requested, this parameter will return the first A*B*C elements, reshaped to (A, B, C) from the provided list. If the list contains less than A*B*C elements, it will (by default) be tiled until it is long enough (i.e. the sampling will start again at the first element, if necessary multiple times).

Added in 0.4.0.

Parameters values (ndarray or iterable of number) – An iterable of values to sample from in the order within the iterable.

Methods

```python
copy(self) Create a shallow copy of this parameter.
decoppy(self) Create a deep copy of this parameter.
draw_distribution_graph(self[, title, size, ...]) Generate an image visualizing the parameter's sample distribution.
draw_sample(self[, random_state]) Draws a single sample value from this parameter.
draw_samples(self, size[, random_state]) Draw one or more samples from the parameter.
```

class imgaug.parameters.DiscreteUniform(a, b)
Bases: imgaug.parameters.StochasticParameter

Uniform distribution over the discrete interval [a..b].

Parameters

- a (int or tuple of int or list of int or imgaug.parameters.StochasticParameter) – Lower bound of the interval. If a>b, a and b will automatically be flipped. If a==b, all generated values will be identical to a.
  - If a single int, this int will be used as a constant value.
If a tuple of two integers \((a, b)\), the value will be sampled from the discrete interval \([a..b]\) once per call.

- If a list of integers, a random value will be picked from the list once per call.
- If a StochasticParameter, that parameter will be queried once per call.

“per call” denotes a call of DiscreteUniform.draw_sample() or DiscreteUniform.draw_samples().

- \(b\) (int or imgaug.parameters.StochasticParameter) – Upper bound of the interval. Analogous to \(a\).

Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.DiscreteUniform(10, Choice([20, 30, 40]))
>>> sample = param.draw_sample()
>>> assert 10 <= sample <= 40
```

Create a discrete uniform distribution which’s interval differs between calls and can be \([10..20]\), \([10..30]\) or \([10..40]\).

Methods

- copy(self) Create a shallow copy of this parameter.
- deepcopy(self) Create a deep copy of this parameter.
- draw_distribution_graph(self[, title, size, ...]) Generate an image visualizing the parameter’s sample distribution.
- draw_sample(self[, random_state]) Draws a single sample value from this parameter.
- draw_samples(self, size[, random_state]) Draw one or more samples from the parameter.

class imgaug.parameters.Discretize(other_param, round=True)

Bases: imgaug.parameters.StochasticParameter

Convert a continuous distribution to a discrete one.

This will round the values and then cast them to integers. Values sampled from already discrete distributions are not changed.

Parameters

- other_param (imgaug.parameters.StochasticParameter) – The other parameter, which’s values are to be discretized.
- round (bool, optional) – Whether to round before converting to integer dtype.

Added in 0.4.0.

Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.Discretize(iap.Normal(0, 1.0))
```

Create a discrete standard gaussian distribution.
Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
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<td>draw_distribution_graph(self[, title, size, ...])</td>
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</tr>
<tr>
<td>draw_samples(self, size[, random_state])</td>
<td>Draw one or more samples from the parameter.</td>
</tr>
</tbody>
</table>

```python
class imgaug.parameters.Divide(other_param, val, elementwise=False)
    Bases: imgaug.parameters.StochasticParameter

Divide the samples of another stochastic parameter.

This parameter will automatically prevent division by zero (uses 1.0) as the denominator in these cases.

Parameters

- **other_param** (*number or tuple of number or list of number or imgaug.parameters.StochasticParameter*) – Other parameter which’s sampled values are to be divided by `val`. Let `S` be the requested shape of samples, then the datatype behaviour is as follows:
  - If a **single number**, this number will be used as a constant value to fill an array of shape `S`.
  - If a **tuple of two numbers** `(a, b)`, an array of shape `S` will be filled with uniformly sampled values from the continuous interval `[a, b)`.
  - If a **list of numbers**, an array of shape `S` will be filled with randomly picked values from the list.
  - If a **StochasticParameter**, that parameter will be queried once per call to generate an array of shape `S`.

“per call” denotes a call of `Divide.draw_sample()` or `Divide.draw_samples()`.

- **val** (*number or tuple of number or list of number or imgaug.parameters.StochasticParameter*) – Denominator to use. Datatype behaviour is analogous to `other_param`, though if `elementwise=False` (the default), only a single sample will be generated per call instead of `S`.

- **elementwise** (*bool, optional*) – Controls the sampling behaviour of `val`. If set to `False`, a single samples will be requested from `val` and used as the constant denominator. If set to `True`, samples of shape `S` will be requested from `val` and used to divide the samples of `other_param` elementwise.

Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.Divide(iap.Uniform(0.0, 1.0), 2)
```

Convert a uniform distribution `[0.0, 1.0)` to `[0, 0.5)`. 

Methods

```python
copy(self) Create a shallow copy of this parameter.
decopy(self) Create a deep copy of this parameter.
draw_distribution_graph(self[, title, size, ...]) Generate an image visualizing the parameter’s sample distribution.
draw_sample(self[, random_state]) Draws a single sample value from this parameter.
draw_samples(self, size[, random_state]) Draw one or more samples from the parameter.
```

class imgaug.parameters.ForceSign(other_param, positive, mode='invert', reroll_count_max=2)
Bases: imgaug.parameters.StochasticParameter

Convert a parameter’s samples to either positive or negative values.

Parameters

- **other_param** (imgaug.parameters.StochasticParameter) – Other parameter which’s sampled values are to be modified.
- **positive** (bool) – Whether to force all signs to be positive (True) or negative (False).
- **mode** (‘invert’, ‘reroll’, optional) – Method to change the signs. Valid values are invert and reroll. `invert` means that wrong signs are simply flipped. `reroll` means that all samples with wrong signs are sampled again, optionally many times, until they randomly end up having the correct sign.
- **reroll_count_max** (int, optional) – If `mode` is set to `reroll`, this determines how often values may be rerolled before giving up and simply flipping the sign (as in `mode="invert"`). This shouldn’t be set too high, as rerolling is expensive.

Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.ForceSign(iap.Poisson(1), positive=False)
```

Create a poisson distribution with `alpha=1` that is flipped towards negative values.

Methods

```python
copy(self) Create a shallow copy of this parameter.
decopy(self) Create a deep copy of this parameter.
draw_distribution_graph(self[, title, size, ...]) Generate an image visualizing the parameter’s sample distribution.
draw_sample(self[, random_state]) Draws a single sample value from this parameter.
draw_samples(self, size[, random_state]) Draw one or more samples from the parameter.
```

class imgaug.parameters.FrequencyNoise(exponent=(-4, 4), size_px_max=(4, 32), upscale_method=['linear', 'nearest'])
Bases: imgaug.parameters.StochasticParameter

Parameter to generate noise of varying frequencies.

This parameter expects to sample noise for 2d planes, i.e. for sizes \((H, W, [C])\) and will return a value in
the range \([0.0, 1.0]\) per spatial location in that plane.

The exponent controls the frequencies and therefore noise patterns. Small values (around \(-4.0\)) will result in large blobs. Large values (around 4.0) will result in small, repetitive patterns.

The noise is sampled from low resolution planes and upscaled to the requested height and width. The size of the low resolution plane may be defined (high values can be slow) and the interpolation method for upscaling can be set.

**Parameters**

- **exponent** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Exponent to use when scaling in the frequency domain. Sane values are in the range \(-4\) (large blobs) to 4 (small patterns). To generate cloud-like structures, use roughly \(-2\).
  - If a single number, this number will be used as a constant value.
  - If a tuple of two numbers \((a, b)\), the value will be sampled from the continuous interval \([a, b)\) once per call.
  - If a list of numbers, a random value will be picked from the list once per call.
  - If a StochasticParameter, that parameter will be queried once per call.

- **size_px_max** *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)* – Maximum height and width in pixels of the low resolution plane. Upon any sampling call, the requested shape will be downscaled until the height or width (whichever is larger) does not exceed this maximum value anymore. Then the noise will be sampled at that shape and later upscaled back to the requested shape.
  - If a single int, this int will be used as a constant value.
  - If a tuple of two ints \((a, b)\), the value will be sampled from the discrete interval \([a..b]\) once per call.
  - If a list of ints, a random value will be picked from the list once per call.
  - If a StochasticParameter, that parameter will be queried once per call.

“per call” denotes a call of `FrequencyNoise.draw_sample()` or `FrequencyNoise.draw_samples()`.

- **upscale_method** *(imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional)* – After generating the noise maps in low resolution environments, they have to be upsampled to the originally requested shape (i.e. usually the image size). This parameter controls the interpolation method to use. See also `imresize_many_images()` for a description of possible values.
  - If imgaug.ALL, then either nearest or linear or area or cubic is picked per iteration (all same probability).
  - If str, then that value will always be used as the method (must be nearest or linear or area or cubic).
  - If list of str, then a random value will be picked from that list per call.
  - If StochasticParameter, then a random value will be sampled from that parameter per call.
Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.FrequencyNoise(
    exponent=-2,
    size_px_max=(16, 32),
    upscale_method="linear")
```

Create a parameter that produces noise with cloud-like patterns.

Methods

<table>
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<tr>
<th>Method</th>
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</thead>
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<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this parameter.</td>
</tr>
<tr>
<td><code>draw_distribution_graph(self[, title, size, ...])</code></td>
<td>Generate an image visualizing the parameter’s sample distribution.</td>
</tr>
<tr>
<td><code>draw_sample(self[, random_state])</code></td>
<td>Draws a single sample value from this parameter.</td>
</tr>
<tr>
<td><code>draw_samples(self, size[, random_state])</code></td>
<td>Draw one or more samples from the parameter.</td>
</tr>
</tbody>
</table>

```python
class imgaug.parameters.FromLowerResolution(other_param, size_percent=None, size_px=None,
                                           method='nearest', min_size=1)
```

Bases: `imgaug.parameters.StochasticParameter`

Parameter to sample from other parameters at lower image resolutions.

This parameter is intended to be used with parameters that would usually sample one value per pixel (or one value per pixel and channel). Instead of sampling from the other parameter at full resolution, it samples at lower resolution, e.g. 0.5*H x 0.5*W with H being the height and W being the width. After the low-resolution sampling this parameter then upscales the result to HxW.

This parameter is intended to produce coarse samples. E.g. combining this with `Binomial` can lead to large rectangular areas of 1 s and 0 s.

Parameters

- **other_param** (`imgaug.parameters.StochasticParameter`) – The other parameter which is to be sampled on a coarser image.

- **size_percent** (`None or number or iterable of number or imgaug.parameters.StochasticParameter, optional`) – Size of the 2d sampling plane in percent of the requested size. I.e. this is relative to the size provided in the call to `draw_samples(size)`. Lower values will result in smaller sampling planes, which are then upscaled to `size`. This means that lower values will result in larger rectangles. The size may be provided as a constant value or a tuple (a, b), which will automatically be converted to the continuous uniform range [a, b] or a `StochasticParameter`, which will be queried per call to `FromLowerResolution.draw_sample()` and `FromLowerResolution.draw_samples()`.

- **size_px** (`None or number or iterable of numbers or imgaug.parameters.StochasticParameter, optional`) – Size of the 2d sampling plane in pixels. Lower values will result in smaller sampling planes, which are then upscaled to the input `size` of `draw_samples(size)`. This means that lower values will result in larger rectangles. The size may be provided as a constant value or a tuple (a, b), which will automatically be converted to the discrete uniform range [a..b] or a `StochasticParameter`,...
which will be queried once per call to FromLowerResolution.draw_sample() and FromLowerResolution.draw_samples().

- **method** *(str or int or imgaug.parameters.StochasticParameter, optional)* – Upsampling/interpolation method to use. This is used after the sampling is finished and the low resolution plane has to be upsamled to the requested size in draw_samples(size, ...). The method may be the same as in imresize_many_images(). Usually nearest or linear are good choices. nearest will result in rectangles with sharp edges and linear in rectangles with blurry and round edges. The method may be provided as a StochasticParameter, which will be queried once per call to FromLowerResolution.draw_sample() and FromLowerResolution.draw_samples().

- **min_size** *(int, optional)* – Minimum size in pixels of the low resolution sampling plane.

### Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.FromLowerResolution(Binomial(0.05), size_px=(2, 16), method=Choice(['nearest', 'linear']))
```

Samples from a binomial distribution with p=0.05. The sampling plane will always have a size HxWxC with H and W being independently sampled from [2..16] (i.e. it may range from 2x2xC up to 16x16xC max, but may also be e.g. 4x8xC). The upsampling method will be nearest in 50% of all cases and linear in the other 50 percent. The result will sometimes be rectangular patches of sharp 1`s surrounded by 0`s and sometimes blurry blobs of 1``s, surrounded by values `<1.0.

### Methods

- `copy(self)` Create a shallow copy of this parameter.
- `deepcopy(self)` Create a deep copy of this parameter.
- `draw_distribution_graph(self[, title, size, ...])` Generate an image visualizing the parameter’s sample distribution.
- `draw_sample(self[, random_state])` Draws a single sample value from this parameter.
- `draw_samples(self, size[, random_state])` Draw one or more samples from the parameter.

### Class

**class** imgaug.parameters.IterativeNoiseAggregator*(other_param, iterations=(1, 3), aggregation_method=['max', 'avg'])*

Bases: imgaug.parameters.StochasticParameter

Aggregate multiple iterations of samples from another parameter.

This is supposed to be used in conjunction with SimplexNoise or FrequencyNoise. If a shape S is requested, it will request I times S samples from the underlying parameter, where I is the number of iterations. The I arrays will be combined to a single array of shape S using an aggregation method, e.g. simple averaging.

**Parameters**

- **other_param** *(StochasticParameter)* – The other parameter from which to sample one or more times.

- **iterations** *(int or iterable of int or list of int or imgaug.parameters.StochasticParameter, optional)* –
The number of iterations.

- If a single int, this int will be used as a constant value.
- If a tuple of two ints (a, b), the value will be sampled from the discrete interval [a..b] once per call.
- If a list of int, a random value will be picked from the list once per call.
- If a StochasticParameter, that parameter will be queried once per call.

“per call” denotes a call of IterativeNoiseAggregator.draw_sample() or IterativeNoiseAggregator.draw_samples().

- aggregation_method (imgaug.ALL or {'min', 'avg', 'max'} or list of str or imgaug.parameters.StochasticParameter, optional) – The method to use to aggregate the samples of multiple iterations to a single output array. All methods combine several arrays of shape S each to a single array of shape S and hence work elementwise. Known methods are min (take the minimum over all iterations), max (take the maximum) and avg (take the average).
- If an str, it must be one of the described methods and will be used for all calls.
- If a list of str, it must contain one or more of the described methods and a random one will be samples once per call.
- If imgaug.ALL, then equivalent to the list ['min', 'max', 'avg'].
- If StochasticParameter, a value will be sampled from that parameter once per call and must be one of the described methods.

“per call” denotes a call of IterativeNoiseAggregator.draw_sample() or IterativeNoiseAggregator.draw_samples().

Examples

```python
>>> import imgaug.parameters as iap
>>> noise = iap.IterativeNoiseAggregator(
>>>     iap.SimplexNoise(),
>>>     iterations=(2, 5),
>>>     aggregation_method="max")
```

Create a parameter that – upon each call – generates 2 to 5 arrays of simplex noise with the same shape. Then it combines these noise maps to a single map using elementwise maximum.

Methods

```
copy(self) Create a shallow copy of this parameter.
deepcopy(self) Create a deep copy of this parameter.
draw_distribution_graph(self[, title, size, ...]) Generate an image visualizing the parameter’s sample distribution.
draw_sample(self[, random_state]) Draws a single sample value from this parameter.
draw_samples(self, size[, random_state]) Draw one or more samples from the parameter.
```

```
class imgaug.parameters.Laplace(loc, scale)
    Bases: imgaug.parameters.StochasticParameter
```

13.2. imgaug.parameters
Parameter that resembles a (continuous) laplace distribution.

This is a wrapper around numpy’s `numpy.random.laplace()`.

**Parameters**

- **loc** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – The position of the distribution peak, similar to the mean in normal distributions.
  - If a single number, this number will be used as a constant value.
  - If a tuple of two numbers (a, b), the value will be sampled from the continuous interval [a, b) once per call.
  - If a list of number, a random value will be picked from the list once per call.
  - If a StochasticParameter, that parameter will be queried once per call.
  “per call” denotes a call of Laplace.draw_sample() or Laplace.draw_samples().

- **scale** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – The exponential decay factor, similar to the standard deviation in gaussian distributions. If this parameter reaches 0, the output array will be filled with loc. Datatype behaviour is the analogous to loc.

**Examples**

```python
>>> import imgaug.parameters as iap
>>> param = iap.Laplace(0, 1.0)
```

Create a laplace distribution, which’s peak is at 0 and decay is 1.0.

**Methods**

- `copy(self)` Create a shallow copy of this parameter.
- `deepcopy(self)` Create a deep copy of this parameter.
- `draw_distribution_graph(self[, title, size, ...])` Generate an image visualizing the parameter’s sample distribution.
- `draw_sample(self[, random_state])` Draws a single sample value from this parameter.
- `draw_samples(self, size[, random_state])` Draw one or more samples from the parameter.

**class** imgaug.parameters.Multiply (other_param, val, elementwise=False)

**Bases:** imgaug.parameters.StochasticParameter

Multiply the samples of another stochastic parameter.

**Parameters**

- **other_param** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Other parameter which’s sampled values are to be multiplied with val. Let S be the requested shape of samples, then the datatype behaviour is as follows:
  - If a single number, this number will be used as a constant value to fill an array of shape S.
- If a tuple of two numbers \((a, b)\), an array of shape \(S\) will be filled with uniformly sampled values from the continuous interval \([a, b)\).
- If a list of number, an array of shape \(S\) will be filled with randomly picked values from the list.
- If a StochasticParameter, that parameter will be queried once per call to generate an array of shape \(S\).

“per call” denotes a call of Multiply.draw_sample() or Multiply.draw_samples().

- **val** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter)* – Multiplier to use. Datatype behaviour is analogous to other_param, though if `elementwise=False` (the default), only a single sample will be generated per call instead of \(S\).

- **elementwise** *(bool, optional)* – Controls the sampling behaviour of `val`. If set to `False`, a single samples will be requested from `val` and used as the constant multiplier. If set to `True`, samples of shape \(S\) will be requested from `val` and multiplied elementwise with the samples of `other_param`.

### Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.Multiply(iap.Uniform(0.0, 1.0), -1)
```

Convert a uniform distribution from \([0.0, 1.0)\) to \((-1.0, 0.0]\).

### Methods

- `copy(self)` Create a shallow copy of this parameter.
- `deepcopy(self)` Create a deep copy of this parameter.
- `draw_distribution_graph(self[, title, size, ...])` Generate an image visualizing the parameter’s sample distribution.
- `draw_sample(self[, random_state])` Draws a single sample value from this parameter.
- `draw_samples(self, size[, random_state])` Draw one or more samples from the parameter.

#### imgaug.parameters.Negative *(other_param, mode='invert', reroll_count_max=2)*

Convert another parameter’s results to negative values.

### Parameters

- **other_param** *(imgaug.parameters.StochasticParameter)* – Other parameter which’s sampled values are to be modified.

- **mode** *(‘invert’, ‘reroll’, optional)* – How to change the signs. Valid values are `invert` and `reroll.invert` means that wrong signs are simply flipped. `reroll` means that all samples with wrong signs are sampled again, optionally many times, until they randomly end up having the correct sign.

- **reroll_count_max** *(int, optional)* – If `mode` is set to `reroll`, this determines how often values may be rerolled before giving up and simply flipping the sign (as in `mode="invert"`). This shouldn’t be set too high, as rerolling is expensive.
Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.Negative(iap.Normal(0, 1), mode="reroll")
```

Create a gaussian distribution that has only negative values. If any positive value is sampled in the process, that sample is resampled up to two times to get a negative one. If it isn’t negative after the second resampling step, the sign is simply flipped.

```python
class imgaug.parameters.Normal(loc, scale)
```

Bases: `imgaug.parameters.StochasticParameter`

Parameter that resembles a normal/gaussian distribution.

**Parameters**

- `loc` *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter)* —
  The mean of the normal distribution.
  - If a single number, this number will be used as a constant value.
  - If a tuple of two numbers \((a, b)\), the value will be sampled from the continuous interval \([a, b)\) once per call.
  - If a list of numbers, a random value will be picked from the list once per call.
  - If a `StochasticParameter`, that parameter will be queried once per call.
  “per call” denotes a call of `Laplace.draw_sample()` or `Laplace.draw_samples()`.

- `scale` *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter)* — The standard deviation of the normal distribution. If this parameter reaches 0, the output array will be filled with `loc`. Datatype behaviour is the analogous to `loc`.

Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.Normal(Choice([-1.0, 1.0]), 1.0)
```

Create a gaussian distribution with a mean that differs by call. Samples values may sometimes follow \(N(-1.0, 1.0)\) and sometimes \(N(1.0, 1.0)\).

Methods

<table>
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<th>Description</th>
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<td>Create a shallow copy of this parameter.</td>
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<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this parameter.</td>
</tr>
<tr>
<td><code>draw_distribution_graph(self[, title, size, ...])</code></td>
<td>Generate an image visualizing the parameter’s sample distribution.</td>
</tr>
<tr>
<td><code>draw_sample(self[, random_state])</code></td>
<td>Draws a single sample value from this parameter.</td>
</tr>
<tr>
<td><code>draw_samples(self, size[, random_state])</code></td>
<td>Draw one or more samples from the parameter.</td>
</tr>
</tbody>
</table>
class imgaug.parameters.Poisson(lam)

Bases: imgaug.parameters.StochasticParameter

Parameter that resembles a poisson distribution.

A poisson distribution with \( \lambda=0 \) has its highest probability at point 0 and decreases quickly from there. Poisson distributions are discrete and never negative.

Parameters lam (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) –

Lambda parameter of the poisson distribution.

• If a single number, this number will be used as a constant value.

• If a tuple of two numbers \((a, b)\), the value will be sampled from the continuous interval \([a, b)\) once per call.

• If a list of numbers, a random value will be picked from the list once per call.

• If a StochasticParameter, that parameter will be queried once per call.

“per call” denotes a call of Poisson.draw_sample() or Poisson.draw_samples().

Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.Poisson(1)
>>> sample = param.draw_sample()
>>> assert sample >= 0
```

Create a poisson distribution with \( \lambda=1 \) and sample a value from it.

Methods

- copy(self)
  - Create a shallow copy of this parameter.

- deepcopy(self)
  - Create a deep copy of this parameter.

- draw_distribution_graph(self[, title, size, ...])
  - Generate an image visualizing the parameter’s sample distribution.

- draw_sample(self[, random_state])
  - Draws a single sample value from this parameter.

- draw_samples(self, size[, random_state])
  - Draw one or more samples from the parameter.

imgaug.parameters.Positive(\(other_param, mode='invert', reroll_count_max=2\))

Convert another parameter’s results to positive values.

Parameters

- other_param (imgaug.parameters.StochasticParameter) – Other parameter which’s sampled values are to be modified.

- mode ('invert', 'reroll', optional) – How to change the signs. Valid values are invert and reroll.invert means that wrong signs are simply flipped. reroll means that all samples with wrong signs are sampled again, optionally many times, until they randomly end up having the correct sign.

- reroll_count_max (int, optional) – If mode is set to reroll, this determines how often values may be rerolled before giving up and simply flipping the sign (as in mode="invert"). This shouldn’t be set too high, as rerolling is expensive.
Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.Positive(iap.Normal(0, 1), mode="reroll")
```

Create a gaussian distribution that has only positive values. If any negative value is sampled in the process, that sample is resampled up to two times to get a positive one. If it isn’t positive after the second resampling step, the sign is simply flipped.

```python
class imgaug.parameters.Power(other_param, val, elementwise=False)
Bases: imgaug.parameters.StochasticParameter
```

Exponentiate the samples of another stochastic parameter.

**Parameters**

- `other_param` *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter)* – Other parameter which’s sampled values are to be exponentiated by `val`. Let \( S \) be the requested shape of samples, then the datatype behaviour is as follows:
  - If a single *number*, this *number* will be used as a constant value to fill an array of shape \( S \).
  - If a tuple of *two numbers* \((a, b)\), an array of shape \( S \) will be filled with uniformly sampled values from the continuous interval \([a, b)\).
  - If a list of *numbers*, an array of shape \( S \) will be filled with randomly picked values from the list.
  - If a *StochasticParameter*, that parameter will be queried once per call to generate an array of shape \( S \).

  “per call” denotes a call of `Power.draw_sample()` or `Power.draw_samples()`.

- `val` *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter)* – Value to use exponentiate the samples of `other_param`. Datatype behaviour is analogous to `other_param`, though if `elementwise=False` (the default), only a single sample will be generated per call instead of \( S \).

- `elementwise` *(bool, optional)* – Controls the sampling behaviour of `val`. If set to `False`, a single samples will be requested from `val` and used as the constant multiplier. If set to `True`, samples of shape \( S \) will be requested from `val` and used to exponentiate elementwise the samples of `other_param`.

Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.Power(iap.Uniform(0.0, 1.0), 2)
```

Converts a uniform range \([0.0, 1.0)\) to a distribution that is peaked towards 1.0.

Methods

- `copy(self)` Create a shallow copy of this parameter.

Continued on next page
Table 25 – continued from previous page

<table>
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<td>deepcopy(self)</td>
<td>Create a deep copy of this parameter.</td>
</tr>
<tr>
<td>draw_distribution_graph(self[, title, size, ...])</td>
<td>Generate an image visualizing the parameter’s sample distribution.</td>
</tr>
<tr>
<td>draw_sample(self[, random_state])</td>
<td>Draws a single sample value from this parameter.</td>
</tr>
<tr>
<td>draw_samples(self, size[, random_state])</td>
<td>Draw one or more samples from the parameter.</td>
</tr>
</tbody>
</table>

class imgaug.parameters.RandomSign(other_param, p_positive=0.5)

Bases: imgaug.parameters.StochasticParameter

Convert a parameter’s samples randomly to positive or negative values.

Parameters

- **other_param** (imgaug.parameters.StochasticParameter) – Other parameter which’s sampled values are to be modified.
- **p_positive** (number) – Fraction of values that are supposed to be turned to positive values.

Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.RandomSign(iap.Poisson(1))
```

Create a poisson distribution with \( \alpha = 1 \) that is mirrored/copied (not flipped) at the y-axis.

Methods

<table>
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<td>copy(self)</td>
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<td>draw_samples(self, size[, random_state])</td>
<td>Draw one or more samples from the parameter.</td>
</tr>
</tbody>
</table>

class imgaug.parameters.Sigmoid(other_param, threshold=(-10, 10), activated=True, mul=1, add=0)

Bases: imgaug.parameters.StochasticParameter

Apply a sigmoid function to the outputs of another parameter.

This is intended to be used in combination with SimplexNoise or FrequencyNoise. It pushes the noise values away from \( \sim 0.5 \) and towards \( 0.0 \) or \( 1.0 \), making the noise maps more binary.

Parameters

- **other_param** (imgaug.parameters.StochasticParameter) – The other parameter to which the sigmoid will be applied.
- **threshold** (number or tuple of number or iterable of number or imgaug.parameters.StochasticParameter, optional) – Sets the value of the sigmoid’s saddle point, i.e. where values start to quickly shift from \( 0.0 \) to \( 1.0 \).
  - If a single number, this number will be used as a constant value.
  - If a tuple of two numbers \((a, b)\), the value will be sampled from the continuous interval \([a, b]\) once per call.
— If a list of number, a random value will be picked from the list once per call.
— If a StochasticParameter, that parameter will be queried once per call.

“per call” denotes a call of Sigmoid.draw_sample() or Sigmoid.draw_samples().

• **activated (bool or number, optional)** – Defines whether the sigmoid is activated. If this is False, the results of other_param will not be altered. This may be set to a float p in value range “[0.0, 1.0]”, which will result in activated being True in p percent of all calls.

• **mul (number, optional)** – The results of other_param will be multiplied with this value before applying the sigmoid. For noise values (range [0.0, 1.0]) this should be set to about 20.

• **add (number, optional)** – This value will be added to the results of other_param before applying the sigmoid. For noise values (range [0.0, 1.0]) this should be set to about -10.0, provided mul was set to 20.

**Examples**

```python
>>> import imgaug.parameters as iap
>>> param = iap.Sigmoid(
>>>     iap.SimplexNoise(),
>>>     activated=0.5,
>>>     mul=20,
>>>     add=-10)
```

Applies a sigmoid to simplex noise in 50% of all calls. The noise results are modified to match the sigmoid’s expected value range. The sigmoid’s outputs are in the range [0.0, 1.0].

**Methods**

- `copy(self)`: Create a shallow copy of this parameter.
- `create_for_noise(other_param[, threshold, ...])`: Create a Sigmoid adjusted for noise parameters.
- `deepcopy(self)`: Create a deep copy of this parameter.
- `draw_distribution_graph(self[, title, size, ...])`: Generate an image visualizing the parameter’s sample distribution.
- `draw_sample(self[, random_state])`: Draws a single sample value from this parameter.
- `draw_samples(self[, size[, random_state]])`: Draw one or more samples from the parameter.

```
static create_for_noise(other_param, threshold=(-10, 10), activated=True)
```

Create a Sigmoid adjusted for noise parameters.

“noise” here denotes SimplexNoise and FrequencyNoise.

**Parameters**

- **other_param** (imgaug.parameters.StochasticParameter) – See __init__().
- **threshold** (number or tuple of number or iterable of number or imgaug.parameters.StochasticParameter, optional) – See __init__().
- **activated** (bool or number, optional) – See __init__().

**Returns** A sigmoid adjusted to be used with noise.
Return type  **Sigmoid**

class **SimplexNoise** *(size_px_max=(2, 16), upscale_method=['linear', 'nearest'])*

Bases: **StochasticParameter**

Parameter that generates simplex noise of varying resolutions.

This parameter expects to sample noise for 2d planes, i.e. for sizes \((H, W, [C])\) and will return a value in the range \([0.0, 1.0]\) per spatial location in that plane.

The noise is sampled from low resolution planes and upscaled to the requested height and width. The size of the low resolution plane may be defined (large values can be slow) and the interpolation method for upscaling can be set.

**Parameters**

- **size_px_max** *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)* – Maximum height and width in pixels of the low resolution plane. Upon any sampling call, the requested shape will be downscaled until the height or width (whichever is larger) does not exceed this maximum value anymore. Then the noise will be sampled at that shape and later upscaled back to the requested shape.

  - If a single int, this int will be used as a constant value.
  - If a tuple of two ints \((a, b)\), the value will be sampled from the discrete interval \([a..b]\) once per call.
  - If a list of int, a random value will be picked from the list once per call.
  - If a StochasticParameter, that parameter will be queried once per call.

  “per call” denotes a call of SimplexNoise.draw_sample() or SimplexNoise.draw_samples().

- **upscale_method** *(str or int or list of str or list of int or imgaug.parameters.StochasticParameter, optional)* – After generating the noise maps in low resolution environments, they have to be upscaled to the originally requested shape (i.e. usually the image size). This parameter controls the interpolation method to use. See also imresize_many_images() for a description of possible values.

  - If imgaug.ALL, then either nearest or linear or area or cubic is picked per iteration (all same probability).
  - If str, then that value will always be used as the method (must be nearest or linear or area or cubic).
  - If list of str, then a random value will be picked from that list per call.
  - If StochasticParameter, then a random value will be sampled from that parameter per call.

**Examples**

```python
>>> import imgaug.parameters as iap
>>> param = iap.SimplexNoise(upscale_method="linear")
```

Create a parameter that produces smooth simplex noise of varying sizes.
Create a parameter that produces rectangular simplex noise of rather high detail.

### Methods

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<td>Create a shallow copy of this parameter.</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this parameter.</td>
</tr>
<tr>
<td><code>draw_distribution_graph(self, title=None, size=(1000, 1000), bins=100)</code></td>
<td>Generate an image visualizing the parameter’s sample distribution.</td>
</tr>
<tr>
<td><code>draw_sample(self, random_state)</code></td>
<td>Draws a single sample value from this parameter.</td>
</tr>
<tr>
<td><code>draw_samples(self, size, random_state)</code></td>
<td>Draw one or more samples from the parameter.</td>
</tr>
</tbody>
</table>

```python
>>> param = iap.SimplexNoise(
    size_px_max=(8, 16),
    upscale_method="nearest")
```

Methods

**copy** *(self)*

Create a shallow copy of this parameter.

**deepcopy** *(self)*

Create a deep copy of this parameter.

**draw_distribution_graph** *(self, title=None, size=(1000, 1000), **...**)*

Generate an image visualizing the parameter’s sample distribution.

**draw_sample** *(self, random_state)*

Draws a single sample value from this parameter.

**draw_samples** *(self, size, random_state)*

Draw one or more samples from the parameter.

```python
>>> param = iap.SimplexNoise(
    size_px_max=(8, 16),
    upscale_method="nearest")
```

Create a parameter that produces rectangular simplex noise of rather high detail.
• **size (tuple of int)** – Number of points to sample. This is always expected to have at least two values. The first defines the number of sampling runs, the second (and further) dimensions define the size assigned to each `draw_samples()` call. E.g. `(10, 20, 15)` will lead to 10 calls of `draw_samples(size=(20, 15))`. The results will be merged to a single 1d array.

• **bins (int)** – Number of bins in the plot histograms.

**Returns**

- **data** – Image of the plot.
- **Return type** (H,W,3) ndarray

**draw_sample** (self, random_state=None)

Draws a single sample value from this parameter.

**Parameters**

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – A seed or random number generator to use during the sampling process. If None, the global RNG will be used. See also `__init__()` for a similar parameter with more details.

**Returns**

A single sample value.

**Return type** any

**draw_samples** (self, size, random_state=None)

Draw one or more samples from the parameter.

**Parameters**

- **size (tuple of int or int)** – Number of samples by dimension.
- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – A seed or random number generator to use during the sampling process. If None, the global RNG will be used. See also `__init__()` for a similar parameter with more details.

**Returns**

Sampled values. Usually a numpy ndarray of basically any dtype, though not strictly limited to numpy arrays. Its shape is expected to match `size`.

**Return type** ndarray

**class** **imgaug.parameters.Subtract** (other_param, val, elementwise=False)

**Bases:** imgaug.parameters.StochasticParameter

Subtract from the samples of another stochastic parameter.

**Parameters**

- **other_param** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Samples of `val` will be subtracted from samples of this parameter. Let `S` be the requested shape of samples, then the datatype behaviour is as follows:
  - If a single number, this number will be used as a constant value to fill an array of shape `S`.
  - If a tuple of two numbers `(a, b)`, an array of shape `S` will be filled with uniformly sampled values from the continuous interval `[a, b)`.
  - If a list of number, an array of shape `S` will be filled with randomly picked values from the list.
- If a `StochasticParameter`, that parameter will be queried once per call to generate an array of shape $S$.

“per call” denotes a call of `Subtract.draw_sample()` or `Subtract.draw_samples()`.

- **val** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter)* – Value to subtract from the other parameter. Datatype behaviour is analogous to `other_param`, though if `elementwise=False` (the default), only a single sample will be generated per call instead of $S$.

- **elementwise** *(bool, optional)* – Controls the sampling behaviour of `val`. If set to `False`, a single samples will be requested from `val` and used as the constant multiplier. If set to `True`, samples of shape $S$ will be requested from `val` and subtracted elementwise from the samples of `other_param`.

### Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.Subtract(iap.Uniform(0.0, 1.0), 1.0)
```

Convert a uniform distribution from $[0.0, 1.0)$ to $[-1.0, 0.0)$.

### Methods

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<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this parameter.</td>
</tr>
<tr>
<td><code>draw_distribution_graph(self[, title, size, ...])</code></td>
<td>Generate an image visualizing the parameter’s sample distribution.</td>
</tr>
<tr>
<td><code>draw_sample(self[, random_state])</code></td>
<td>Draws a single sample value from this parameter.</td>
</tr>
<tr>
<td><code>draw_samples(self, size[, random_state])</code></td>
<td>Draw one or more samples from the parameter.</td>
</tr>
</tbody>
</table>

### class `imgaug.parameters.TruncatedNormal` *(loc, scale, low=-inf, high=inf)*

Bases: `imgaug.parameters.StochasticParameter`

Parameter that resembles a truncated normal distribution.

A truncated normal distribution is similar to a normal distribution, except the domain is smoothly bounded to a min and max value.

This is a wrapper around `scipy.stats.truncnorm()`.

### Parameters

- **loc** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter)* – The mean of the normal distribution.
  - If a single number, this number will be used as a constant value.
  - If a tuple of two numbers $(a, b)$, the value will be sampled from the continuous interval $[a, b)$ once per call.
  - If a list of numbers, a random value will be picked from the list once per call.
  - If a `StochasticParameter`, that parameter will be queried once per call.
“per call” denotes a call of `TruncatedNormal.draw_sample()` or `TruncatedNormal.draw_samples()`.

- **scale** (number or tuple of number or list of number or `imgaug.parameters.StochasticParameter`) – The standard deviation of the normal distribution. If this parameter reaches 0, the output array will be filled with `loc`. Datatype behaviour is the same as for `loc`.

- **low** (number or tuple of number or list of number or `imgaug.parameters.StochasticParameter`) – The minimum value of the truncated normal distribution. Datatype behaviour is the same as for `loc`.

- **high** (number or tuple of number or list of number or `imgaug.parameters.StochasticParameter`) – The maximum value of the truncated normal distribution. Datatype behaviour is the same as for `loc`.

### Examples

```python
>>> import imgaug.parameters as iap
>>> param = iap.TruncatedNormal(0, 5.0, low=-10, high=10)
>>> samples = param.draw_samples(100, random_state=0)
>>> assert np.all(samples >= -10)
>>> assert np.all(samples <= 10)
```

Create a truncated normal distribution with its minimum at -10.0 and its maximum at 10.0.

### Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this parameter.</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this parameter.</td>
</tr>
<tr>
<td><code>draw_distribution_graph(self[, title, size, ...])</code></td>
<td>Generate an image visualizing the parameter’s sample distribution.</td>
</tr>
<tr>
<td><code>draw_sample(self[, random_state])</code></td>
<td>Draws a single sample value from this parameter.</td>
</tr>
<tr>
<td><code>draw_samples(self, size[, random_state])</code></td>
<td>Draw one or more samples from the parameter.</td>
</tr>
</tbody>
</table>

### Class `imgaug.parameters.Uniform(a, b)`

Bases: `imgaug.parameters.StochasticParameter`

Parameter that resembles a uniform distribution over \([a, b)\).

#### Parameters

- **a** (number or tuple of number or list of number or `imgaug.parameters.StochasticParameter`)
  - Lower bound of the interval. If \(a > b\), \(a\) and \(b\) will automatically be flipped. If \(a == b\), all generated values will be identical to \(a\).
  - If a single number, this number will be used as a constant value.
  - If a tuple of two numbers \((a, b)\), the value will be sampled from the continuous interval \([a, b)\) once per call.
  - If a list of numbers, a random value will be picked from the list once per call.
  - If a `StochasticParameter`, that parameter will be queried once per call.

  “per call” denotes a call of `Uniform.draw_sample()` or `Uniform.draw_samples()`.
• **b** (*number or tuple of number or list of number or imgaug.parameters.StochasticParameter*)
  – Upper bound of the interval. Analogous to a.

**Examples**

```python
going import imgaug.parameters as iap
>>> param = iap.Uniform(0, 10.0)
>>> sample = param.draw_sample()
>>> assert 0 <= sample < 10.0
```

Create and sample from a uniform distribution over \([0, 10.0)\).

**Methods**

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>copy(self)</td>
<td>Create a shallow copy of this parameter.</td>
</tr>
<tr>
<td>deepcopy(self)</td>
<td>Create a deep copy of this parameter.</td>
</tr>
<tr>
<td>draw_distribution_graph(self[, title, size, ...])</td>
<td>Generate an image visualizing the parameter’s sample distribution.</td>
</tr>
<tr>
<td>draw_sample(self[, random_state])</td>
<td>Draws a single sample value from this parameter.</td>
</tr>
<tr>
<td>draw_samples(self, size[, random_state])</td>
<td>Draw one or more samples from the parameter.</td>
</tr>
</tbody>
</table>

**class** imgaug.parameters.Weibull(*a*)

**Bases:** imgaug.parameters.StochasticParameter

Parameter that resembles a (continuous) weibull distribution.

This is a wrapper around numpy’s `numpy.random.weibull()`.

**Parameters**

- **a** (*number or tuple of number or list of number or imgaug.parameters.StochasticParameter*)
  – Shape parameter of the distribution.

  - If a single number, this number will be used as a constant value.
  - If a tuple of two numbers \((a, b)\), the value will be sampled from the continuous interval \([a, b)\) once per call.
  - If a list of number, a random value will be picked from the list once per call.
  - If a `StochasticParameter`, that parameter will be queried once per call.

  “per call” denotes a call of `Weibull.draw_sample()` or `Weibull.draw_samples()`.

**Examples**

```python
going import imgaug.parameters as iap
>>> param = iap.Weibull(a=0.5)
```

Create a weibull distribution with shape 0.5.

**Methods**
copy(self) Create a shallow copy of this parameter.
decopy(self) Create a deep copy of this parameter.
draw_distribution_graph(self[, title, size, ...]) Generate an image visualizing the parameter’s sample distribution.
draw_sample(self[, random_state]) Draws a single sample value from this parameter.
draw_samples(self, size[, random_state]) Draw one or more samples from the parameter.

imgaug.parameters.both_np_float_if_one_is_float(a, b)

imgaug.parameters.draw_distributions_grid(params, rows=None, cols=None, graph_sizes=(350, 350), sample_sizes=None, titles=None)

imgaug.parameters.force_np_float_dtype(val)

imgaug.parameters.handle_categorical_string_param(param, name, valid_values=None)

imgaug.parameters.handle_continuous_param(param, name, value_range=None, tuple_to_uniform=True, list_to_choice=True)

imgaug.parameters.handle_discrete_kernel_size_param(param, name, value_range=(1, None), allow_floats=True)

imgaug.parameters.handle_discrete_param(param, name, value_range=None, tuple_to_uniform=True, list_to_choice=True, allow_floats=True)

imgaug.parameters.handle_probability_param(param, name, tuple_to_uniform=False, list_to_choice=False)

imgaug.parameters.show_distributions_grid(params, rows=None, cols=None, graph_sizes=(350, 350), sample_sizes=None, titles=None)

13.3 imgaug.multicore

Classes and functions dealing with augmentation on multiple CPU cores.

class imgaug.multicore.BackgroundAugmenter(batch_loader, augseq, queue_size=50, nb_workers='auto')

Bases: object

Deprecated. Augment batches in the background processes.


This is a wrapper around the multiprocessing module.

Parameters

- **batch_loader** (BatchLoader or multiprocessing Queue) – BatchLoader object that loads the data fed into the BackgroundAugmenter, or alternatively a Queue. If a Queue, then it must be made sure that a final None in the Queue signals that the loading is finished and no more batches will follow. Otherwise the BackgroundAugmenter will wait forever for the next batch.

- **augseq** (Augmenter) – An augmenter to apply to all loaded images. This may be e.g. a Sequential to apply multiple augmenters.
- **queue_size** (*int*) – Size of the queue that is used to temporarily save the augmentation results. Larger values offer the background processes more room to save results when the main process doesn’t load much, i.e. they can lead to smoother and faster training. For large images, high values can block a lot of RAM though.

- **nb_workers** (*‘auto’ or int*) – Number of background workers to spawn. If *auto*, it will be set to \(C-1\), where \(C\) is the number of CPU cores.

### Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>get_batch(self)</code></td>
<td>Returns a batch from the queue of augmented batches.</td>
</tr>
<tr>
<td><code>terminate(self)</code></td>
<td>Terminates all background processes immediately.</td>
</tr>
</tbody>
</table>

#### `all_finished(self)`

Returns out – One batch or None if all workers have finished.

**Return type** None or `imgaug.Batch`

#### `get_batch(self)`

Returns a batch from the queue of augmented batches.

- If workers are still running and there are no batches in the queue, it will automatically wait for the next batch.

**Returns** out – One batch or None if all workers have finished.

**Return type** None or `imgaug.Batch`

#### `terminate(self)`

Terminates all background processes immediately.

This will also free their RAM.

**class** `imgaug.multicore.BatchLoader(load_batch_func, queue_size=50, nb_workers=1, threaded=True)`

**Bases** `object`

**Deprecated.** Load batches in the background.

**Deprecated.** Use `imgaug.multicore.Pool` instead.

Loaded batches can be accessed using `imgaug.BatchLoader.queue`.

**Parameters**

- **load_batch_func** (*callable or generator*) – Generator or generator function (i.e. function that yields `Batch` objects) or a function that returns a list of `Batch` objects. Background loading automatically stops when the last batch was yielded or the last batch in the list was reached.

- **queue_size** (*int, optional*) – Maximum number of batches to store in the queue. May be set higher for small images and/or small batches.

- **nb_workers** (*int, optional*) – Number of workers to run in the background.

- **threaded** (*bool, optional*) – Whether to run the background processes using threads (True) or full processes (False).
Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>all_finished(self)</td>
<td>Determine whether the workers have finished the loading process.</td>
</tr>
<tr>
<td>terminate(self)</td>
<td>Stop all workers.</td>
</tr>
<tr>
<td>count_workers_alive(self)</td>
<td>Determine whether the workers have finished the loading process.</td>
</tr>
</tbody>
</table>

**count_workers_alive**

Determine whether the workers have finished the loading process.

Returns out – True if all workers have finished. Else False.

Return type bool

**Class**

```python
class imgaug.multicore.Pool(augseq=None, processes=None, maxtasksperchild=None, seed=None)
```

Bases: object

Wrapper around multiprocessing.Pool for multicore augmentation.

**Parameters**

- `augseq` (imgaug.augmenters.meta.Augmenter) – The augmentation sequence to apply to batches.
- `processes` (None or int, optional) – The number of background workers, similar to the same parameter in multiprocessing.Pool. If None, the number of the machine’s CPU cores will be used (this counts hyperthreads as CPU cores). If this is set to a negative value `p`, then `-abs(p)` will be used, where `P` is the number of CPU cores. E.g. `-1` would use all cores except one (this is useful to e.g. reserve one core to feed batches to the GPU).
- `maxtasksperchild` (None or int, optional) – The number of tasks done per worker process before the process is killed and restarted, similar to the same parameter in multiprocessing.Pool. If None, worker processes will not be automatically restarted.
- `seed` (None or int, optional) – The seed to use for child processes. If None, a random seed will be used.

**Attributes**

- `pool` Return or create the multiprocessing.Pool instance.

**Methods**

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>close(self)</td>
<td>Close the pool gracefully.</td>
</tr>
<tr>
<td>imap_batches</td>
<td>Augment batches from a generator.</td>
</tr>
<tr>
<td>imap_batches_unordered</td>
<td>Augment batches from a generator (without preservation of order).</td>
</tr>
<tr>
<td>join(self)</td>
<td>Wait for the workers to exit.</td>
</tr>
<tr>
<td>map_batches</td>
<td>Augment a list of batches.</td>
</tr>
<tr>
<td>map_batches_async</td>
<td>Augment batches asynchronously.</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>terminate()</code></td>
<td>Terminate the pool immediately.</td>
</tr>
<tr>
<td><code>close()</code></td>
<td>Close the pool gracefully.</td>
</tr>
<tr>
<td><code>imap_batches()</code></td>
<td>Augment batches from a generator.</td>
</tr>
<tr>
<td><code>imap_batches_unordered()</code></td>
<td>Augment batches from a generator without preservation of order.</td>
</tr>
<tr>
<td><code>join()</code></td>
<td>Wait for the workers to exit.</td>
</tr>
</tbody>
</table>

**Parameters**

- **batches** *(generator of imgaug.augmentables.batches.Batch)* – The batches to augment, provided as a generator. Each call to the generator should yield exactly one batch.

- **chunksize** *(None or int, optional)* – Rough indicator of how many tasks should be sent to each worker. Increasing this number can improve performance.

- **output_buffer_size** *(None or int, optional)* – Max number of batches to handle at the same time in the whole pipeline (including already augmented batches that are waiting to be requested). If the buffer size is reached, no new batches will be loaded from batches until a produced (i.e. augmented) batch is consumed (i.e. requested from this method). The buffer is unlimited if this is set to None. For large datasets, this should be set to an integer value to avoid filling the whole RAM if loading+augmentation happens faster than training.

  *New in version 0.3.0.*

**Yields** `imgaug.augmentables.batches.Batch` – Augmented batch.

**Parameters**

- **batches** *(generator of imgaug.augmentables.batches.Batch)* – The batches to augment, provided as a generator. Each call to the generator should yield exactly one batch.

- **chunksize** *(None or int, optional)* – Rough indicator of how many tasks should be sent to each worker. Increasing this number can improve performance.

- **output_buffer_size** *(None or int, optional)* – Max number of batches to handle at the same time in the whole pipeline (including already augmented batches that are waiting to be requested). If the buffer size is reached, no new batches will be loaded from batches until a produced (i.e. augmented) batch is consumed (i.e. requested from this method). The buffer is unlimited if this is set to None. For large datasets, this should be set to an integer value to avoid filling the whole RAM if loading+augmentation happens faster than training.

  *New in version 0.3.0.*

**Yields** `imgaug.augmentables.batches.Batch` – Augmented batch.
Parameters

- **batches** (list of imgaug.augmentables.batches.Batch) – The batches to augment.
- **chunksize** (None or int, optional) – Rough indicator of how many tasks should be sent to each worker. Increasing this number can improve performance.

Returns Augmented batches.

Return type list of imgaug.augmentables.batches.Batch

map_batches_async (self, batches, chunksize=None, callback=None, error_callback=None)

Augment batches asynchronously.

Parameters

- **batches** (list of imgaug.augmentables.batches.Batch) – The batches to augment.
- **chunksize** (None or int, optional) – Rough indicator of how many tasks should be sent to each worker. Increasing this number can improve performance.
- **callback** (None or callable, optional) – Function to call upon finish. See multiprocessing.Pool.
- **error_callback** (None or callable, optional) – Function to call upon errors. See multiprocessing.Pool.

Returns Asynchronous result. See multiprocessing.Pool.

Return type multiprocessing.MapResult

pool

Return or create the multiprocessing.Pool instance.

This creates a new instance upon the first call and afterwards returns that instance (until the property _pool is set to None again).

Returns The multiprocessing.Pool used internally by this imgaug.multicore.Pool.

Return type multiprocessing.Pool

terminate (self)

Terminate the pool immediately.

### 13.4 imgaug.dtypes

Functions to interact/analyze with numpy dtypes.

- `imgaug.dtypes.change_dtype_(arr, dtype, clip=True, round=True)`
- `imgaug.dtypes.change_dtypes_(images, dtypes, clip=True, round=True)`
- `imgaug.dtypes.clip_(array, min_value, max_value)`
- `imgaug.dtypes.clip_to_dtype_value_range_(array, dtype, validate=True, validate_values=None)`
- `imgaug.dtypes.copy_dtypes_for_restore(images, force_list=False)`
- `imgaug.dtypes.gate_dtypes(dtypes, allowed, disallowed, augmenter=None)`
- `imgaug.dtypes.get_minimal_dtype(arrays, increase_itemsize_factor=1)`
- `imgaug.dtypes.get_value_range_of_dtype(dtype)`
Classes and functions related to pseudo-random number generation.

This module deals with the generation of pseudo-random numbers. It provides the `RNG` class, which is the primary random number generator in `imgaug`. It also provides various utility functions related random number generation, such as copying random number generators or setting their state.

The main benefit of this module is to hide the actually used random number generation classes and methods behind `imgaug`-specific classes and methods. This allows to deal with `numpy` using two different interfaces (one old interface in `numpy` <=1.16 and a new one in `numpy` 1.17+). It also allows to potentially switch to a different framework/library in the future.

### 13.5.1 Definitions

- **numpy generator** or **numpy random number generator**: Usually an instance of `numpy.random.Generator`. Can often also denote an instance of `numpy.random.RandomState` as both have almost the same interface.

- **RandomState**: An instance of `numpy.random.RandomState`. Note that outside of this module, the term “random state” often roughly translates to “any random number generator with `numpy`-like interface in a given state”, i.e. it can then include instances of `numpy.random.Generator` or `RNG`.

- **RNG**: An instance of `RNG`.

### Examples

```python
>>> import imgaug.random as iarandom
>>> rng = iarandom.RNG(1234)
>>> rng.integers(0, 1000)
```

Initialize a random number generator with seed 1234, then sample a single integer from the discrete interval `[0, 1000)`. This will use a `numpy.random.Generator` in `numpy` 1.17+ and automatically fall back to `numpy.random.RandomState` in `numpy` <=1.16.

```python
class imgaug.random.RNG(generator)
    Bases: object

    Random number generator for `imgaug`.

    This class is a wrapper around `numpy.random.Generator` and automatically falls back to `numpy.random.RandomState` in case of `numpy` version 1.16 or lower. It allows to use `numpy` 1.17’s sampling functions in 1.16 too and supports a variety of useful functions on the wrapped sampler, e.g. getting its state or copying it.

    Not supported sampling functions of `numpy` <=1.16:
```
• numpy.random.RandomState.rand()
• numpy.random.RandomState.randn()
• numpy.random.RandomState.randint()
• numpy.random.RandomState.random_integers()
• numpy.random.RandomState.random_sample()
• numpy.random.RandomState.ranf()
• numpy.random.RandomState.sample()
• numpy.random.RandomState.seed()
• numpy.random.RandomState.get_state()
• numpy.random.RandomState.set_state()

In `choice()`, the `axis` argument is not yet supported.

Parameters generator (None or int or RNG or numpy.random.Generator or
numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState)
– The numpy random number generator to use. In case of numpy version 1.17 or later, this
shouldn’t be a RandomState as that class is outdated. Behaviour for different datatypes:

• If None: The global RNG is wrapped by this RNG (they are then effectively identical, any
sampling on this RNG will affect the global RNG).

• If int: In numpy 1.17+, the value is used as a seed for a Generator wrapped by this
RNG. I.e. it will be provided as the entropy to a SeedSequence, which will then be used
for an SFC64 bit generator and wrapped by a Generator. In numpy <=1.16, the value is
used as a seed for a RandomState, which is then wrapped by this RNG.

• If RNG: That RNG’s generator attribute will be used as the generator for this RNG, i.e.
the same as RNG(other_rng.generator).

• If numpy.random.Generator: That generator will be wrapped.

• If numpy.random.BitGenerator: A numpy generator will be created (and wrapped
by this RNG) that contains the bit generator.

• If numpy.random.SeedSequence: A numpy generator will be created (and
wrapped by this RNG) that contains an SFC64 bit generator initialized with the given
SeedSequence.

• If numpy.random.RandomState: In numpy <=1.16, this RandomState will be
wrapped and used to sample random values. In numpy 1.17+, a seed will be derived from
this RandomState and a new numpy generator.Generator based on an SFC64
bit generator will be created and wrapped by this RNG.

Attributes

state Get the state of this RNG.

Methods

| advance_(self) | Advance the RNG’s internal state in-place by one step. |
| beta(self, a, b, [size]) | Call numpy.random.Generator.beta(). |

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<table>
<thead>
<tr>
<th>Method</th>
<th>Call</th>
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</thead>
<tbody>
<tr>
<td><code>binomial(self, n, p[, size])</code></td>
<td>Call <code>numpy.random.Generator.binomial()</code></td>
</tr>
<tr>
<td><code>bytes(self, length)</code></td>
<td>Call <code>numpy.random.Generator.bytes()</code></td>
</tr>
<tr>
<td><code>chisquare(self, df[, size])</code></td>
<td>Call <code>numpy.random.Generator.chisquare()</code></td>
</tr>
<tr>
<td><code>choice(self, a[, size, replace, p])</code></td>
<td>Call <code>numpy.random.Generator.choice()</code></td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a copy of this RNG.</td>
</tr>
<tr>
<td><code>copy_unless_global_rng(self)</code></td>
<td>Create a copy of this RNG unless it is the global RNG.</td>
</tr>
<tr>
<td><code>create_fully_random()</code></td>
<td>Create a new RNG, based on entropy provided from the OS.</td>
</tr>
<tr>
<td><code>create_pseudo_random_()</code></td>
<td>Create a new RNG in pseudo-random fashion.</td>
</tr>
<tr>
<td><code>derive_rng_(self)</code></td>
<td>Create a child RNG.</td>
</tr>
<tr>
<td><code>derive_rngs_(self, n)</code></td>
<td>Create n child RNGs.</td>
</tr>
<tr>
<td><code>dirichlet(self, alpha[, size])</code></td>
<td>Call <code>numpy.random.Generator.dirichlet()</code></td>
</tr>
<tr>
<td><code>duplicate(self, n)</code></td>
<td>Create a list containing n times this RNG.</td>
</tr>
<tr>
<td><code>equals(self, other)</code></td>
<td>Estimate whether this RNG and other have the same state.</td>
</tr>
<tr>
<td><code>equals_global_rng(self)</code></td>
<td>Estimate whether this RNG has the same state as the global RNG.</td>
</tr>
<tr>
<td><code>exponential(self[, scale, size])</code></td>
<td>Call <code>numpy.random.Generator.exponential()</code></td>
</tr>
<tr>
<td><code>f(self, dfnum, dfden[, size])</code></td>
<td>Call <code>numpy.random.Generator.f()</code></td>
</tr>
<tr>
<td><code>gamma(self, shape[, scale, size])</code></td>
<td>Call <code>numpy.random.Generator.gamma()</code></td>
</tr>
<tr>
<td><code>generate_seed_(self)</code></td>
<td>Sample a random seed.</td>
</tr>
<tr>
<td><code>generate_seeds_ (self, n)</code></td>
<td>Generate n random seed values.</td>
</tr>
<tr>
<td><code>geometric(self, p[, size])</code></td>
<td>Call <code>numpy.random.Generator.geometric()</code></td>
</tr>
<tr>
<td><code>gumbel(self[, loc, scale, size])</code></td>
<td>Call <code>numpy.random.Generator.gumbel()</code></td>
</tr>
<tr>
<td><code>hypergeometric(self, ngood, nbad, nsample[, ...])</code></td>
<td>Call <code>numpy.random.Generator.hypergeometric()</code></td>
</tr>
<tr>
<td><code>integers(self, low[, high, size, dtype,...])</code></td>
<td>Call <code>numpy.random.Generator.integers()</code> or <code>randint()</code></td>
</tr>
<tr>
<td><code>is_global_rng(self)</code></td>
<td>Estimate whether this RNG is identical to the global RNG.</td>
</tr>
<tr>
<td><code>laplace(self[, loc, scale, size])</code></td>
<td>Call <code>numpy.random.Generator.laplace()</code></td>
</tr>
<tr>
<td><code>logistic(self[, loc, scale, size])</code></td>
<td>Call <code>numpy.random.Generator.logistic()</code></td>
</tr>
<tr>
<td><code>lognormal(self[, mean, sigma, size])</code></td>
<td>Call <code>numpy.random.Generator.lognormal()</code></td>
</tr>
<tr>
<td><code>logseries(self, p[, size])</code></td>
<td>Call <code>numpy.random.Generator.logseries()</code></td>
</tr>
<tr>
<td><code>multinomial(self, n, pvals[, size])</code></td>
<td>Call <code>numpy.random.Generator.multinomial()</code></td>
</tr>
<tr>
<td><code>multivariate_normal(self, mean, cov[, size,...])</code></td>
<td>Call <code>numpy.random.Generator.multivariate_normal()</code></td>
</tr>
<tr>
<td><code>negative_binomial(self, n, p[, size])</code></td>
<td>Call <code>numpy.random.Generator.negative_binomial()</code></td>
</tr>
<tr>
<td><code>noncentral_chisquare(self, df, nonc[, size])</code></td>
<td>Call <code>numpy.random.Generator.noncentral_chisquare()</code></td>
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<thead>
<tr>
<th>Method</th>
<th>Call</th>
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<td><code>noncentral_f</code></td>
<td><code>numpy.random.Generator.noncentral_f()</code></td>
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<td><code>normal</code></td>
<td><code>numpy.random.Generator.normal()</code></td>
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<tr>
<td><code>pareto</code></td>
<td><code>numpy.random.Generator.pareto()</code></td>
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<td><code>permutation</code></td>
<td><code>numpy.random.Generator.permutation()</code></td>
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<td><code>poisson</code></td>
<td><code>numpy.random.Generator.poisson()</code></td>
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<td><code>power</code></td>
<td><code>numpy.random.Generator.power()</code></td>
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<tr>
<td><code>rand</code></td>
<td><code>numpy.random.RandomState.rand()</code></td>
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<tr>
<td><code>randint</code></td>
<td><code>numpy.random.RandomState.randint()</code></td>
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<tr>
<td><code>randn</code></td>
<td><code>numpy.random.RandomState.randn()</code></td>
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<tr>
<td><code>random</code></td>
<td>numpy’s random() or random_sample()</td>
</tr>
<tr>
<td><code>random_integers</code></td>
<td><code>numpy.random.RandomState.random_integers()</code></td>
</tr>
<tr>
<td><code>random_sample</code></td>
<td><code>numpy.random.RandomState.random_sample()</code></td>
</tr>
<tr>
<td><code>rayleigh</code></td>
<td><code>numpy.random.Generator.rayleigh()</code></td>
</tr>
<tr>
<td><code>reset_cache_</code></td>
<td>Reset all cache of this RNG.</td>
</tr>
<tr>
<td><code>set_state_</code></td>
<td>Set the state if the RNG in-place.</td>
</tr>
<tr>
<td><code>shuffle</code></td>
<td><code>numpy.random.Generator.shuffle()</code></td>
</tr>
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<td><code>standard_cauchy</code></td>
<td><code>numpy.random.Generator.standard_cauchy()</code></td>
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<td><code>standard_exponential</code></td>
<td><code>numpy.random.Generator.standard_exponential()</code></td>
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<td><code>standard_gamma</code></td>
<td><code>numpy.random.Generator.standard_gamma()</code></td>
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<td><code>standard_normal</code></td>
<td><code>numpy.random.Generator.standard_normal()</code></td>
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<td><code>standard_t</code></td>
<td><code>numpy.random.Generator.standard_t()</code></td>
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<td><code>tomaxint</code></td>
<td><code>numpy.random.RandomState.tomaxint()</code></td>
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<tr>
<td><code>triangular</code></td>
<td><code>numpy.random.Generator.triangular()</code></td>
</tr>
<tr>
<td><code>uniform</code></td>
<td><code>numpy.random.Generator.uniform()</code></td>
</tr>
<tr>
<td><code>use_state_of_</code></td>
<td>Copy and use (in-place) the state of another RNG.</td>
</tr>
<tr>
<td><code>vonmises</code></td>
<td><code>numpy.random.Generator.vonmises()</code></td>
</tr>
<tr>
<td><code>wald</code></td>
<td><code>numpy.random.Generator.wald()</code></td>
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<tr>
<td><code>weibull</code></td>
<td><code>numpy.random.Generator.weibull()</code></td>
</tr>
<tr>
<td><code>zipf</code></td>
<td><code>numpy.random.Generator.zipf()</code></td>
</tr>
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</table>

`advance_(self)`

Advance the RNG’s internal state in-place by one step.
This advances the underlying generator’s state.

**Note:** This simply samples one or more random values. This means that a call of this method will not completely change the outputs of the next called sampling method. To achieve more drastic output changes, call `derive_rng_()`.

**Returns** The RNG itself.

**Return type** `RNG`

```
beta (self, a, b, size=None)
Call numpy.random.Generator.beta().
```

```
binomial (self, n, p, size=None)
Call numpy.random.Generator.binomial().
```

```
bytes (self, length)
Call numpy.random.Generator.bytes().
```

```
chisquare (self, df, size=None)
Call numpy.random.Generator.chisquare().
```

```
choice (self, a, size=None, replace=True, p=None)
Call numpy.random.Generator.choice().
```

```
copy (self)
Create a copy of this RNG.

Returns Copy of this RNG. The copy will produce the same random samples.

Return type `RNG`
```

```
copy_unless_global_rng (self)
Create a copy of this RNG unless it is the global RNG.

Returns Copy of this RNG unless it is the global RNG. In the latter case the RNG instance itself will be returned without any changes.

Return type `RNG`
```

```
classmethod create_fully_random ()
Create a new RNG, based on entropy provided from the OS.

Returns A new RNG. It is not derived from any other previously created RNG, nor does it depend on the seeding of imgaug or numpy.

Return type `RNG`
```

```
classmethod create_pseudo_random ()
Create a new RNG in pseudo-random fashion.

A seed will be sampled from the current global RNG and used to initialize the new RNG.

This advances the global RNG’s state.

Returns A new RNG, derived from the current global RNG.

Return type `RNG`
```

```
derive_rng_ (self)
Create a child RNG.

This advances the underlying generator’s state.
```
Returns A child RNG.

Return type RNG

derive_rngs_(self, n)
Create n child RNGs.

This advances the underlying generator’s state.

Parameters n (int) – Number of child RNGs to derive.

Returns Child RNGs.

Return type list of RNG

dirichlet (self, alpha, size=None)
Call numpy.random.Generator.dirichlet().

duplicate (self, n)
Create a list containing n times this RNG.

This method was mainly introduced as a replacement for previous calls of derive_rngs_(). These calls turned out to be very slow in numpy 1.17+ and were hence replaced by simple duplication (except for the cases where child RNGs absolutely had to be created). This RNG duplication method doesn’t help very much against code repetition, but it does mark the points where it would be desirable to create child RNGs for various reasons. Once deriving child RNGs is somehow sped up in the future, these calls can again be easily found and replaced.

Parameters n (int) – Length of the output list.

Returns List containing n times this RNG (same instances, no copies).

Return type list of RNG

equals (self, other)
Estimate whether this RNG and other have the same state.

Returns True if this RNG’s generator and the generator of other have equal internal states. False otherwise.

Return type bool

equals_global_rng (self)
Estimate whether this RNG has the same state as the global RNG.

Returns True is this RNG has the same state as the global RNG, i.e. it will lead to the same sampled values given the same sampling method calls. The RNGs don’t have to be identical object instances, which protects against e.g. copy effects. False otherwise.

Return type bool

exponential (self, scale=1.0, size=None)
Call numpy.random.Generator.exponential().

f (self, dfnum, dfden, size=None)
Call numpy.random.Generator.f().

gamma (self, shape, scale=1.0, size=None)
Call numpy.random.Generator.gamma().

generate_seed_ (self)
Sample a random seed.

This advances the underlying generator’s state.

See SEED_MIN_VALUE and SEED_MAX_VALUE for the seed’s value range.
Returns The sampled seed.

Return type int

generate_seeds_(self, n)
Generate n random seed values.
This advances the underlying generator’s state.
See SEED_MIN_VALUE and SEED_MAX_VALUE for the seed’s value range.

Parameters n (int) – Number of seeds to sample.

Returns 1D-array of int32 seeds.

Return type ndarray

generates (self, p, size=None)
Call numpy.random.Generator.geometric().

gumbel (self, loc=0.0, scale=1.0, size=None)
Call numpy.random.Generator.gumbel().

hypergeometric (self, ngood, nbad, nsample, size=None)
Call numpy.random.Generator.hypergeometric().

integers (self, low, high=None, size=None, dtype='int32', endpoint=False)
Call numpy’s integers() or randint().

Note: Changed dtype argument default value from numpy’s int64 to int32.

is_global_rng (self)
Estimate whether this RNG is identical to the global RNG.

Returns True is this RNG’s underlying generator is identical to the global RNG’s underlying generator. The RNGs themselves may be different, only the wrapped generator matters. False otherwise.

Return type bool

laplace (self, loc=0.0, scale=1.0, size=None)
Call numpy.random.Generator.laplace().

logistic (self, loc=0.0, scale=1.0, size=None)
Call numpy.random.Generator.logistic().

lognormal (self, mean=0.0, sigma=1.0, size=None)
Call numpy.random.Generator.lognormal().

logseries (self, p, size=None)
Call numpy.random.Generator.logseries().

multinomial (self, n, pvals, size=None)
Call numpy.random.Generator.multinomial().

multivariate_normal (self, mean, cov, size=None, check_valid='warn', tol=1e-08)
Call numpy.random.Generator.multivariate_normal().

negative_binomial (self, n, p, size=None)
Call numpy.random.Generator.negative_binomial().

noncentral_chisquare (self, df, nonc, size=None)
Call numpy.random.Generator.noncentral_chisquare().
noncentral_f (self, dfnum, dfden, nonc, size=None)
   Call numpy.random.Generator.noncentral_f().

normal (self, loc=0.0, scale=1.0, size=None)
   Call numpy.random.Generator.normal().

pareto (self, a, size=None)
   Call numpy.random.Generator.pareto().

permutation (self, x)
   Call numpy.random.Generator.permutation().

poisson (self, lam=1.0, size=None)
   Call numpy.random.Generator.poisson().

power (self, a, size=None)
   Call numpy.random.Generator.power().

rand (self, *args)
   Call numpy.random.RandomState.rand().

   Warning: This method is outdated in numpy. Use RNG.random() instead.

   Added in 0.4.0.

randint (self, low, high=None, size=None, dtype='int32')
   Call numpy.random.RandomState.randint().

   Note: Changed dtype argument default value from numpy’s I to int32.

   Warning: This method is outdated in numpy. Use RNG.integers() instead.

   Added in 0.4.0.

randn (self, *args)
   Call numpy.random.RandomState.randn().

   Warning: This method is outdated in numpy. Use RNG.standard_normal() instead.

   Added in 0.4.0.

random (self, size, dtype='float32', out=None)
   Call numpy’s random() or random_sample().

   Note: Changed dtype argument default value from numpy’s d to float32.

random_integers (self, low, high=None, size=None)
   Call numpy.random.RandomState.random_integers().
random_sample (self, size)
Call numpy.random.RandomState.random_sample().

Warning: This method is outdated in numpy. Use **RNG.integers()** instead.

Added in 0.4.0.

rayleigh (self, scale=1.0, size=None)
Call numpy.random.Generator.rayleigh().

reset_cache_(self)
Reset all cache of this RNG.

Returns The RNG itself.

Return type **RNG**

set_state_(self, value)
Set the state if the RNG in-place.

Parameters value (tuple or dict) – The new state of the RNG. Should correspond to the output of the **state** property.

Returns The RNG itself.

Return type **RNG**

shuffle (self, x)
Call numpy.random.Generator.shuffle().

standard_cauchy (self, size=None)
Call numpy.random.Generator.standard_cauchy().

standard_exponential (self, size=None, dtype='float32', method='zig', out=None)
Call numpy.random.Generator.standard_exponential().

Note: Changed **dtype** argument default value from numpy’s **d** to **float32**.

standard_gamma (self, shape, size=None, dtype='float32', out=None)
Call numpy.random.Generator.standard_gamma().

Note: Changed **dtype** argument default value from numpy’s **d** to **float32**.

standard_normal (self, size=None, dtype='float32', out=None)
Call numpy.random.Generator.standard_normal().

Note: Changed **dtype** argument default value from numpy’s **d** to **float32**.

standard_t (self, df, size=None)
Call numpy.random.Generator.standard_t().

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state
Get the state of this RNG.

Returns The state of the RNG. In numpy 1.17+, the bit generator’s state will be returned. In
numpy <=1.16, the RandomState’s state is returned. In both cases the state is a copy.
In-place changes will not affect the RNG.

Return type tuple or dict
tomaxint (self, size=None)
Call numpy.random.RandomState.tomaxint().

Warning: This method is outdated in numpy. Use RNG.integers() instead.

Added in 0.4.0.
triangular (self, left, mode, right, size=None)
Call numpy.random.Generator.triangular().
uniform (self, low=0.0, high=1.0, size=None)
Call numpy.random.Generator.uniform().

use_state_of_ (self, other)
Copy and use (in-place) the state of another RNG.

Note: It is often sensible to first verify that neither this RNG nor other are identical to the global RNG.

Parameters other (RNG) – The other RNG, which’s state will be copied.

Returns The RNG itself.

Return type RNG
vonmises (self, mu, kappa, size=None)
Call numpy.random.Generator.vonmises().
wald (self, mean, scale, size=None)
Call numpy.random.Generator.wald().
weibull (self, a, size=None)
Call numpy.random.Generator.weibull().
zipf (self, a, size=None)
Call numpy.random.Generator.zipf().

imgaug.random.advance_generator_ (generator)
Advance a numpy random generator’s internal state in-place by one step.
This advances the generator’s state.

Note: This simply samples one or more random values. This means that a call of this method will not com-
pletely change the outputs of the next called sampling method. To achieve more drastic output changes, call
derive_generator_().

Parameters generator (numpy.random.Generator or numpy.random.RandomState) – Generator of
which to advance the internal state.
imgaug.random.convert_seed_sequence_to_generator(seed_sequence)
Convert a seed sequence to a numpy (random number) generator.

Parameters seed_sequence (numpy.random.SeedSequence) – The seed value to use.

Returns Generator initialized with the provided seed sequence.

Return type numpy.random.Generator

imgaug.random.convert_seed_to_generator(entropy)
Convert a seed value to a numpy (random number) generator.

Parameters entropy (int) – The seed value to use.

Returns In numpy <=1.16 a RandomState, in 1.17+a Generator. Both are initialized with the provided seed.

Return type numpy.random.Generator or numpy.random.RandomState

imgaug.random.copy_generator(generator)
Copy an existing numpy (random number) generator.

Parameters generator (numpy.random.Generator or numpy.random.RandomState) – The generator to copy.

Returns In numpy <=1.16 a RandomState, in 1.17+a Generator. Both are copies of the input argument.

Return type numpy.random.Generator or numpy.random.RandomState

imgaug.random.copy_generator_unless_global_generator(generator)
Copy a numpy generator unless it is the current global generator.
“global generator” here denotes the generator contained in the global RNG’s .generator attribute.

Parameters generator (numpy.random.Generator or numpy.random.RandomState) – The generator to copy.

Returns In numpy <=1.16 a RandomState, in 1.17+a Generator. Both are copies of the input argument, unless that input is identical to the global generator. If it is identical, the instance itself will be returned without copying it.

Return type numpy.random.Generator or numpy.random.RandomState

imgaug.random.create_fully_random_generator()
Create a new numpy (random) generator, derived from OS’s entropy.

Returns In numpy <=1.16 a RandomState, in 1.17+a Generator. Both are initialized with entropy requested from the OS. They are hence independent of entered seeds or the library’s global RNG.

Return type numpy.random.Generator or numpy.random.RandomState

imgaug.random.create_pseudo_random_generator()
Create a new numpy (random) generator, derived from the global RNG.

This function advances the global RNG’s state.

Returns In numpy <=1.16 a RandomState, in 1.17+a Generator. Both are initialized with a seed sampled from the global RNG.

Return type numpy.random.Generator or numpy.random.RandomState

imgaug.random.derive_generator_(generator)
Create a child numpy (random number) generator from an existing one.
This advances the generator’s state.

**Parameters**

- **generator** (numpy.random.Generator or numpy.random.RandomState) – The generator from which to derive a new child generator.

**Returns**

In numpy <=1.16 a RandomState, in 1.17+ a Generator. In both cases a derived child generator.

**Return type**

numpy.random.Generator or numpy.random.RandomState

---

**imgaug.random.derive_generators_(generator, n)**

Create child numpy (random number) generators from an existing one.

**Parameters**

- **generator** (numpy.random.Generator or numpy.random.RandomState) – The generator from which to derive new child generators.

- **n** (int) – Number of child generators to derive.

**Returns**

In numpy <=1.16 a list of RandomState s, in 1.17+ a list of Generator s. In both cases lists of derived child generators.

**Return type**

list of numpy.random.Generator or list of numpy.random.RandomState

---

**imgaug.random.generate_seed_(generator)**

Sample a seed from the provided generator.

This function advances the generator’s state.

See **SEED_MIN_VALUE** and **SEED_MAX_VALUE** for the seed’s value range.

**Parameters**

- **generator** (numpy.random.Generator or numpy.random.RandomState) – The generator from which to sample the seed.

**Returns**

The sampled seed.

**Return type**

int

---

**imgaug.random.generate_seeds_(generator, n)**

Sample n seeds from the provided generator.

This function advances the generator’s state.

**Parameters**

- **generator** (numpy.random.Generator or numpy.random.RandomState) – The generator from which to sample the seed.

- **n** (int) – Number of seeds to sample.

**Returns**

1D-array of int32 seeds.

**Return type**

ndarray

---

**imgaug.random.get_generator_state(generator)**

Get the state of this provided generator.

**Parameters**

- **generator** (numpy.random.Generator or numpy.random.RandomState) – The generator, which’s state is supposed to be extracted.

**Returns**

The state of the generator. In numpy 1.17+, the bit generator’s state will be returned. In numpy <=1.16, the RandomState’s state is returned. In both cases the state is a copy. In-place changes will not affect the RNG.

**Return type**

tuple or dict
`imgaug.random.get_global_rng()`  
Get or create the current global RNG of imgaug.

Note that the first call to this function will create a global RNG.

**Returns**  The global RNG to use.

**Return type**  `RNG`

`imgaug.random.is_generator_equal_to(generator, other_generator)`  
Estimate whether two generator have the same class and state.

**Parameters**

- `generator`  *(numpy.random.Generator or numpy.random.RandomState)* – First generator used in the comparison.

- `other_generator`  *(numpy.random.Generator or numpy.random.RandomState)* – Second generator used in the comparison.

**Returns**  True if `generator`’s class and state are the same as the class and state of `other_generator`. False otherwise.

**Return type**  `bool`

`imgaug.random.normalize_generator(generator)`  
Normalize various inputs to a numpy (random number) generator.

This function will first copy the provided argument, i.e. it never returns a provided instance itself.

**Parameters**  `generator`  *(None or int or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState)* – The numpy random number generator to normalize. In case of numpy version 1.17 or later, this shouldn’t be a RandomState as that class is outdated. Behaviour for different datatypes:

- If `None`: The global RNG’s generator is returned.

- If `int`: In numpy 1.17+, the value is used as a seed for a Generator, i.e. it will be provided as the entropy to a SeedSequence, which will then be used for an SFC64 bit generator and wrapped by a Generator, which is then returned. In numpy <=1.16, the value is used as a seed for a RandomState, which will then be returned.

- If `numpy.random.Generator`: That generator will be returned.

- If `numpy.random.BitGenerator`: A numpy generator will be created and returned that contains the bit generator.

- If `numpy.random.SeedSequence`: A numpy generator will be created and returned that contains an SFC64 bit generator initialized with the given SeedSequence.

- If `numpy.random.RandomState`: In numpy <=1.16, this RandomState will be returned. In numpy 1.17+, a seed will be derived from this RandomState and a new numpy.generator.Generator based on an SFC64 bit generator will be created and returned.

**Returns**  In numpy <=1.16 a RandomState, in 1.17+ a Generator (even if the input was a RandomState).

**Return type**  `numpy.random.Generator or numpy.random.RandomState`

`imgaug.random.normalize_generator_(generator)`  
Normalize in-place various inputs to a numpy (random number) generator.

This function will try to return the provided instance itself.
Parameters generator (None or int or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState) – See normalize_generator().

Returns In numpy <=1.16 a RandomState, in 1.17+ a Generator (even if the input was a RandomState).

Return type numpy.random.Generator or numpy.random.RandomState

imgaug.random.polyfill_integers (generator, low, high=None, size=None, dtype='int32', endpoint=False)

Sample integers from a generator in different numpy versions.

Parameters

- generator (numpy.random.Generator or numpy.random.RandomState) – The generator to sample from. If it is a RandomState, numpy.random.RandomState.randint() will be called, otherwise numpy.random.Generator.integers().
- low (int or array-like of ints) – See numpy.random.Generator.integers().
- high (int or array-like of ints, optional) – See numpy.random.Generator.integers().
- size (int or tuple of ints, optional) – See numpy.random.Generator.integers().
- dtype ({str, dtype}, optional) – See numpy.random.Generator.integers().
- endpoint (bool, optional) – See numpy.random.Generator.integers().

Returns See numpy.random.Generator.integers().

Return type int or ndarray of ints

imgaug.random.polyfill_random (generator, size, dtype='float32', out=None)

Sample random floats from a generator in different numpy versions.

Parameters

- generator (numpy.random.Generator or numpy.random.RandomState) – The generator to sample from. Both RandomState and Generator support random(), but with different interfaces.
- size (int or tuple of ints, optional) – See numpy.random.Generator.random().
- dtype ({str, dtype}, optional) – See numpy.random.Generator.random().
- out (ndarray, optional) – See numpy.random.Generator.random().

Returns See numpy.random.Generator.random().

Return type float or ndarray of floats

imgaug.random.reset_generator_cache_ (generator)

Reset a numpy (random number) generator’s internal cache.

This function modifies the generator’s state in-place.

Parameters generator (numpy.random.Generator or numpy.random.RandomState) – The generator of which to reset the cache.

Returns In numpy <=1.16 a RandomState, in 1.17+ a Generator. In both cases the input argument itself.

Return type numpy.random.Generator or numpy.random.RandomState
```python
imgaug.random.seed(entropy)
Set the seed of imgaug’s global RNG (in-place).

The global RNG controls most of the “randomness” in imgaug.

The global RNG is the default one used by all augmenters. Under special circumstances (e.g. when an augmenter
is switched to deterministic mode), the global RNG is replaced with a local one. The state of that replacement
may be dependent on the global RNG’s state at the time of creating the child RNG.

Parameters

- entropy (int) – The seed value to use.

imgaug.random.set_generator_state_(generator, state)
Set the state of a numpy (random number) generator in-place.

Parameters

- generator (numpy.random.Generator or numpy.random.RandomState) – The generator,
  which’s state is supposed to be modified.
- state (tuple or dict) – The new state of the generator. Should correspond to the output of
generate_generator_state().

imgaug.random.supports_new_numpy_rng_style()
Determine whether numpy supports the new random interface (v1.17+).

Returns True if the new random interface is supported by numpy, i.e. if numpy has version
1.17 or later. Otherwise False, i.e. numpy has version 1.16 or older and numpy.random.
RandomState should be used instead.

Return type  bool

class imgaug.random.temporary_numpy_seed(entropy=None)
Context to temporarily alter the random state of numpy.random.

The random state’s internal state will be set back to the original one once the context finishes.

Added in 0.4.0.

Parameters

- entropy (None or int) – The seed value to use. If None then the seed will not be altered
  and the internal state of numpy.random will not be reset back upon context exit (i.e. this
  context will do nothing).

13.6 imgaug.validation

Helper functions to validate input data and produce error messages.

imgaug.validation.assert_is_iterable_of(iterable_var, classes)
Assert that iterable_var only contains instances of given classes.

Parameters

- iterable_var (iterable) – See is_iterable_of().
- classes (type or iterable of type) – See is_iterable_of().

imgaug.validation.convert_iterable_to_string_of_types(iterable_var)
Convert an iterable of values to a string of their types.

Parameters

- iterable_var (iterable) – An iterable of variables, e.g. a list of integers.
```
**Returns**  String representation of the types in `iterable_var`. One per item in `iterable_var`. Separated by commas.

**Return type**  str

`imgaug.validation.is_iterable_of(iterable_var, classes)`

Check whether `iterable_var` contains only instances of given classes.

**Parameters**

- `iterable_var (iterable)` – An iterable of items that will be matched against `classes`.
- `classes (type or iterable of type)` – One or more classes that each item in `var` must be an instance of. If this is an iterable, a single match per item is enough.

**Returns**  Whether `var` only contains instances of `classes`. If `var` was empty, True will be returned.

**Return type**  bool

### 13.7 imgaug.augmentables.base

Interfaces used by augmentable objects.

Added in 0.4.0.

```python
class imgaug.augmentables.base.IAugmentable
    Bases: object

    Interface of augmentable objects.

    This interface is right now only used to “mark” augmentable objects. It does not enforce any methods yet (but will probably in the future).

    Currently, only *OnImage classes are marked as augmentable. Non-OnImage objects are normalized to OnImage-objects. Batches are not yet marked as augmentable, but might be in the future.

    Added in 0.4.0.
```

### 13.8 imgaug.augmentables.batches

Classes representing batches of normalized or unnormalized data.

```python
class imgaug.augmentables.batches.Batch(images=None, heatmaps=None, segmentation_maps=None, keypoints=None, bounding_boxes=None, polygons=None, line_strings=None, data=None)
    Bases: object

    Class encapsulating a batch before and after augmentation.

    **Parameters**

    - `images (None or (N,H,W,C) ndarray or list of (H,W,C) ndarray)` – The images to augment.
    - `heatmaps (None or list of imgaug.augmentables.heatmaps.HeatmapsOnImage)` – The heatmaps to augment.
    - `segmentation_maps (None or list of imgaug.augmentables.segmaps.SegmentationMapsOnImage)` – The segmentation maps to augment.
```
• keypoints (None or list of imgaug.augmentables.kps.KeypointOnImage) – The keypoints to augment.

• bounding_boxes (None or list of imgaug.augmentables.bbs.BoundingBoxesOnImage) – The bounding boxes to augment.

• polygons (None or list of imgaug.augmentables.polys.PolygonsOnImage) – The polygons to augment.

• line_strings (None or list of imgaug.augmentables.lines.LineStringsOnImage) – The line strings to augment.

• data – Additional data that is saved in the batch and may be read out after augmentation. This could e.g. contain filepaths to each image in images. As this object is usually used for background augmentation with multiple processes, the augmented Batch objects might not be returned in the original order, making this information useful.

Attributes

bounding_boxes Deprecated. Use Batch.bounding_boxes_unaug instead.

heatmaps Deprecated. Use Batch.heatmaps_unaug instead.

images Deprecated. Use Batch.images_unaug instead.

keypoints Deprecated. Use Batch.keypoints_unaug instead.

segmentation_maps Deprecated. Use Batch.segmentation_maps_unaug instead.

Methods

decopy (self[, images_unaug, images_aug, ...]) Copy this batch and all of its column values.

fill_from_batch_in_augmentation_(self, ...) Set the columns in this batch to the column values of another batch.

get_column_names (self) Get the names of types of augmentables that contain data.

to_batch_in_augmentation (self) Convert this batch to a _BatchInAugmentation instance.

to_normalized_batch (self) Return this batch.

bounding_boxes

Deprecated. Use Batch.bounding_boxes_unaug instead.

Get unaugmented bounding boxes.

decopy (self, images_unaug='DEFAULT', images_aug='DEFAULT', heatmaps_unaug='DEFAULT', heatmaps_aug='DEFAULT', segmentation_maps_unaug='DEFAULT', segmentation_maps_aug='DEFAULT', keypoints_unaug='DEFAULT', keypoints_aug='DEFAULT', bounding_boxes_unaug='DEFAULT', bounding_boxes_aug='DEFAULT', polygons_unaug='DEFAULT', polygons_aug='DEFAULT', line_strings_unaug='DEFAULT', line_strings_aug='DEFAULT') Copy this batch and all of its column values.

Parameters

• images_unaug (imgaug.augmentables.batches.DEFAULT or None or (N,H,W,C) ndarray or list of (H,W,C) ndarray) – Copies the current attribute value without changes if set
to imgaug.augmentables.batches.DEFAULT. Otherwise same as in Batch.__init__().

- **images_aug** (imgaug.augmentables.batches.DEFAULT or None or \((N,H,W,C)\) ndarray or list of \((H,W,C)\) ndarray) – Copies the current attribute value without changes if set to imgaug.augmentables.batches.DEFAULT. Otherwise same as in Batch.__init__().

- **heatmaps_unaug** (imgaug.augmentables.batches.DEFAULT or None or list of imgaug.augmentables.heatmaps.HeatmapsOnImage) – Copies the current attribute value without changes if set to imgaug.augmentables.batches.DEFAULT. Otherwise same as in Batch.__init__().

- **heatmaps_aug** (imgaug.augmentables.batches.DEFAULT or None or list of imgaug.augmentables.heatmaps.HeatmapsOnImage) – Copies the current attribute value without changes if set to imgaug.augmentables.batches.DEFAULT. Otherwise same as in Batch.__init__().

- **segmentation_maps_unaug** (imgaug.augmentables.batches.DEFAULT or None or list of imgaug.augmentables.segmaps.SegmentationMapsOnImage) – Copies the current attribute value without changes if set to imgaug.augmentables.batches.DEFAULT. Otherwise same as in Batch.__init__().

- **segmentation_maps_aug** (imgaug.augmentables.batches.DEFAULT or None or list of imgaug.augmentables.segmaps.SegmentationMapsOnImage) – Copies the current attribute value without changes if set to imgaug.augmentables.batches.DEFAULT. Otherwise same as in Batch.__init__().

- **keypoints_unaug** (imgaug.augmentables.batches.DEFAULT or None or list of imgaug.augmentables.kps.KeypointOnImage) – Copies the current attribute value without changes if set to imgaug.augmentables.batches.DEFAULT. Otherwise same as in Batch.__init__().

- **keypoints_aug** (imgaug.augmentables.batches.DEFAULT or None or list of imgaug.augmentables.kps.KeypointOnImage) – Copies the current attribute value without changes if set to imgaug.augmentables.batches.DEFAULT. Otherwise same as in Batch.__init__().

- **bounding_boxes_unaug** (imgaug.augmentables.batches.DEFAULT or None or list of imgaug.augmentables.bbs.BoundingBoxesOnImage) – Copies the current attribute value without changes if set to imgaug.augmentables.batches.DEFAULT. Otherwise same as in Batch.__init__().

- **bounding_boxes_aug** (imgaug.augmentables.batches.DEFAULT or None or list of imgaug.augmentables.bbs.BoundingBoxesOnImage) – Copies the current attribute value without changes if set to imgaug.augmentables.batches.DEFAULT. Otherwise same as in Batch.__init__().

- **polygons_unaug** (imgaug.augmentables.batches.DEFAULT or None or list of imgaug.augmentables.polys.PolygonsOnImage) – Copies the current attribute value without changes if set to imgaug.augmentables.batches.DEFAULT. Otherwise same as in Batch.__init__().

- **polygons_aug** (imgaug.augmentables.batches.DEFAULT or None or list of imgaug.augmentables.polys.PolygonsOnImage) – Copies the current attribute value without changes if set to imgaug.augmentables.batches.DEFAULT. Otherwise same as in Batch.__init__().

- **line_strings_unaug** (imgaug.augmentables.batches.DEFAULT or None or list of imgaug.augmentables.lines.LineStringsOnImage) – Copies the current attribute value with-
out changes if set to `imgaug.augmentables.batches.DEFAULT`. Otherwise same as in `Batch.__init__()`.

* `line_strings_aug` *(imgaug.augmentables.batches.DEFAULT or None or list of imgaug.augmentables.lines.LineStringsOnImage)* – Copies the current attribute value without changes if set to `imgaug.augmentables.batches.DEFAULT`. Otherwise same as in `Batch.__init__()`.

Returns Deep copy of the batch, optionally with new attributes.

Return type `Batch`

**fill_from_batch_in_augmentation** *(self, batch_in_augmentation)*

Set the columns in this batch to the column values of another batch.

This method works in-place.

Added in 0.4.0.

Parameters `batch_in_augmentation` *(BatchInAugmentation)* – Batch of which to use the column values. The values are *not* copied. Only their references are used.

Returns The updated batch. (Modified in-place.)

Return type `Batch`

**get_column_names** *(self)*

Get the names of types of augmentables that contain data.

This method is intended for situations where one wants to know which data is contained in the batch that has to be augmented, visualized or something similar.

Added in 0.4.0.

Returns Names of types of augmentables. E.g. `"images", "polygons"`.

Return type list of str

**heatmaps**

Deprecated. Use `Batch.heatmaps_unaug` instead.

Get unaugmented heatmaps.

**images**

Deprecated. Use `Batch.images_unaug` instead.

Get unaugmented images.

**keypoints**

Deprecated. Use `Batch.keypoints_unaug` instead.

Get unaugmented keypoints.

**segmentation_maps**

Deprecated. Use `Batch.segmentation_maps_unaug` instead.

Get unaugmented segmentation maps.

**to_batch_in_augmentation** *(self)*

Convert this batch to a `BatchInAugmentation` instance.

Added in 0.4.0.

Returns The converted batch.

Return type `imgaug.augmentables.batches.BatchInAugmentation`
to_normalized_batch(self)
    Return this batch.

    This method does nothing and only exists to simplify interfaces that accept both UnnormalizedBatch and Batch.

    Added in 0.4.0.

    Returns: This batch (not copied).

    Return type: imgaug.augmentables.batches.Batch

class imgaug.augmentables.batches.UnnormalizedBatch(images=None, heatmaps=None, segmentation_maps=None, keypoints=None, bounding_boxes=None, polygons=None, line_strings=None, data=None)

Bases: object

Class for batches of unnormalized data before and after augmentation.

Parameters:

- **images** (None or (N,H,W,C) ndarray or (N,H,W) ndarray or iterable of (H,W,C) ndarray or iterable of (H,W) ndarray) – The images to augment.

- **heatmaps** (None or (N,H,W,C) ndarray or imgaug.augmentables.heatmaps.HeatmapsOnImage or iterable of (H,W,C) ndarray or iterable of imgaug.augmentables.heatmaps.HeatmapsOnImage) – The heatmaps to augment. If anything else than HeatmapsOnImage, then the number of heatmaps must match the number of images provided via parameter images. The number is contained either in N or the first iterable’s size.

- **segmentation_maps** (None or (N,H,W) ndarray or imgaug.augmentables.segmaps.SegmentationMapsOnImage or iterable of (H,W) ndarray or iterable of imgaug.augmentables.segmaps.SegmentationMapsOnImage) – The segmentation maps to augment. If anything else than SegmentationMapsOnImage, then the number of segmaps must match the number of images provided via parameter images. The number is contained either in N or the first iterable’s size.

- **keypoints** (None or list of (N,K,2) ndarray or tuple of number or imgaug.augmentables.kps.Keypoint or iterable of (K,2) ndarray or iterable of tuple of number or iterable of imgaug.augmentables.kps.Keypoint or iterable of imgaug.augmentables.kps.KeypointOnImage or iterable of iterable of tuple of number or iterable of iterable of imgaug.augmentables.kps.Keypoint) – The keypoints to augment. If a tuple (or iterable(s) of tuple), then interpreted as (x,y) coordinates and must hence contain two numbers. A single tuple represents a single coordinate on one image, an iterable of tuples the coordinates on one image and an iterable of iterable of tuples the coordinates on several images. Analogous if Keypoint objects are used instead of tuples. If an ndarray, then N denotes the number of images and K the number of keypoints on each image. If anything else than KeypointsOnImage is provided, then the number of keypoint groups must match the number of images provided via parameter images. The number is contained e.g. in N or in case of “iterable of iterable of tuples” in the first iterable’s size.

- **bounding_boxes** (None or (N,B,4) ndarray or tuple of number or imgaug.augmentables.bbs.BoundingBox or imgaug.augmentables.bbs.BoundingBoxesOnImage or iterable of (B,4) ndarray or iterable of iterable of tuple of number or iterable of iterable of imgaug.augmentables.bbs.BoundingBox or iterable of iterable of imgaug.augmentables.bbs.BoundingBoxesOnImage or iterable of iterable of iterable of number) – The bounding boxes to augment. If a tuple (or iterable(s) of tuple), then interpreted as (x,y,w,h) coordinates and must hence contain four numbers. A single tuple represents a single coordinate on one image, an iterable of tuples the coordinates on one image and an iterable of iterable of tuples the coordinates on several images. Analogous if BoundingBox objects are used instead of tuples. If an iterable of tuple, then interpreted as (x,y,w,h) coordinates and must hence contain four numbers. A single tuple represents a single coordinate on one image, an iterable of tuples the coordinates on one image and an iterable of iterable of tuples the coordinates on several images. Analogous if BoundingBox objects are used instead of tuples. If an ndarray, then N denotes the number of images and B the number of bounding boxes on each image. If anything else than BoundingBoxesOnImage is provided, then the number of bounding box groups must match the number of images provided via parameter images. The number is contained e.g. in N or in case of “iterable of iterable of tuples” in the first iterable’s size.
The bounding boxes to augment. This is analogous to the keypoints parameter. However, each tuple – and also the last index in case of arrays – has size 4, denoting the bounding box coordinates $x_1$, $y_1$, $x_2$ and $y_2$.

- **polygons** (None or $(N,\#\text{polys},\#\text{points},2)$ ndarray or imgaug.augmentables.polys.Polygon or imgaug.augmentables.polys.PolygonsOnImage or iterable of $(\#\text{polys},\#\text{points},2)$ ndarray or iterable of tuple of number or iterable of imgaug.augmentables.kps.Keypoint or iterable of iterable of imgaug.augmentables.polys.Polygon or iterable of iterable of imgaug.augmentables.polys.PolygonsOnImage or iterable of iterable of $(\#\text{points},2)$ ndarray or iterable of iterable of tuple of number or iterable of iterable of imgaug.augmentables.kps.Keypoint or iterable of iterable of iterable of number or iterable of iterable of iterable of tuple of imgaug.augmentables.kps.Keypoint) – The polygons to augment. This is similar to the keypoints parameter. However, each polygon may be made up of several $(x, y)$ coordinates (three or more are required for valid polygons). The following datatypes will be interpreted as a single polygon on a single image:
  - imgaug.augmentables.polys.Polygon
  - iterable of tuple of number
  - iterable of imgaug.augmentables.kps.Keypoint

The following datatypes will be interpreted as multiple polygons on a single image:
  - imgaug.augmentables.polys.PolygonsOnImage
  - iterable of imgaug.augmentables.polys.Polygon
  - iterable of iterable of tuple of number
  - iterable of iterable of imgaug.augmentables.kps.Keypoint
  - iterable of iterable of iterable of imgaug.augmentables.polys.Polygon

The following datatypes will be interpreted as multiple polygons on multiple images:
  - $(N,\#\text{polys},\#\text{points},2)$ ndarray
  - iterable of $(\#\text{polys},\#\text{points},2)$ ndarray
  - iterable of iterable of $(\#\text{points},2)$ ndarray
  - iterable of iterable of iterable of tuple of number
  - iterable of iterable of iterable of tuple of imgaug.augmentables.kps.Keypoint

- **line_strings** (None or $(N,\#\text{lines},\#\text{points},2)$ ndarray or imgaug.augmentables.lines.LineString or imgaug.augmentables.lines.LineStringOnImage or iterable of $(\#\text{lines},\#\text{points},2)$ ndarray or iterable of tuple of number or iterable of imgaug.augmentables.kps.Keypoint or iterable of iterable of imgaug.augmentables.lines.LineString or iterable of iterable of imgaug.augmentables.lines.LineStringOnImage or iterable of iterable of $(\#\text{points},2)$ ndarray or iterable of iterable of tuple of number or iterable of iterable of imgaug.augmentables.kps.Keypoint or iterable of iterable of iterable of imgaug.augmentables.polys.LineString or iterable of iterable of iterable of tuple of number or iterable of iterable of iterable of tuple of imgaug.augmentables.kps.Keypoint) – The line strings to augment. See polygons for more details as polygons follow a similar structure to line strings.
- **data** – Additional data that is saved in the batch and may be read out after augmentation. This could e.g. contain filepaths to each image in `images`. As this object is usually used for background augmentation with multiple processes, the augmented Batch objects might not be returned in the original order, making this information useful.

### Methods

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<tr>
<th>Method</th>
<th>Description</th>
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<tr>
<td><code>fill_from_augmented_normalized_batch(self, batch_aug_norm)</code></td>
<td>Fill this batch with (normalized) augmentation results. This method receives a (normalized) Batch instance, takes all <code>_aug</code> attributes out if it and assigns them to this batch in unnormalized form. Hence, the datatypes of all <code>_aug</code> attributes will match the datatypes of the <code>_unaug</code> attributes. <strong>Parameters</strong> <code>batch_aug_norm</code> (imgaug.augmentables.batches.Batch) – Batch after normalization and augmentation. <strong>Returns</strong> New UnnormalizedBatch instance. All <code>_unaug</code> attributes are taken from the old UnnormalizedBatch (without deepcopying them) and all <code>_aug</code> attributes are taken from <code>batch_normalized</code>, converted to unnormalized form. <strong>Return type</strong> imgaug.augmentables.batches.UnnormalizedBatch</td>
</tr>
<tr>
<td><code>fill_from_augmented_normalized_batch_(self, batch_aug_norm)</code></td>
<td>Fill this batch with (normalized) augmentation results in-place. This method receives a (normalized) Batch instance, takes all <code>_aug</code> attributes out if it and assigns them to this batch in unnormalized form. Hence, the datatypes of all <code>_aug</code> attributes will match the datatypes of the <code>_unaug</code> attributes. Added in 0.4.0. <strong>Parameters</strong> <code>batch_aug_norm</code> (imgaug.augmentables.batches.Batch) – Batch after normalization and augmentation. <strong>Returns</strong> This instance itself. All <code>_unaug</code> attributes are unchanged. All <code>_aug</code> attributes are taken from <code>batch_normalized</code>, converted to unnormalized form. <strong>Return type</strong> imgaug.augmentables.batches.UnnormalizedBatch</td>
</tr>
<tr>
<td><code>get_column_names(self)</code></td>
<td>Get the names of types of augmentables that contain data. This method is intended for situations where one wants to know which data is contained in the batch that has to be augmented, visualized or something similar. Added in 0.4.0. <strong>Returns</strong> Names of types of augmentables. E.g. [&quot;images&quot;, &quot;polygons&quot;].</td>
</tr>
</tbody>
</table>
Return type  list of str

to_normalized_batch (self)
Convert this unnormalized batch to an instance of Batch.
As this method is intended to be called before augmentation, it assumes that none of the *_aug attributes
is yet set. It will produce an AssertionError otherwise.
The newly created Batch’s *_unaug attributes will match the ones in this batch, just in normalized form.

Returns  The batch, with *_unaug attributes being normalized.

Return type  imgaug.augmentables.batches.Batch

13.9  imgaug.augmentables.bbs

Classes representing bounding boxes.

class  imgaug.augmentables.bbs.BoundingBox (x1, y1, x2, y2, label=None)
    Bases: object
    
    Class representing bounding boxes.

    Each bounding box is parameterized by its top left and bottom right corners. Both are given as x and y-
    coordinates. The corners are intended to lie inside the bounding box area. As a result, a bounding box that
    lies completely inside the image but has maximum extensions would have coordinates (0.0, 0.0) and (W
    - epsilon, H - epsilon). Note that coordinates are saved internally as floats.

    Parameters

    •  x1 (number) – X-coordinate of the top left of the bounding box.
    •  y1 (number) – Y-coordinate of the top left of the bounding box.
    •  x2 (number) – X-coordinate of the bottom right of the bounding box.
    •  y2 (number) – Y-coordinate of the bottom right of the bounding box.
    •  label (None or str, optional) – Label of the bounding box, e.g. a string representing the
      class.

    Attributes

    area  Estimate the area of the bounding box.
    center_x  Estimate the x-coordinate of the center point of the bounding box.
    center_y  Estimate the y-coordinate of the center point of the bounding box.
    coords  Get the top-left and bottom-right coordinates as one array.
    height  Estimate the height of the bounding box.
    width  Estimate the width of the bounding box.
    x1_int  Get the x-coordinate of the top left corner as an integer.
    x2_int  Get the x-coordinate of the bottom left corner as an integer.
    y1_int  Get the y-coordinate of the top left corner as an integer.
    y2_int  Get the y-coordinate of the bottom left corner as an integer.
Methods

**almost_equals**(self, other[, max_distance])

Compare this and another BB’s label and coordinates.

**clip_out_of_image**(self, image)

Clip off all parts of the BB box that are outside of the image.

**clip_out_of_image_(self, image)**

Clip off parts of the BB box that are outside of the image in-place.

**compute_out_of_image_area**(self, image)

Compute the area of the BB that is outside of the image plane.

**compute_out_of_image_fraction**(self, image)

Compute fraction of BB area outside of the image plane.

**contains**(self, other)

Estimate whether the bounding box contains a given point.

**coords_almost_equals**(self, other[, max_distance])

Estimate if this and another BB have almost identical coordinates.

**copy**(self[, x1, y1, x2, y2, label])

Create a shallow copy of this BoundingBox instance.

**cut_out_of_image**(self, *args, **kwargs)

Deprecated.

**deepcopy**(self[, x1, y1, x2, y2, label])

Create a deep copy of the BoundingBox object.

**draw_box_on_image**(self, image[, color, ...])

Draw the rectangle of the bounding box on an image.

**draw_label_on_image**(self, image[, color, ...])

Draw a box showing the BB’s label.

**draw_on_image**(self, image[, color, alpha, ...])

Draw the bounding box on an image.

**extend**(self[, all_sides, top, right, ...])

Extend the size of the bounding box along its sides.

**extend_(self[, all_sides, top, right, ...])**

Extend the size of the bounding box along its sides in-place.

**extract_from_image**(self, image[, pad, ...])

Extract the image pixels within the bounding box.

**from_point_soup**(xy)

Convert a \((2P,)\) or \((P,2)\) ndarray to a BB instance.

**intersection**(self, other[, default])

Compute the intersection BB between this BB and another BB.

**iou**(self, other)

Compute the IoU between this bounding box and another one.

**is_fully_within_image**(self, image)

Estimate whether the bounding box is fully inside the image area.

**is_out_of_image**(self, image[, fully, partly])

Estimate whether the BB is partially/fully outside of the image area.

**is_partly_within_image**(self, image)

Estimate whether the BB is at least partially inside the image area.

**project**(self, from_shape, to_shape)

Project the bounding box onto a differently shaped image.

**project_**(self, from_shape, to_shape)

Project the bounding box onto a differently shaped image in-place.

**shift**(self[, x, y, top, right, bottom, left])

Move this bounding box along the x/y-axis.

**shift_**(self[, x, y])

Move this bounding box along the x/y-axis in-place.

**to_keypoints**(self)

Convert the BB’s corners to keypoints (clockwise, from top left).

**to_polygon**(self)

Convert this bounding box to a polygon covering the same area.

**union**(self, other)

Compute the union BB between this BB and another BB.
almost_equal\(s\) \((self, other, max\_distance=0.0001)\)

Compare this and another BB’s label and coordinates.

This is the same as \(\text{coords\_almost\_equals()}\) but additionally compares the labels.

Added in 0.4.0.

Parameters

- \(\text{other (imgaug.augmentables.bbs.BoundingBox or iterable)}\) – The other object to compare against. Expected to be a BoundingBox.

- \(\text{max\_distance (number, optional)}\) – See \(\text{coords\_almost\_equals()}\).

Returns True if the coordinates are almost equal and additionally the labels are equal. Otherwise False.

Return type \(\text{bool}\)

area

Estimate the area of the bounding box.

Returns Area of the bounding box, i.e. \(\text{height \times width}\).

Return type \(\text{number}\)

center_x

Estimate the x-coordinate of the center point of the bounding box.

Returns X-coordinate of the center point of the bounding box.

Return type \(\text{number}\)

center_y

Estimate the y-coordinate of the center point of the bounding box.

Returns Y-coordinate of the center point of the bounding box.

Return type \(\text{number}\)

clip_out_of_image \((self, image)\)

Clip off all parts of the BB box that are outside of the image.

Parameters \(\text{image ((H,W,\ldots) ndarray or tuple of int)}\) – Image dimensions to use for the clipping of the bounding box. If an ndarray, its shape will be used. If a tuple, it is assumed to represent the image shape and must contain at least two integers.

Returns Bounding box, clipped to fall within the image dimensions.

Return type \(\text{imgaug.augmentables.bbs.BoundingBox}\)

clip_out_of_image_ \((self, image)\)

Clip off parts of the BB box that are outside of the image in-place.

Added in 0.4.0.

Parameters \(\text{image ((H,W,\ldots) ndarray or tuple of int)}\) – Image dimensions to use for the clipping of the bounding box. If an ndarray, its shape will be used. If a tuple, it is assumed to represent the image shape and must contain at least two integers.

Returns Bounding box, clipped to fall within the image dimensions. The object may have been modified in-place.

Return type \(\text{imgaug.augmentables.bbs.BoundingBox}\)
compute_out_of_image_area (self, image)

Compute the area of the BB that is outside of the image plane.

Added in 0.4.0.

Parameters image (H,W,...) ndarray or tuple of int – Image dimensions to use. If an ndarray, its shape will be used. If a tuple, it is assumed to represent the image shape and must contain at least two integers.

Returns Total area of the bounding box that is outside of the image plane. Can be 0.0.

Return type float

calculate_out_of_image_fraction (self, image)

Compute fraction of BB area outside of the image plane.

This estimates \( f = \frac{A_{ooi}}{A} \), where \( A_{ooi} \) is the area of the bounding box that is outside of the image plane, while \( A \) is the total area of the bounding box.

Added in 0.4.0.

Parameters image (H,W,...) ndarray or tuple of int – Image dimensions to use. If an ndarray, its shape will be used. If a tuple, it is assumed to represent the image shape and must contain at least two integers.

Returns Fraction of the bounding box area that is outside of the image plane. Returns 0.0 if the bounding box is fully inside of the image plane. If the bounding box has an area of zero, the result is 1.0 if its coordinates are outside of the image plane, otherwise 0.0.

Return type float

contains (self, other)

Estimate whether the bounding box contains a given point.

Parameters other (tuple of number or imgaug.augmentables.bbs.Keypoint) – Point to check for.

Returns True if the point is contained in the bounding box, False otherwise.

Return type bool

cords

Get the top-left and bottom-right coordinates as one array.

Added in 0.4.0.

Returns A (N, 2) numpy array with N=2 containing the top-left and bottom-right coordinates.

Return type ndarray

cords_almost_equals (self, other, max_distance=0.0001)

Estimate if this and another BB have almost identical coordinates.

Added in 0.4.0.

Parameters

- other (imgaug.augmentables.bbs.BoundingBox or iterable) – The other bounding box with which to compare this one. If this is an iterable, it is assumed to represent the top-left and bottom-right coordinates of that bounding box, given as e.g. an (2,2) ndarray or an (4,) ndarray or as a similar list.

- max_distance (number, optional) – The maximum euclidean distance between a corner on one bounding box and the closest corner on the other bounding box. If the distance is exceeded for any such pair, the two BBs are not viewed as equal.

Returns Whether the two bounding boxes have almost identical corner coordinates.
Return type  bool

copy  (self, x1=None, y1=None, x2=None, y2=None, label=None)

Create a shallow copy of this BoundingBox instance.

Parameters

• x1 (None or number) – If not None, then the x1 coordinate of the copied object will be set to this value.
• y1 (None or number) – If not None, then the y1 coordinate of the copied object will be set to this value.
• x2 (None or number) – If not None, then the x2 coordinate of the copied object will be set to this value.
• y2 (None or number) – If not None, then the y2 coordinate of the copied object will be set to this value.
• label (None or string) – If not None, then the label of the copied object will be set to this value.

Returns  Shallow copy.

Return type  imgaug.augmentables.bbs.BoundingBox

cut_out_of_image  (self, *args, **kwargs)

Deprecated. Use BoundingBox.clip_out_of_image() instead. clip_out_of_image() has the exactly same interface.

Clip off all parts of the BB box that are outside of the image.

deepecopy  (self, x1=None, y1=None, x2=None, y2=None, label=None)

Create a deep copy of the BoundingBox object.

Parameters

• x1 (None or number) – If not None, then the x1 coordinate of the copied object will be set to this value.
• y1 (None or number) – If not None, then the y1 coordinate of the copied object will be set to this value.
• x2 (None or number) – If not None, then the x2 coordinate of the copied object will be set to this value.
• y2 (None or number) – If not None, then the y2 coordinate of the copied object will be set to this value.
• label (None or string) – If not None, then the label of the copied object will be set to this value.

Returns  Deep copy.

Return type  imgaug.augmentables.bbs.BoundingBox

draw_box_on_image  (self, image, color=(0, 255, 0), alpha=1.0, size=1, copy=True, raise_if_out_of_image=False, thickness=None)

Draw the rectangle of the bounding box on an image.

This method does not draw the label.

Added in 0.4.0.

Parameters
• **image** ((H,W,C) ndarray) – The image onto which to draw the bounding box rectangle. Currently expected to be `uint8`.

• **color** (iterable of int, optional) – The color to use, corresponding to the channel layout of the image. Usually RGB.

• **alpha** (float, optional) – The transparency of the drawn bounding box, where 1.0 denotes no transparency and 0.0 is invisible.

• **size** (int, optional) – The thickness of the bounding box in pixels. If the value is larger than 1, then additional pixels will be added around the bounding box (i.e. extension towards the outside).

• **copy** (bool, optional) – Whether to copy the input image or change it in-place.

• **raise_if_out_of_image** (bool, optional) – Whether to raise an error if the bounding box is fully outside of the image. If set to `False`, no error will be raised and only the parts inside the image will be drawn.

• **thickness** (None or int, optional) – Deprecated.

**Returns** Image with bounding box drawn on it.

**Return type** (H,W,C) ndarray(uint8)

---

### draw_label_on_image

```python
draw_label_on_image(self, image, color=(0, 255, 0), color_text=None, color_bg=None, alpha=1.0, size=1, size_text=20, height=30, copy=True, raise_if_out_of_image=False)
```

Draw a box showing the BB’s label.

The box is placed right above the BB’s rectangle.

Added in 0.4.0.

**Parameters**

• **image** ((H,W,C) ndarray) – The image onto which to draw the label. Currently expected to be `uint8`.

• **color** (None or iterable of int, optional) – The color to use, corresponding to the channel layout of the image. Usually RGB. Text and background colors will be derived from this.

• **color_text** (None or iterable of int, optional) – The text color to use. If `None`, derived from `color_bg`.

• **color_bg** (None or iterable of int, optional) – The background color of the label box. If `None`, derived from `color`.

• **alpha** (float, optional) – The transparency of the drawn bounding box, where 1.0 denotes no transparency and 0.0 is invisible.

• **size** (int, optional) – The thickness of the bounding box in pixels. If the value is larger than 1, then additional pixels will be added around the bounding box (i.e. extension towards the outside).

• **size_text** (int, optional) – Font size to use.

• **height** (int, optional) – Height of the label box in pixels.

• **copy** (bool, optional) – Whether to copy the input image or change it in-place.

• **raise_if_out_of_image** (bool, optional) – Whether to raise an error if the bounding box is fully outside of the image. If set to `False`, no error will be raised and only the parts inside the image will be drawn.

**Returns** Image with bounding box drawn on it.
Return type (H,W,C) ndarray(uint8)

draw_on_image (self, image, color=(0, 255, 0), alpha=1.0, size=1, copy=True, raise_if_out_of_image=False, thickness=None)

Draw the bounding box on an image.

This will automatically also draw the label, unless it is None. To only draw the box rectangle use draw_box_on_image(). To draw the label even if it is None or to configure e.g. its color, use draw_label_on_image().

Parameters

- **image** ((H,W,C) ndarray) – The image onto which to draw the bounding box. Currently expected to be uint8.

- **color** (iterable of int, optional) – The color to use, corresponding to the channel layout of the image. Usually RGB.

- **alpha** (float, optional) – The transparency of the drawn bounding box, where 1.0 denotes no transparency and 0.0 is invisible.

- **size** (int, optional) – The thickness of the bounding box in pixels. If the value is larger than 1, then additional pixels will be added around the bounding box (i.e. extension towards the outside).

- **copy** (bool, optional) – Whether to copy the input image or change it in-place.

- **raise_if_out_of_image** (bool, optional) – Whether to raise an error if the bounding box is fully outside of the image. If set to False, no error will be raised and only the parts inside the image will be drawn.

- **thickness** (None or int, optional) – Deprecated.

Returns Image with bounding box drawn on it.

Return type (H,W,C) ndarray(uint8)

extend (self, all_sides=0, top=0, right=0, bottom=0, left=0)

Extend the size of the bounding box along its sides in-place.

Added in 0.4.0.
Parameters

- **all_sides** *(number, optional)* – Value by which to extend the bounding box size along all sides.
- **top** *(number, optional)* – Value by which to extend the bounding box size along its top side.
- **right** *(number, optional)* – Value by which to extend the bounding box size along its right side.
- **bottom** *(number, optional)* – Value by which to extend the bounding box size along its bottom side.
- **left** *(number, optional)* – Value by which to extend the bounding box size along its left side.

Returns

Extended bounding box. The object may have been modified in-place.

Return type `imgaug.BoundingBox`

```python
extract_from_image(self, image, pad=True, pad_max=None, prevent_zero_size=True)
```

Extract the image pixels within the bounding box.

This function will zero-pad the image if the bounding box is partially/fully outside of the image.

Parameters

- **image** *(H,W) ndarray or (H,W,C) ndarray* – The image from which to extract the pixels within the bounding box.
- **pad** *(bool, optional)* – Whether to zero-pad the image if the object is partially/fully outside of it.
- **pad_max** *(None or int, optional)* – The maximum number of pixels that may be zero-padded on any side, i.e. if this has value \(N\) the total maximum of added pixels is \(4 \times N\). This option exists to prevent extremely large images as a result of single points being moved very far away during augmentation.
- **prevent_zero_size** *(bool, optional)* – Whether to prevent the height or width of the extracted image from becoming zero. If this is set to True and the height or width of the bounding box is below 1, the height/width will be increased to 1. This can be useful to prevent problems, e.g. with image saving or plotting. If it is set to False, images will be returned as \((H', W')\) or \((H', W', \text{3})\) with \(H\) or \(W\) potentially being 0.

Returns

Pixels within the bounding box. Zero-padded if the bounding box is partially/fully outside of the image. If **prevent_zero_size** is activated, it is guaranteed that \(H'>0\) and \(W'>0\), otherwise only \(H'>=0\) and \(W'>=0\).

Return type `(H',W')` `ndarray` or `(H',W',C)` `ndarray`

```python
classmethod from_point_soup(xy)
```

Convert a `(2P,)` or `(P,2)` `ndarray` to a BB instance.

This is the inverse of `to_xyxy_array()`.

Added in 0.4.0.

Parameters `xy` *((2P,) ndarray or (P,2) array or iterable of number or iterable of iterable of number)* – Array containing \(P\) points in xy-form denoting a soup of points around which to place a bounding box. The array should usually be of dtype `float32`.

Returns

Bounding box around the points.

Return type `imgaug.augmentables.bbs.BoundingBox`
**height**
Estimate the height of the bounding box.

**Returns**  Height of the bounding box.

**Return type**  number

**intersection** *(self, other, default=None)*
Compute the intersection BB between this BB and another BB.

Note that in extreme cases, the intersection can be a single point. In that case the intersection bounding box exists and it will be returned, but it will have a height and width of zero.

**Parameters**
- **other** *(imgaug.augmentables.bbs.BoundingBox)* – Other bounding box with which to generate the intersection.
- **default** *(any, optional)* – Default value to return if there is no intersection.

**Returns**  Intersection bounding box of the two bounding boxes if there is an intersection. If there is no intersection, the default value will be returned, which can by anything.

**Return type**  imgaug.augmentables.bbs.BoundingBox or any

**iou** *(self, other)*
Compute the IoU between this bounding box and another one.

IoU is the intersection over union, defined as:

```
`area(intersection(A, B)) / area(union(A, B))``
```
```
= area(intersection(A, B))
/ (area(A) + area(B) - area(intersection(A, B)))```
```

**Parameters**  other *(imgaug.augmentables.bbs.BoundingBox)* – Other bounding box with which to compare.

**Returns**  IoU between the two bounding boxes.

**Return type**  float

**is_fully_within_image** *(self, image)*
Estimate whether the bounding box is fully inside the image area.

**Parameters**  image *(ndarray or tuple of int)* – Image dimensions to use. If an ndarray, its shape will be used. If a tuple, it is assumed to represent the image shape and must contain at least two integers.

**Returns**  True if the bounding box is fully inside the image area. False otherwise.

**Return type**  bool

**is_out_of_image** *(self, image, fully=True, partly=False)*
Estimate whether the BB is partially/fully outside of the image area.

**Parameters**
- **image** *(ndarray or tuple of int)* – Image dimensions to use. If an ndarray, its shape will be used. If a tuple, it is assumed to represent the image shape and must contain at least two integers.
- **fully** *(bool, optional)* – Whether to return True if the bounding box is fully outside of the image area.
• **partly** (*bool, optional*) – Whether to return `True` if the bounding box is at least partially outside the image area.

Returns `True` if the bounding box is partially/fully outside of the image area, depending on defined parameters. `False` otherwise.

**Return type** `bool`

**is_partly_within_image** (*self, image*)

Estimate whether the BB is at least partially inside the image area.

**Parameters**

- **image** (*ndarray or tuple of int*) – Image dimensions to use. If an ndarray, its shape will be used. If a tuple, it is assumed to represent the image shape and must contain at least two integers.

Returns `True` if the bounding box is at least partially inside the image area. `False` otherwise.

**Return type** `bool`

**project** (*self, from_shape, to_shape*)

Project the bounding box onto a differently shaped image.

E.g. if the bounding box is on its original image at \(x_1 = (10 \text{ of } 100 \text{ pixels})\) and \(y_1 = (20 \text{ of } 100 \text{ pixels})\) and is projected onto a new image with size \((\text{width}=200, \text{height}=200)\), its new position will be \((x_1=20, y_1=40)\). (Analogous for \(x_2/y_2\).)

This is intended for cases where the original image is resized. It cannot be used for more complex changes (e.g. padding, cropping).

**Parameters**

- **from_shape** (*tuple of int or ndarray*) – Shape of the original image. (Before resize.)
- **to_shape** (*tuple of int or ndarray*) – Shape of the new image. (After resize.)

Returns `BoundingBox` instance with new coordinates.

**Return type** `imgaug.augmentables.bbs.BoundingBox`

**project_** (*self, from_shape, to_shape*)

Project the bounding box onto a differently shaped image in-place.

E.g. if the bounding box is on its original image at \(x_1 = (10 \text{ of } 100 \text{ pixels})\) and \(y_1 = (20 \text{ of } 100 \text{ pixels})\) and is projected onto a new image with size \((\text{width}=200, \text{height}=200)\), its new position will be \((x_1=20, y_1=40)\). (Analogous for \(x_2/y_2\).)

This is intended for cases where the original image is resized. It cannot be used for more complex changes (e.g. padding, cropping).

Added in 0.4.0.

**Parameters**

- **from_shape** (*tuple of int or ndarray*) – Shape of the original image. (Before resize.)
- **to_shape** (*tuple of int or ndarray*) – Shape of the new image. (After resize.)

Returns `BoundingBox` instance with new coordinates. The object may have been modified in-place.

**Return type** `imgaug.augmentables.bbs.BoundingBox`

**shift** (*self, x=0, y=0, top=None, right=None, bottom=None, left=None*)

Move this bounding box along the x/y-axis.

The origin \((0, 0)\) is at the top left of the image.
Parameters

- **x (number, optional)** – Value to be added to all x-coordinates. Positive values shift towards the right images.
- **y (number, optional)** – Value to be added to all y-coordinates. Positive values shift towards the bottom images.
- **top (None or int, optional)** – Deprecated since 0.4.0. Amount of pixels by which to shift this object from the top (towards the bottom).
- **right (None or int, optional)** – Deprecated since 0.4.0. Amount of pixels by which to shift this object from the right (towards the left).
- **bottom (None or int, optional)** – Deprecated since 0.4.0. Amount of pixels by which to shift this object from the bottom (towards the top).
- **left (None or int, optional)** – Deprecated since 0.4.0. Amount of pixels by which to shift this object from the left (towards the right).

Returns Shifting bounding box.

Return type *imgaug.augmentables.bbs.BoundingBox*

```python
shift__(self, x=0, y=0)
```
Move this bounding box along the x/y-axis in-place.

The origin (0, 0) is at the top left of the image.

Added in 0.4.0.

Parameters

- **x (number, optional)** – Value to be added to all x-coordinates. Positive values shift towards the right images.
- **y (number, optional)** – Value to be added to all y-coordinates. Positive values shift towards the bottom images.

Returns Shifted bounding box. The object may have been modified in-place.

Return type *imgaug.augmentables.bbs.BoundingBox*

```python
to_keypoints(self)
```
Convert the BB’s corners to keypoints (clockwise, from top left).

Returns Corners of the bounding box as keypoints.

Return type list of *imgaug.augmentables.kps.Keypoint*

```python
to_polygon(self)
```
Convert this bounding box to a polygon covering the same area.

Added in 0.4.0.

Returns The bounding box converted to a polygon.

Return type *imgaug.augmentables.polys.Polygon*

```python
union(self, other)
```
Compute the union BB between this BB and another BB.

This is equivalent to drawing a bounding box around all corner points of both bounding boxes.

Parameters **other (imgaug.augmentables.bbs.BoundingBox)** – Other bounding box with which to generate the union.
Returns Union bounding box of the two bounding boxes.

Return type `imgaug.augmentables.bbs.BoundingBox`

**width**

Estimate the width of the bounding box.

Returns Width of the bounding box.

Return type `number`

**x1_int**

Get the x-coordinate of the top left corner as an integer.

Returns X-coordinate of the top left corner, rounded to the closest integer.

Return type `int`

**x2_int**

Get the x-coordinate of the bottom left corner as an integer.

Returns X-coordinate of the bottom left corner, rounded to the closest integer.

Return type `int`

**y1_int**

Get the y-coordinate of the top left corner as an integer.

Returns Y-coordinate of the top left corner, rounded to the closest integer.

Return type `int`

**y2_int**

Get the y-coordinate of the bottom left corner as an integer.

Returns Y-coordinate of the bottom left corner, rounded to the closest integer.

Return type `int`

```
class imgaug.augmentables.bbs.BoundingBoxesOnImage(bounding_boxes, shape)
Bases: imgaug.augmentables.base.IAugmentable

Container for the list of all bounding boxes on a single image.

Parameters

- **bounding_boxes** (`list of imgaug.augmentables.bbs.BoundingBox`) – List of bounding boxes on the image.
  
- **shape** (`tuple of int or ndarray`) – The shape of the image on which the objects are placed. Either an image with shape `(H, W, [C])` or a tuple denoting such an image shape.

Examples

```python
>>> import numpy as np
>>> from imgaug.augmentables.bbs import BoundingBox, BoundingBoxesOnImage
>>> image = np.zeros((100, 100))
>>> bbs = [
...     BoundingBox(x1=10, y1=20, x2=20, y2=30),
...     BoundingBox(x1=25, y1=50, x2=30, y2=70)
... ]
>>> bbs_oi = BoundingBoxesOnImage(bbs, shape=image.shape)
```
Attributes

- **empty**  Determine whether this instance contains zero bounding boxes.
- **height**  Get the height of the image on which the bounding boxes fall.
- **items**  Get the bounding boxes in this container.
- **width**  Get the width of the image on which the bounding boxes fall.

Methods

- **clip_out_of_image**  Clip off all parts from all BBs that are outside of the image.
- **clip_out_of_image_**  Clip off in-place all parts from all BBs that are outside of the image.
- **copy**  Create a shallow copy of the BoundingBoxesOnImage instance.
- **cut_out_of_image**  Deprecated.
- **deepcopy**  Create a deep copy of the BoundingBoxesOnImage object.
- **draw_on_image**  Draw all bounding boxes onto a given image.
- **fill_from_xyxy_array**  Modify the BB coordinates of this instance in-place.
- **from_point_soups**  Convert an \((N, 2P)\) or \((N, P, 2)\) ndarray to a BBsOI instance.
- **from_xyxy_array**  Convert an \((N, 4)\) or \((N, 2, 2)\) ndarray to a BBsOI instance.
- **invert_to_keypoints_on_image_**  Invert the output of to_keypoints_on_image() in-place.
- **on**  Project bounding boxes from one image (shape) to a another one.
- **on_**  Project BBs from one image (shape) to a another one in-place.
- **remove_out_of_image**  Remove all BBs that are fully/partially outside of the image.
- **remove_out_of_image_**  Remove in-place all BBs that are fully/partially outside of the image.
- **remove_out_of_image_fraction**  Remove all BBs with an out of image fraction of at least \(fraction\).
- **shift**  Move all BBs along the x/y-axis.
- **shift_**  Move all BBs along the x/y-axis in-place.
- **to_keypoints_on_image**  Convert the bounding boxes to one KeypointsOnImage instance.
- **to_polygons_on_image**  Convert the bounding boxes to one PolygonsOnImage instance.
- **to_xy_array**  Convert the BoundingBoxesOnImage object to an \((N, 2)\) ndarray.
- **to_xyxy_array**  Convert the BoundingBoxesOnImage object to an \((N, 4)\) ndarray.
clip_out_of_image (self)
 Clip off all parts from all BBs that are outside of the image.

 Returns Bounding boxes, clipped to fall within the image dimensions.
 Return type imgaug.augmentables.bbs.BoundingBoxesOnImage

clip_out_of_image_ (self)
 Clip off in-place all parts from all BBs that are outside of the image.
 Added in 0.4.0.

 Returns Bounding boxes, clipped to fall within the image dimensions. The object and its items
 may have been modified in-place.
 Return type imgaug.augmentables.bbs.BoundingBoxesOnImage

copy (self, bounding_boxes=None, shape=None)
 Create a shallow copy of the BoundingBoxesOnImage instance.

 Parameters
 • bounding_boxes (None or list of imgaug.augmentables.bbs.BoundingBox, optional) – List
 of bounding boxes on the image. If None, the instance’s bounding boxes will be copied.
 • shape (tuple of int, optional) – The shape of the image on which the bounding boxes are
 placed. If None, the instance’s shape will be copied.

 Returns Shallow copy.
 Return type imgaug.augmentables.bbs.BoundingBoxesOnImage

cut_out_of_image (self)
 clip_out_of_image() has the exactly same interface.
 Clip off all parts from all BBs that are outside of the image.

deepcopy (self, bounding_boxes=None, shape=None)
 Create a deep copy of the BoundingBoxesOnImage object.

 Parameters
 • bounding_boxes (None or list of imgaug.augmentables.bbs.BoundingBox, optional) – List
 of bounding boxes on the image. If None, the instance’s bounding boxes will be copied.
 • shape (tuple of int, optional) – The shape of the image on which the bounding boxes are
 placed. If None, the instance’s shape will be copied.

 Returns Deep copy.
 Return type imgaug.augmentables.bbs.BoundingBoxesOnImage

draw_on_image (self, image, color=(0, 255, 0), alpha=1.0, size=1, copy=True,
 raise_if_out_of_image=False, thickness=None)
 Draw all bounding boxes onto a given image.

 Parameters
 • image (H,W,3 ndarray) – The image onto which to draw the bounding boxes. This image
 should usually have the same shape as set in BoundingBoxesOnImage.shape.
 • color (int or list of int or tuple of int or (3,) ndarray, optional) – The RGB color of all
 bounding boxes. If a single int C, then that is equivalent to (C, C, C).
 • alpha (float, optional) – Alpha/transparency of the bounding box.
• **size** (*int, optional*) – Thickness in pixels.

• **copy** (*bool, optional*) – Whether to copy the image before drawing the bounding boxes.

• **raise_if_out_of_image** (*bool, optional*) – Whether to raise an exception if any bounding box is outside of the image.

• **thickness** (*None or int, optional*) – Deprecated.

**Returns** Image with drawn bounding boxes.

**Return type** *(H,W,3) ndarray*

**empty**

Determine whether this instance contains zero bounding boxes.

**Returns** True if this object contains zero bounding boxes.

**Return type** *bool*

**fill_from_xy_array_(self, xy)**

Modify the BB coordinates of this instance in-place.

See **fill_from_xyxy_array_(self)**.

Added in 0.4.0.

**Parameters**

*xy* (*(2*B, 2) ndarray or iterable of iterable of number*) – Coordinates of B bounding boxes on an image, given as a *(2*B, 2)* array of two corner xy-coordinates per bounding box. B must match the number of bounding boxes in this instance.

**Returns** This instance itself, with updated bounding box coordinates. Note that the instance was modified in-place.

**Return type** *BoundingBoxesOnImage*

**fill_from_xyxy_array_(self, xyxy)**

Modify the BB coordinates of this instance in-place.

**Note:** This currently expects exactly one entry in xyxy per bounding in this instance. (I.e. two corner coordinates per instance.) Otherwise, an **AssertionError** will be raised.

**Note:** This method will automatically flip x-coordinates if x1>x2 for a bounding box. (Analogous for y-coordinates.)

Added in 0.4.0.

**Parameters**

*xyxy* (*(N, 4) ndarray or iterable of iterable of number*) – Coordinates of N bounding boxes on an image, given as a *(N, 4)* array of two corner xy-coordinates per bounding box. N must match the number of bounding boxes in this instance.

**Returns** This instance itself, with updated bounding box coordinates. Note that the instance was modified in-place.

**Return type** *BoundingBoxesOnImage*

**classmethod from_point_soups(xy, shape)**

Convert an *(N, 2P) or (N, P, 2) ndarray to a BBsOI instance.

Added in 0.4.0.

**Parameters**
• **xy** ((N, 2P) ndarray or (N, P, 2) array or iterable of iterable of number or iterable of iterable of number) – Array containing the corner coordinates of N bounding boxes. Each bounding box is represented by a soup of P points. If (N, P) then the second axis is expected to be in xy-form (e.g. x1, y1, x2, y2,...). The final bounding box coordinates will be derived using \( \min \) and \( \max \) operations on the xy-values. The array should usually be of dtype `float32`.

• **shape** (tuple of int) – Shape of the image on which the bounding boxes are placed. Should usually be \((H, W, C)\) or \((H, W)\).

Returns: Object containing a list of `BoundingBox` instances derived from the provided point soups.

Return type: `imgaug.augmentables.bbs.BoundingBoxesOnImage`

**classmethod from_xyxy_array**(xyxy, shape)
Convert an \((N, 4)\) or \((N, 2, 2)\) ndarray to a BBsOI instance.

This is the inverse of `to_xyxy_array()`.

Parameters

• **xyxy** ((N, 4) ndarray or (N, 2, 2) array) – Array containing the corner coordinates of N bounding boxes. Each bounding box is represented by its top-left and bottom-right coordinates. The array should usually be of dtype `float32`.

• **shape** (tuple of int) – Shape of the image on which the bounding boxes are placed. Should usually be \((H, W, C)\) or \((H, W)\).

Returns: Object containing a list of `BoundingBox` instances derived from the provided corner coordinates.

Return type: `imgaug.augmentables.bbs.BoundingBoxesOnImage`

**height**
Get the height of the image on which the bounding boxes fall.

Returns: Image height.

Return type: int

**invert_to_keypoints_on_image**(self, kpsoi)
Invert the output of `to_keypoints_on_image()` in-place.

This function writes in-place into this BoundingBoxesOnImage instance.

Added in 0.4.0.

Parameters kpsoi (imgaug.augmentables.kps.KeypointsOnImages) – Keypoints to convert back to bounding boxes, i.e. the outputs of `to_keypoints_on_image()`.

Returns: Bounding boxes container with updated coordinates. Note that the instance is also updated in-place.

Return type: `BoundingBoxesOnImage`

**items**
Get the bounding boxes in this container.

Added in 0.4.0.

Returns: Bounding boxes within this container.

Return type: list of `BoundingBox`
on (self, image)
Project bounding boxes from one image (shape) to another one.

**Parameters**
- **image** *(ndarray or tuple of int)* – New image onto which the bounding boxes are to be projected. May also simply be that new image’s shape tuple.

**Returns**
Object containing the same bounding boxes after projection to the new image shape.

**Return type**
*imgaug.augmentables.bbs.BoundingBoxesOnImage*

on_ (self, image)
Project BBs from one image (shape) to another one in-place.

Added in 0.4.0.

**Parameters**
- **image** *(ndarray or tuple of int)* – New image onto which the bounding boxes are to be projected. May also simply be that new image’s shape tuple.

**Returns**
Object containing the same bounding boxes after projection to the new image shape. The object and its items may have been modified in-place.

**Return type**
*imgaug.augmentables.bbs.BoundingBoxesOnImage*

remove_out_of_image (self, fully=True, partly=False)
Remove all BBs that are fully/partially outside of the image.

**Parameters**
- **fully** *(bool, optional)* – Whether to remove bounding boxes that are fully outside of the image.
- **partly** *(bool, optional)* – Whether to remove bounding boxes that are partially outside of the image.

**Returns**
Reduced set of bounding boxes, with those that were fully/partially outside of the image being removed.

**Return type**
*imgaug.augmentables.bbs.BoundingBoxesOnImage*

remove_out_of_image_ (self, fully=True, partly=False)
Remove in-place all BBs that are fully/partially outside of the image.

Added in 0.4.0.

**Parameters**
- **fully** *(bool, optional)* – Whether to remove bounding boxes that are fully outside of the image.
- **partly** *(bool, optional)* – Whether to remove bounding boxes that are partially outside of the image.

**Returns**
Reduced set of bounding boxes, with those that were fully/partially outside of the image being removed. The object and its items may have been modified in-place.

**Return type**
*imgaug.augmentables.bbs.BoundingBoxesOnImage*

remove_out_of_image_fraction (self, fraction)
Remove all BBs with an out of image fraction of at least `fraction`.

Added in 0.4.0.

**Parameters**
- **fraction** *(number)* – Minimum out of image fraction that a bounding box has to have in order to be removed. A fraction of 1.0 removes only bounding boxes that are 100% outside of the image. A fraction of 0.0 removes all bounding boxes.
Returns Reduced set of bounding boxes, with those that had an out of image fraction greater or equal the given one removed.

Return type `imgaug.augmentables.bbs.BoundingBoxesOnImage`

`remove_out_of_image_fraction_(self, fraction)`

Remove in-place all BBs with an OOI fraction of at least `fraction`.

‘OOI’ is the abbreviation for ‘out of image’.

Added in 0.4.0.

Parameters `fraction` *(number)* – Minimum out of image fraction that a bounding box has to have in order to be removed. A fraction of 1.0 removes only bounding boxes that are 100% outside of the image. A fraction of 0.0 removes all bounding boxes.

Returns Reduced set of bounding boxes, with those that had an out of image fraction greater or equal the given one removed. The object and its items may have been modified in-place.

Return type `imgaug.augmentables.bbs.BoundingBoxesOnImage`

`shift_(self, x=0, y=0)`

Move all BBs along the x/y-axis in-place.

The origin (0, 0) is at the top left of the image.

Parameters

- `x` *(number, optional)* – Value to be added to all x-coordinates. Positive values shift towards the right images.
- `y` *(number, optional)* – Value to be added to all y-coordinates. Positive values shift towards the bottom images.
- `top` *(None or int, optional)* – Deprecated since 0.4.0. Amount of pixels by which to shift all objects from the top (towards the bottom).
- `right` *(None or int, optional)* – Deprecated since 0.4.0. Amount of pixels by which to shift all objects from the right (towards the left).
- `bottom` *(None or int, optional)* – Deprecated since 0.4.0. Amount of pixels by which to shift all objects from the bottom (towards the top).
- `left` *(None or int, optional)* – Deprecated since 0.4.0. Amount of pixels by which to shift all objects from the left (towards the right).

Returns Shifted bounding boxes. The object and its items may have been modified in-place.

Return type `imgaug.augmentables.bbs.BoundingBoxesOnImage`
Return type *imgaug.augmentables.bbs.BoundingBoxesOnImage*

**to_keypoints_on_image**(self)
Convert the bounding boxes to one KeypointsOnImage instance.
Added in 0.4.0.

Returns A keypoints instance containing N*4 coordinates for N bounding boxes. Order matches the order in bounding_boxes.

Return type *imgaug.augmentables.kps.KeypointsOnImage*

**to_polygons_on_image**(self)
Convert the bounding boxes to one PolygonsOnImage instance.
Added in 0.4.0.

Returns A PolygonsOnImage containing polygons. Each polygon covers the same area as the corresponding bounding box.

Return type *imgaug.augmentables.polys.PolygonsOnImage*

**to_xy_array**(self)
Convert the BoundingBoxesOnImage object to an (N,2) ndarray.
Added in 0.4.0.

Returns (2*B,2) ndarray of xy-coordinates, where B denotes the number of bounding boxes.

Return type ndarray

**to_xyxy_array**(self, *dtype=*`numpy.dtype`*optional*) – Desired output datatype of the ndarray.

Returns (N,4) ndarray, where N denotes the number of bounding boxes and 4 denotes the top-left and bottom-right bounding box corner coordinates in form (x1, y1, x2, y2).

Return type ndarray

**width**
Get the width of the image on which the bounding boxes fall.

Returns Image width.

Return type int

### 13.10 imgaug.augmentables.heatmaps

Classes to represent heatmaps, i.e. float arrays of [0.0, 1.0].

**class imgaug.augmentables.heatmaps.HeatmapsOnImage**(arr, *shape*, *min_value=0.0*, *max_value=1.0*)

Bases: *imgaug.augmentables.base.IAugmentable*

Object representing heatmaps on a single image.

Parameters
• **arr** ((H,W) ndarray or (H,W,C) ndarray) – Array representing the heatmap(s) on a single image. Multiple heatmaps may be provided, in which case C is expected to denote the heatmap index. The array must be of dtype float32.

• **shape** (tuple of int) – Shape of the image on which the heatmap(s) is/are placed. Not the shape of the heatmap(s) array, unless it is identical to the image shape (note the likely difference between the arrays in the number of channels). This is expected to be (H, W) or (H, W, C) with C usually being 3. If there is no corresponding image, use (H_arr, W_arr) instead, where H_arr is the height of the heatmap(s) array (analogous W_arr).

• **min_value** (float, optional) – Minimum value for the heatmaps that arr represents. This will usually be 0.0.

• **max_value** (float, optional) – Maximum value for the heatmaps that arr represents. This will usually be 1.0.

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**avg_pool** (self, block_size)

Average-pool the heatmap(s) array using a given block/kernel size.

- **Parameters**
  - **block_size** (int or tuple of int) – Size of each block of values to pool, aka kernel size. See **pool**() for details.

- **Returns**
  - Heatmaps after average pooling.

- **Return type**
  - imgaug.augmentables.heatmaps.HeatmapsOnImage

**classmethod change_normalization** (arr, source, target)

Change the value range of a heatmap array.
E.g. the value range may be changed from the interval \([0.0, 1.0]\) to \([-1.0, 1.0]\).

**Parameters**

- **arr** *(ndarray)* – Heatmap array to modify.
- **source** *(tuple of float)* – Current value range of the input array, given as a tuple \((\text{min}, \text{max})\), where both are float values.
- **target** *(tuple of float)* – Desired output value range of the array, given as a tuple \((\text{min}, \text{max})\), where both are float values.

**Returns**  
Input array, with value range projected to the desired target value range.

**Return type** *ndarray*

**copy** *(self)*

Create a shallow copy of the heatmaps object.

**Returns**  
Shallow copy.

**Return type** *imgaug.augmentables.heatmaps.HeatmapsOnImage*

**deepcopy** *(self)*

Create a deep copy of the heatmaps object.

**Returns**  
Deep copy.

**Return type** *imgaug.augmentables.heatmaps.HeatmapsOnImage*

**draw** *(self, size=None, cmap='jet')*

Render the heatmaps as RGB images.

**Parameters**

- **size** *(None or float or iterable of int or iterable of float, optional)* – Size of the rendered RGB image as \((\text{height}, \text{width})\). See `imresize_single_image()` for details. If set to `None`, no resizing is performed and the size of the heatmaps array is used.
- **cmap** *(str or None, optional)* – Name of the `matplotlib` color map to use when convert the heatmaps to RGB images. If set to `None`, no color map will be used and the heatmaps will be converted to simple intensity maps.

**Returns**  
Rendered heatmaps as `uint8` arrays. Always a list containing one RGB image per heatmap array channel.

**Return type** *list of (H,W,3) ndarray*

**draw_on_image** *(self, image, alpha=0.75, cmap='jet', resize='heatmaps')*

Draw the heatmaps as overlays over an image.

**Parameters**

- **image** *(\((H,W,3)\) ndarray)* – Image onto which to draw the heatmaps. Expected to be of dtype `uint8`.
- **alpha** *(float, optional)* – Alpha/opacity value to use for the mixing of image and heatmaps. Larger values mean that the heatmaps will be more visible and the image less visible.
- **cmap** *(str or None, optional)* – Name of the `matplotlib` color map to use. See `HeatmapsOnImage.draw()` for details.
- **resize** *(‘heatmaps’, ‘image’), optional)* – In case of size differences between the image and heatmaps, either the image or the heatmaps can be resized. This parameter controls which of the two will be resized to the other’s size.
Returns Rendered overlays as `uint8` arrays. Always a list containing one RGB image per heatmap array channel.

Return type list of (H,W,3) ndarray

**static from_0to1**(arr_0to1, shape, min_value=0.0, max_value=1.0)
Create a heatmaps object from a \([0.0, 1.0]\) float array.

Parameters

- arr_0to1 ((H,W) or (H,W,C) ndarray) – Heatmap(s) array, where \(H\) is the height, \(W\) is the width and \(C\) is the number of heatmap channels. Expected dtype is float32.
- shape (tuple of ints) – Shape of the image on which the heatmap(s) is/are placed. Not the shape of the heatmaps array, unless it is identical to the image shape (note the likely difference between the arrays in the number of channels). If there is not a corresponding image, use the shape of the heatmaps array.
- min_value (float, optional) – Minimum value of the float heatmaps that the input array represents. This will usually be 0.0. In most other cases it will be close to the interval \([0.0, 1.0]\). Calling `get_arr()`, will automatically convert the interval \([0.0, 1.0]\) float array to this \([\text{min}, \text{max}]\) interval.
- max_value (float, optional) – Minimum value of the float heatmaps that the input array represents. This will usually be 1.0. See parameter `min_value` for details.

Returns Heatmaps object.

Return type `imgaug.augmentables.heatmaps.HeatmapsOnImage`

**static from_uint8**(arr_uint8, shape, min_value=0.0, max_value=1.0)
Create a float-based heatmaps object from an uint8 array.

Parameters

- arr_uint8 ((H,W) ndarray or (H,W,C) ndarray) – Heatmap(s) array, where \(H\) is height, \(W\) is width and \(C\) is the number of heatmap channels. Expected dtype is uint8.
- shape (tuple of int) – Shape of the image on which the heatmap(s) is/are placed. Not the shape of the heatmaps array, unless it is identical to the image shape (note the likely difference between the arrays in the number of channels). If there is not a corresponding image, use the shape of the heatmaps array.
- min_value (float, optional) – Minimum value of the float heatmaps that the input array represents. This will usually be 0.0. In most other cases it will be close to the interval \([0.0, 1.0]\). Calling `get_arr()`, will automatically convert the interval \([0.0, 1.0]\) float array to this \([\text{min}, \text{max}]\) interval.
- max_value (float, optional) – Minimum value of the float heatmaps that the input array represents. This will usually be 1.0. See parameter `min_value` for details.

Returns Heatmaps object.

Return type `imgaug.augmentables.heatmaps.HeatmapsOnImage`

**get_arr**(self)
Get the heatmap’s array in value range provided to `__init__()`.

The `HeatmapsOnImage` object saves heatmaps internally in the value range \([0.0, 1.0]\). This function converts the internal representation to \([\text{min}, \text{max}]\), where `min` and `max` are provided to `HeatmapsOnImage.__init__()` upon instantiation of the object.

Returns Heatmap array of dtype float32.
Return type (H,W) ndarray or (H,W,C) ndarray

invert(self)
Invert each component in the heatmap.

This shifts low values towards high values and vice versa.

This changes each value to:

\[ v' = \max - (v - \min) \]

where \( v \) is the value at a spatial location, \( \min \) is the minimum value in the heatmap and \( \max \) is the maximum value. As the heatmap uses internally a 0.0 to 1.0 representation, this simply becomes \( v' = 1.0 - v \).

This function can be useful e.g. when working with depth maps, where algorithms might have an easier time representing the furthest away points with zeros, requiring an inverted depth map.

Returns Inverted heatmap.

Return type imgaug.augmentables.heatmaps.HeatmapsOnImage

max_pool(self, block_size)
Max-pool the heatmap(s) array using a given block/kernel size.

Parameters block_size (int or tuple of int) – Size of each block of values to pool, aka kernel size. See pool() for details.

Returns Heatmaps after max-pooling.

Return type imgaug.augmentables.heatmaps.HeatmapsOnImage

pad(self, top=0, right=0, bottom=0, left=0, mode='constant', cval=0.0)
Pad the heatmaps at their top/right/bottom/left side.

Parameters

- top (int, optional) – Amount of pixels to add at the top side of the heatmaps. Must be 0 or greater.
- right (int, optional) – Amount of pixels to add at the right side of the heatmaps. Must be 0 or greater.
- bottom (int, optional) – Amount of pixels to add at the bottom side of the heatmaps. Must be 0 or greater.
- left (int, optional) – Amount of pixels to add at the left side of the heatmaps. Must be 0 or greater.
- mode (string, optional) – Padding mode to use. See pad() for details.
- cval (number, optional) – Value to use for padding mode is constant. See pad() for details.

Returns Padded heatmaps of height \( H' = H + top + bottom \) and width \( W' = W + left + right \).

Return type imgaug.augmentables.heatmaps.HeatmapsOnImage

pad_to_aspect_ratio(self, aspect_ratio, mode='constant', cval=0.0, return_pad_amounts=False)
Pad the heatmaps until they match a target aspect ratio.

Depending on which dimension is smaller (height or width), only the corresponding sides (left/right or top/bottom) will be padded. In each case, both of the sides will be padded equally.

Parameters
• **aspect_ratio** *(float)* – Target aspect ratio, given as width/height. E.g. 2.0 denotes the image having twice as much width as height.

• **mode** *(str, optional)* – Padding mode to use. See pad() for details.

• **cval** *(number, optional)* – Value to use for padding if mode is constant. See pad() for details.

• **return_pad_amounts** *(bool, optional)* – If False, then only the padded instance will be returned. If True, a tuple with two entries will be returned, where the first entry is the padded instance and the second entry are the amounts by which each array side was padded. These amounts are again a tuple of the form (top, right, bottom, left), with each value being an integer.

**Returns**

• **imgaug.augmentables.heatmaps.HeatmapsOnImage** – Padded heatmaps as HeatmapsOnImage instance.

• **tuple of int** – Amounts by which the instance’s array was padded on each side, given as a tuple (top, right, bottom, left). This tuple is only returned if return_pad_amounts was set to True.

**resize**(self, sizes, interpolation='cubic')

Resize the heatmap(s) array given a target size and interpolation.

**Parameters**

• **sizes** *(float or iterable of int or iterable of float)* – New size of the array in (height, width). See imresize_single_image() for details.

• **interpolation** *(None or str or int, optional)* – The interpolation to use during resize. See imresize_single_image() for details.

**Returns** Resized heatmaps object.

**Return type** **imgaug.augmentables.heatmaps.HeatmapsOnImage**

**scale**(self, *args, **kwargs)

Deprecated. Use HeatmapsOnImage.resize() instead. resize() has the exactly same interface.

Resize the heatmap(s) array given a target size and interpolation.

**to_uint8**(self)

Convert this heatmaps object to an uint8 array.

**Returns** Heatmap as an uint8 array, i.e. with the discrete value range [0, 255].

**Return type** *(H,W,C) ndarray*

### 13.11 imgaug.augmentables.kps

Classes to represent keypoints, i.e. points given as xy-coordinates.

**class** **imgaug.augmentables.kps.Keypoint**(x, y)

Bases: object

A single keypoint (aka landmark) on an image.

**Parameters**

• **x** *(number)* – Coordinate of the keypoint on the x axis.
• y (number) – Coordinate of the keypoint on the y axis.

Attributes

- **coords** Get the xy-coordinates as an \((N, 2)\) ndarray.
- **x_int** Get the keypoint’s x-coordinate, rounded to the closest integer.
- **xy** Get the keypoint’s x- and y-coordinate as a single array.
- **xy_int** Get the keypoint’s xy-coord, rounded to closest integer.
- **y_int** Get the keypoint’s y-coordinate, rounded to the closest integer.

Methods

- `almost_equals(self, other[, max_distance])` Compare this and another KP’s coordinates.
- `compute_out_of_image_fraction(self, image)` Compute fraction of the keypoint that is out of the image plane.
- `coords_almost_equals(self, other[, max_distance])` Estimate if this and another KP have almost identical coordinates.
- `copy(self[, x, y])` Create a shallow copy of the keypoint instance.
- `deepcopy(self[, x, y])` Create a deep copy of the keypoint instance.
- `draw_on_image(self, image[, color, alpha, ...])` Draw the keypoint onto a given image.
- `generate_similar_points_manhattan(self, ...)` Generate nearby points based on manhattan distance.
- `is_out_of_image(self, image)` Estimate whether this point is outside of the given image plane.
- `project(self, from_shape, to_shape)` Project the keypoint onto a new position on a new image.
- `project__(self, from_shape, to_shape)` Project in-place the keypoint onto a new position on a new image.
- `shift(self[, x, y])` Move the keypoint around on an image.
- `shift__(self[, x, y])` Move the keypoint around on an image in-place.

### `almost_equals (self, other, max_distance=0.0001)`

Compare this and another KP’s coordinates.

**Note:** This method is currently identical to `coords_almost_equals`. It exists for consistency with `BoundingBox` and `Polygons`.

Added in 0.4.0.

**Parameters**

- **other** (*imgaug.augmentables.kps.Keypoint or iterable*) – The other object to compare against. Expected to be a Keypoint.
- **max_distance** (*number, optional*) – See `coords_almost_equals()`.

**Returns** True if the coordinates are almost equal. Otherwise False.

**Return type** bool

- `compute_out_of_image_fraction (self, image)` Compute fraction of the keypoint that is out of the image plane.
The fraction is always either 1.0 (point is outside of the image plane) or 0.0 (point is inside the image plane). This method exists for consistency with other augmentables, e.g. bounding boxes.

Added in 0.4.0.

**Parameters**

- **image** *(ndarray or tuple of int)* – Image dimensions to use. If an ndarray, its shape will be used. If a tuple, it is assumed to represent the image shape and must contain at least two integers.

**Returns** Either 1.0 (point is outside of the image plane) or 0.0 (point is inside of it).

**Return type** float

**coords**

Get the xy-coordinates as an \((N, 2)\) ndarray.

Added in 0.4.0.

**Returns** An \((N, 2)\) float32 ndarray with \(N=1\) containing the coordinates of this keypoint.

**Return type** ndarray

**coords_almost_equals** *(self, other, max_distance=0.0001)*

Estimate if this and another KP have almost identical coordinates.

Added in 0.4.0.

**Parameters**

- **other** *(imgaug.augmentables.kps.Keypoint or iterable)* – The other keypoint with which to compare this one. If this is an iterable, it is assumed to contain the xy-coordinates of a keypoint.

- **max_distance** *(number, optional)* – The maximum euclidean distance between a this keypoint and the other one. If the distance is exceeded, the two keypoints are not viewed as equal.

**Returns** Whether the two keypoints have almost identical coordinates.

**Return type** bool

**copy** *(self, x=None, y=None)*

Create a shallow copy of the keypoint instance.

**Parameters**

- **x** *(None or number, optional)* – Coordinate of the keypoint on the x axis. If None, the instance’s value will be copied.

- **y** *(None or number, optional)* – Coordinate of the keypoint on the y axis. If None, the instance’s value will be copied.

**Returns** Shallow copy.

**Return type** imgaug.augmentables.kps.Keypoint

**deepcopy** *(self, x=None, y=None)*

Create a deep copy of the keypoint instance.

**Parameters**

- **x** *(None or number, optional)* – Coordinate of the keypoint on the x axis. If None, the instance’s value will be copied.

- **y** *(None or number, optional)* – Coordinate of the keypoint on the y axis. If None, the instance’s value will be copied.
Returns Deep copy.

Return type `imgaug.augmentables.kps.Keypoint`

draw_on_image (self, image, color=(0, 255, 0), alpha=1.0, size=3, copy=True, raise_if_out_of_image=False)

Draw the keypoint onto a given image.

The keypoint is drawn as a square.

Parameters

- **image** ((H,W,3) ndarray) – The image onto which to draw the keypoint.
- **color** (int or list of int or tuple of int or (3,) ndarray, optional) – The RGB color of the keypoint. If a single `int C`, then that is equivalent to `(C,C,C)`.
- **alpha** (float, optional) – The opacity of the drawn keypoint, where 1.0 denotes a fully visible keypoint and 0.0 an invisible one.
- **size** (int, optional) – The size of the keypoint. If set to `S`, each square will have size `S x S`.
- **copy** (bool, optional) – Whether to copy the image before drawing the keypoint.
- **raise_if_out_of_image** (bool, optional) – Whether to raise an exception if the keypoint is outside of the image.

Returns image – Image with drawn keypoint.

Return type (H,W,3) ndarray

generate_similar_points_manhattan (self, nb_steps, step_size, return_array=False)

Generate nearby points based on Manhattan distance.

To generate the first neighbouring points, a distance of `S` (step size) is moved from the center point (this keypoint) to the top, right, bottom and left, resulting in four new points. From these new points, the pattern is repeated. Overlapping points are ignored.

The resulting points have a shape similar to a square rotated by 45 degrees.

Parameters

- **nb_steps** (int) – The number of steps to move from the center point. `nb_steps=1` results in a total of 5 output points (one center point + four neighbours).
- **step_size** (number) – The step size to move from every point to its neighbours.
- **return_array** (bool, optional) – Whether to return the generated points as a list of `Keypoint` or an array of shape `(N, 2)`, where `N` is the number of generated points and the second axis contains the x-/y-coordinates.

Returns If `return_array` was False, then a list of `Keypoint`. Otherwise a numpy array of shape `(N, 2)`, where `N` is the number of generated points and the second axis contains the x-/y-coordinates. The center keypoint (the one on which this function was called) is always included.

Return type list of imgaug.augmentables.kps.Keypoint or (N,2) ndarray

is_out_of_image (self, image)

Estimate whether this point is outside of the given image plane.

Added in 0.4.0.
Parameters image \((H,W,\ldots)\) ndarray or tuple of int – Image dimensions to use. If an ndarray, its shape will be used. If a tuple, it is assumed to represent the image shape and must contain at least two integers.

Returns True is the point is inside the image plane, False otherwise.

Return type bool

project (self, from_shape, to_shape)
Project the keypoint onto a new position on a new image.

E.g. if the keypoint is on its original image at \(x=(10 \text{ of } 100 \text{ pixels})\) and \(y=(20 \text{ of } 100 \text{ pixels})\) and is projected onto a new image with size \((\text{width}=200, \text{height}=200)\), its new position will be \((20, 40)\).

This is intended for cases where the original image is resized. It cannot be used for more complex changes (e.g. padding, cropping).

Parameters

- from_shape (tuple of int) – Shape of the original image. (Before resize.)
- to_shape (tuple of int) – Shape of the new image. (After resize.)

Returns Keypoint object with new coordinates.

Return type imgaug.augmentables.kps.Keypoint

project (self, from_shape, to_shape)
Project in-place the keypoint onto a new position on a new image.

E.g. if the keypoint is on its original image at \(x=(10 \text{ of } 100 \text{ pixels})\) and \(y=(20 \text{ of } 100 \text{ pixels})\) and is projected onto a new image with size \((\text{width}=200, \text{height}=200)\), its new position will be \((20, 40)\).

This is intended for cases where the original image is resized. It cannot be used for more complex changes (e.g. padding, cropping).

Added in 0.4.0.

Parameters

- from_shape (tuple of int) – Shape of the original image. (Before resize.)
- to_shape (tuple of int) – Shape of the new image. (After resize.)

Returns Keypoint object with new coordinates. The instance of the keypoint may have been modified in-place.

Return type imgaug.augmentables.kps.Keypoint

shift (self, x=0, y=0)
Move the keypoint around on an image.

Parameters

- x (number, optional) – Move by this value on the x axis.
- y (number, optional) – Move by this value on the y axis.

Returns Keypoint object with new coordinates.

Return type imgaug.augmentables.kps.Keypoint

shift (self, x=0, y=0)
Move the keypoint around on an image in-place.
Parameters

- **x** (number, optional) – Move by this value on the x axis.
- **y** (number, optional) – Move by this value on the y axis.

Returns Keypoint object with new coordinates. The instance of the keypoint may have been modified in-place.

Return type `imgaug.augmentables.kps.Keypoint`

**x_int**

Get the keypoint’s x-coordinate, rounded to the closest integer.

Returns result – Keypoint’s x-coordinate, rounded to the closest integer.

Return type int

**xy**

Get the keypoint’s x- and y-coordinate as a single array.

Added in 0.4.0.

Returns A `(2,)` ndarray denoting the xy-coordinate pair.

Return type ndarray

**xy_int**

Get the keypoint’s xy-coord, rounded to closest integer.

Added in 0.4.0.

Returns A `(2,)` ndarray denoting the xy-coordinate pair.

Return type ndarray

**y_int**

Get the keypoint’s y-coordinate, rounded to the closest integer.

Returns result – Keypoint’s y-coordinate, rounded to the closest integer.

Return type int

**class** `imgaug.augmentables.kps.KeypointsOnImage(keypoints, shape)`

Bases: `imgaug.augmentables.base.IAugmentable`

Container for all keypoints on a single image.

Parameters

- **keypoints** (list of `imgaug.augmentables.kps.Keypoint`) – List of keypoints on the image.
- **shape** (tuple of int or ndarray) – The shape of the image on which the objects are placed. Either an image with shape `(H, W, [C])` or a tuple denoting such an image shape.

Examples

```python
>>> import numpy as np
>>> from imgaug.augmentables.kps import Keypoint, KeypointsOnImage
>>> image = np.zeros((70, 70))
>>> kps = [Keypoint(x=10, y=20), Keypoint(x=34, y=60)]
>>> kps_oi = KeypointsOnImage(kps, shape=image.shape)
```
Attributes

- **empty** Determine whether this object contains zero keypoints.
- **height** Get the image height.
- **items** Get the keypoints in this container.
- **width** Get the image width.

Methods

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clip_out_of_image(self)

Remove all KPs that are outside of the image plane.

This method exists for consistency with other augmentables, e.g. bounding boxes.
Added in 0.4.0.

**Returns**  Keypoints that are inside the image plane.

**Return type**  `imgaug.augmentables.kps.KeypointsOnImage`

`clip_out_of_image_` *(self)*

Remove all KPs that are outside of the image plane.

This method exists for consistency with other augmentables, e.g. bounding boxes.

Added in 0.4.0.

**Returns**  Keypoints that are inside the image plane. The object may have been modified in-place.

**Return type**  `imgaug.augmentables.kps.KeypointsOnImage`

`copy` *(self, keypoints=None, shape=None)*

Create a shallow copy of the `KeypointsOnImage` object.

**Parameters**

- **keypoints** *(None or list of `imgaug.Keypoint`, optional)* – List of keypoints on the image. If None, the instance’s keypoints will be copied.

- **shape** *(tuple of int, optional)* – The shape of the image on which the keypoints are placed. If None, the instance’s shape will be copied.

**Returns**  Shallow copy.

**Return type**  `imgaug.augmentables.kps.KeypointsOnImage`

`deepcopy` *(self, keypoints=None, shape=None)*

Create a deep copy of the `KeypointsOnImage` object.

**Parameters**

- **keypoints** *(None or list of `imgaug.Keypoint`, optional)* – List of keypoints on the image. If None, the instance’s keypoints will be copied.

- **shape** *(tuple of int, optional)* – The shape of the image on which the keypoints are placed. If None, the instance’s shape will be copied.

**Returns**  Deep copy.

**Return type**  `imgaug.augmentables.kps.KeypointsOnImage`

`draw_on_image` *(self, image, color=(0, 255, 0), alpha=1.0, size=3, copy=True, raise_if_out_of_image=False)*

Draw all keypoints onto a given image.

Each keypoint is drawn as a square of provided color and size.

**Parameters**

- **image** *(`(H,W,3)` ndarray)* – The image onto which to draw the keypoints. This image should usually have the same shape as set in `KeypointsOnImage.shape`.

- **color** *(int or list of int or tuple of int or (3,) ndarray, optional)* – The RGB color of all keypoints. If a single int C, then that is equivalent to `(C,C,C)`.

- **alpha** *(float, optional)* – The opacity of the drawn keypoint, where 1.0 denotes a fully visible keypoint and 0.0 an invisible one.

- **size** *(int, optional)* – The size of each point. If set to C, each square will have size C × C.

- **copy** *(bool, optional)* – Whether to copy the image before drawing the points.
• `raise_if_out_of_image` *(bool, optional)* – Whether to raise an exception if any keypoint is outside of the image.

**Returns**  Image with drawn keypoints.

**Return type**  (H,W,3) ndarray

**empty**
Determine whether this object contains zero keypoints.

**Returns**  True if this object contains zero keypoints.

**Return type**  bool

**fill_from_xy_array** *(self, xy)*
Modify the keypoint coordinates of this instance in-place.

**Note:** This currently expects that `xy` contains exactly as many coordinates as there are keypoints in this instance. Otherwise, an `AssertionError` will be raised.

Added in 0.4.0.

**Parameters**  `xy` *(\(N, 2\) ndarray or iterable of iterable of number)* – Coordinates of \(N\) keypoints on an image, given as a \((N, 2)\) array of xy-coordinates. \(N\) must match the number of keypoints in this instance.

**Returns**  This instance itself, with updated keypoint coordinates. Note that the instance was modified in-place.

**Return type**  `KeypointsOnImage`

**static from_coords_array** *(coords, shape)*
Deprecated. Use `KeypointsOnImage.from_xy_array()` instead.

Convert an \((N, 2)\) array to a `KeypointsOnImage` object.

**Parameters**

`coords`  \([(N, 2)\] ndarrays\)]
Coordinates of \(N\) keypoints on an image, given as a \((N, 2)\) array of xy-coordinates.

`shape`  [tuple] The shape of the image on which the keypoints are placed.

**Returns**

`imgaug.augmentables.kps.KeypointsOnImage`  `KeypointsOnImage` object containing the array’s keypoints.

**static from_distance_maps** *(distance_maps, inverted=False, if_not_found_coords={'x': -1, 'y': -1}, threshold=None, nb_channels=None)*
Convert outputs of `to_distance_maps()` to `KeypointsOnImage`.

This is the inverse of `KeypointsOnImage.to_distance_maps()`.

**Parameters**

• `distance_maps` *(\(H,W,N\) ndarrays)* – The distance maps. \(N\) is the number of keypoints.

• `inverted` *(bool, optional)* – Whether the given distance maps were generated in inverted mode (i.e. `KeypointsOnImage.to_distance_maps()` was called with `inverted=True`) or in non-inverted mode.
• if_not_found_coords (tuple or list or dict or None, optional) – Coordinates to use for keypoints that cannot be found in distance_maps.
  – If this is a list/tuple, it must contain two int values.
  – If it is a dict, it must contain the keys x and y with each containing one int value.
  – If this is None, then the keypoint will not be added to the final KeypointsOnImage object.

• threshold (float, optional) – The search for keypoints works by searching for the argmin (non-inverted) or argmax (inverted) in each channel. This parameters contains the maximum (non-inverted) or minimum (inverted) value to accept in order to view a hit as a keypoint. Use None to use no min/max.

• nb_channels (None or int, optional) – Number of channels of the image on which the keypoints are placed. Some keypoint augmenters require that information. If set to None, the keypoint’s shape will be set to (height, width), otherwise (height, width, nb_channels).

Returns The extracted keypoints.

Return type imgaug.augmentables.kps.KeypointsOnImage

static from_keypoint_image(image, if_not_found_coords={'x': -1, 'y': -1}, threshold=1, nb_channels=None)
Convert to_keypoint_image() outputs to KeypointsOnImage.

This is the inverse of KeypointsOnImage.to_keypoint_image().

Parameters

• image ((H,W,N) ndarray) – The keypoints image. N is the number of keypoints.

• if_not_found_coords (tuple or list or dict or None, optional) – Coordinates to use for keypoints that cannot be found in image.
  – If this is a list/tuple, it must contain two int values.
  – If it is a dict, it must contain the keys x and y with each containing one int value.
  – If this is None, then the keypoint will not be added to the final KeypointsOnImage object.

• threshold (int, optional) – The search for keypoints works by searching for the argmax in each channel. This parameters contains the minimum value that the max must have in order to be viewed as a keypoint.

• nb_channels (None or int, optional) – Number of channels of the image on which the keypoints are placed. Some keypoint augmenters require that information. If set to None, the keypoint’s shape will be set to (height, width), otherwise (height, width, nb_channels).

Returns The extracted keypoints.

Return type imgaug.augmentables.kps.KeypointsOnImage

classmethod from_xy_array(xy, shape)
Convert an (N,2) array to a KeypointsOnImage object.

Parameters

• xy ((N, 2) ndarray or iterable of iterable of number) – Coordinates of N keypoints on an image, given as a (N,2) array of xy-coordinates.

• shape (tuple of int or ndarray) – The shape of the image on which the keypoints are placed.
Returns \texttt{KeypointsOnImage} object containing the array’s keypoints.

Return type \texttt{imgaug.augmentables.kps.KeypointsOnImage}

\texttt{get_coords_array}(\texttt{self})

Deprecated. Use \texttt{KeypointsOnImage.to_xy_array()} instead.

Convert all keypoint coordinates to an array of shape $(N,2)$.

Returns

$(N, 2) \, \texttt{ndarray}$ Array containing the coordinates of all keypoints. $N$ denotes the number of keypoints. The second axis denotes the x/y-coordinates.

\texttt{height}

Get the image height.

Returns Image height.

Return type \texttt{int}

\texttt{invert_to_keypoints_on_image_}(\texttt{self}, \texttt{kpsoi})

Invert the output of \texttt{to_keypoints_on_image()} in-place.

This function writes in-place into this \texttt{KeypointsOnImage} instance.

Added in 0.4.0.

Parameters \texttt{kpsoi} (\texttt{imgaug.augmentables.kps.KeypointsOnImages}) – Keypoints to copy data from, i.e. the outputs of \texttt{to_keypoints_on_image()}.

Returns Keypoints container with updated coordinates. Note that the instance is also updated in-place.

Return type \texttt{KeypointsOnImage}

\texttt{items}

Get the keypoints in this container.

Added in 0.4.0.

Returns Keypoints within this container.

Return type \texttt{list of Keypoint}

\texttt{on}(\texttt{self}, \texttt{image})

Project all keypoints from one image shape to a new one.

Parameters \texttt{image} (\texttt{ndarray or tuple of int}) – New image onto which the keypoints are to be projected. May also simply be that new image’s shape tuple.

Returns Object containing all projected keypoints.

Return type \texttt{imgaug.augmentables.kps.KeypointsOnImage}

\texttt{on_}(\texttt{self}, \texttt{image})

Project all keypoints from one image shape to a new one in-place.

Added in 0.4.0.

Parameters \texttt{image} (\texttt{ndarray or tuple of int}) – New image onto which the keypoints are to be projected. May also simply be that new image’s shape tuple.

Returns Object containing all projected keypoints. The object may have been modified in-place.

Return type \texttt{imgaug.augmentables.kps.KeypointsOnImage}
remove_out_of_image_fraction (self, fraction)

Remove all KPs with an out of image fraction of at least fraction.

This method exists for consistency with other augmentables, e.g. bounding boxes.

Added in 0.4.0.

Parameters fraction (number) – Minimum out of image fraction that a keypoint has to have in order to be removed. Note that any keypoint can only have a fraction of either 1.0 (is outside) or 0.0 (is inside). Set this to $0.0 + \epsilon$ to remove all points that are outside of the image. Setting this to 0.0 will remove all points.

Returns Reduced set of keypoints, with those that had an out of image fraction greater or equal the given one removed.

Return type imgaug.augmentables.kps.KeypointsOnImage

remove_out_of_image_fraction_ (self, fraction)

Remove all KPs with an OOI fraction of at least fraction in-place.

‘OOI’ is the abbreviation for ‘out of image’.

This method exists for consistency with other augmentables, e.g. bounding boxes.

Added in 0.4.0.

Parameters fraction (number) – Minimum out of image fraction that a keypoint has to have in order to be removed. Note that any keypoint can only have a fraction of either 1.0 (is outside) or 0.0 (is inside). Set this to $0.0 + \epsilon$ to remove all points that are outside of the image. Setting this to 0.0 will remove all points.

Returns Reduced set of keypoints, with those that had an out of image fraction greater or equal the given one removed. The object may have been modified in-place.

Return type imgaug.augmentables.kps.KeypointsOnImage

shift (self, x=0, y=0)

Move the keypoints on the x/y-axis.

Parameters

• x (number, optional) – Move each keypoint by this value on the x axis.

• y (number, optional) – Move each keypoint by this value on the y axis.

Returns Keypoints after moving them.

Return type imgaug.augmentables.kps.KeypointsOnImage

shift_ (self, x=0, y=0)

Move the keypoints on the x/y-axis in-place.

Added in 0.4.0.

Parameters

• x (number, optional) – Move each keypoint by this value on the x axis.

• y (number, optional) – Move each keypoint by this value on the y axis.

Returns Keypoints after moving them. The object and its items may have been modified in-place.

Return type imgaug.augmentables.kps.KeypointsOnImage
**to_distance_maps** *(self, inverted=False)*

Generate a \((H, W, N)\) array of distance maps for \(N\) keypoints.

The \(n\)-th distance map contains at every location \((y, x)\) the euclidean distance to the \(n\)-th keypoint.

This function can be used as a helper when augmenting keypoints with a method that only supports the augmentation of images.

**Parameters**

- **inverted** *(bool, optional)* – If True, inverted distance maps are returned where each distance value \(d\) is replaced by \(d/(d+1)\), i.e. the distance maps have values in the range \((0.0, 1.0]\) with 1.0 denoting exactly the position of the respective keypoint.

**Returns**

A float32 array containing \(N\) distance maps for \(N\) keypoints. Each location \((y, x, n)\) in the array denotes the euclidean distance at \((y, x)\) to the \(n\)-th keypoint. If inverted is True, the distance \(d\) is replaced by \(d/(d+1)\). The height and width of the array match the height and width in KeypointsOnImage.shape.

**Return type** *(H,W,N) ndarray*

**to_keypoint_image** *(self, size=1)*

Create an \((H, W, N)\) image with keypoint coordinates set to 255.

This method generates a new uint8 array of shape \((H, W, N)\), where \(H\) is the .shape height, \(W\) the .shape width and \(N\) is the number of keypoints. The array is filled with zeros. The coordinate of the \(n\)-th keypoint is set to 255 in the \(n\)-th channel.

This function can be used as a helper when augmenting keypoints with a method that only supports the augmentation of images.

**Parameters**

- **size** *(int)* – Size of each (squared) point.

**Returns**

Image in which the keypoints are marked. \(H\) is the height, defined in KeypointsOnImage.shape[0] (analogous \(W\)). \(N\) is the number of keypoints.

**Return type** *(H,W,N) ndarray*

**to_keypoints_on_image** *(self)*

Convert the keypoints to one KeypointsOnImage instance.

This method exists for consistency with BoundingBoxesOnImage, PolygonsOnImage and LineStringsOnImage.

Added in 0.4.0.

**Returns**

Copy of this keypoints instance.

**Return type** imgaug.augmentables.kps.KeypointsOnImage

**to_xy_array** *(self)*

Convert all keypoint coordinates to an array of shape \((N, 2)\).

**Returns**

Array containing the coordinates of all keypoints. \(N\) denotes the number of keypoints. The second axis denotes the x/y-coordinates.

**Return type** \((N, 2)\) ndarray

**width**

Get the image width.

**Returns**

Image width.

**Return type** \(\text{int}\)

**compute_geometric_median** *(points=None, eps=1e-05, X=None)*

Estimate the geometric median of points in 2D.
Parameters

- **points** `(N,2) ndarray` – Points in 2D. Second axis must be given in xy-form.
- **eps** `(float, optional)` – Distance threshold when to return the median.
- **X** `(None or (N,2) ndarray, optional)` – Deprecated.

Returns

Geometric median as xy-coordinate.

Return type

`(2,) ndarray`

### 13.12 imgaug.augmentables.lines

Classes representing lines.

```python
class imgaug.augmentables.lines.LineString(coords, label=None)
```

Bases: `object`

Class representing line strings.

A line string is a collection of connected line segments, each having a start and end point. Each point is given as its `(x, y)` absolute (sub-)pixel coordinates. The end point of each segment is also the start point of the next segment.

The line string is not closed, i.e. start and end point are expected to differ and will not be connected in drawings.

Parameters

- **coords** `(iterable of tuple of number or ndarray)` – The points of the line string.
- **label** `(None or str, optional)` – The label of the line string.

Attributes

- `height` Compute the height of a bounding box encapsulating the line.
- `length` Compute the total euclidean length of the line string.
- `width` Compute the width of a bounding box encapsulating the line.
- `xx` Get an array of x-coordinates of all points of the line string.
- `xx_int` Get an array of discrete x-coordinates of all points.
- `yy` Get an array of y-coordinates of all points of the line string.
- `yy_int` Get an array of discrete y-coordinates of all points.

Methods

```python
almost_equals(self, other[, max_distance, ...])` Compare this and another line string.
```

```python
clip_out_of_image(self, image) Clip off all parts of the line string that are outside of the image.
```

```python
compute_distance(self, other[, default]) Compute the minimal distance between the line string and other.
```

```python
compute_neighbour_distances(self) Compute the euclidean distance between each two consecutive points.
```

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<td>Create a deep copy of this line string.</td>
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<tr>
<td><code>is_fully_within_image(self, image[, default])</code></td>
<td>Estimate whether the line string is fully inside an image plane.</td>
</tr>
<tr>
<td><code>is_out_of_image(self, image[, fully, ...])</code></td>
<td>Estimate whether the line is partially/fully outside of the image area.</td>
</tr>
<tr>
<td><code>is_partly_within_image(self, image[, default])</code></td>
<td>Estimate whether the line string is at least partially inside the image.</td>
</tr>
<tr>
<td><code>project(self, from_shape, to_shape)</code></td>
<td>Project the line string onto a differently shaped image.</td>
</tr>
<tr>
<td><code>project_(self, from_shape, to_shape)</code></td>
<td>Project the line string onto a differently shaped image in-place.</td>
</tr>
<tr>
<td><code>shift(self[, x, y, top, right, bottom, left])</code></td>
<td>Move this line string along the x/y-axis.</td>
</tr>
<tr>
<td><code>shift_(self[, x, y])</code></td>
<td>Move this line string along the x/y-axis in-place.</td>
</tr>
<tr>
<td><code>subdivide(self, points_per_edge)</code></td>
<td>Derive a new line string with N interpolated points per edge.</td>
</tr>
<tr>
<td><code>to_bounding_box(self)</code></td>
<td>Generate a bounding box encapsulating the line string.</td>
</tr>
<tr>
<td><code>to_heatmap(self, image_shape[, size_lines, ...])</code></td>
<td>Generate a heatmap object from the line string.</td>
</tr>
<tr>
<td><code>to_keypoints(self)</code></td>
<td>Convert the line string points to keypoints.</td>
</tr>
<tr>
<td><code>to_polygon(self)</code></td>
<td>Generate a polygon from the line string points.</td>
</tr>
<tr>
<td><code>to_segmentation_map(self, image_shape[, ...])</code></td>
<td>Generate a segmentation map object from the line string.</td>
</tr>
</tbody>
</table>

`almost_equals (self, other, max_distance=0.0001, points_per_edge=8)`

Compare this and another line string.
Parameters

- **other** *(<class>imgaug.augmentables.lines.LineString) – The other object to compare against. Expected to be a LineString.)*

- **max_distance** *(float, optional) – See coords_almost_equals().)*

- **points_per_edge** *(int, optional) – See coords_almost_equals().)*

Returns True if the coordinates are almost equal and additionally the labels are equal. Otherwise False.

Return type bool

**clip_out_of_image**(self, image)

Clip off all parts of the line string that are outside of the image.

Parameters

- **image** *(ndarray or tuple of int) – Either an image with shape \((H,W,[C])\) or a tuple denoting such an image shape.)*

Returns Line strings, clipped to the image shape. The result may contain any number of line strings, including zero.

Return type list of imgaug.augmentables.lines.LineString

**compute_distance**(self, other, default=None)

Compute the minimal distance between the line string and other.

Parameters

- **other** *(tuple of number or imgaug.augmentables.kps.Keypoint or imgaug.augmentables.LineString) – Other object to which to compute the distance.)*

- **default** *(any) – Value to return if this line string or other contain no points.)*

Returns Minimal distance to other or default if no distance could be computed.

Return type float or any

**compute_neighbour_distances**(self)

Compute the euclidean distance between each two consecutive points.

Returns *(N-1,) float32 array of euclidean distances between point pairs. Same order as in coords.)*

Return type ndarray

**compute_out_of_image_fraction**(self, image)

Compute fraction of polygon area outside of the image plane.

This estimates \(f = A_{ooi} / A\), where \(A_{ooi}\) is the area of the polygon that is outside of the image plane, while \(A\) is the total area of the bounding box.

Added in 0.4.0.

Parameters

- **image** *(\((H,W,\ldots)\) ndarray or tuple of int) – Image dimensions to use. If an ndarray, its shape will be used. If a tuple, it is assumed to represent the image shape and must contain at least two integers.)*

Returns Fraction of the polygon area that is outside of the image plane. Returns 0.0 if the polygon is fully inside of the image plane. If the polygon has an area of zero, the polygon is treated similarly to a LineString, i.e. the fraction of the line that is inside the image plane is returned.

Return type float
compute_pointwise_distances (self, other, default=None)
Compute min distances between points of this and another line string.

Parameters

- other (tuple of number or imgaug.augmentables.kps.Keypoint or imgaug.augmentables.LineString) – Other object to which to compute the distances.
- default (any) – Value to return if other contains no points.

Returns For each coordinate of this line string, the distance to any closest location on other. default if no distance could be computed.

Return type list of float or any

calculate (self, other)
Concatenate this line string with another one.
This will add a line segment between the end point of this line string and the start point of other.

Parameters other (imgaug.augmentables.lines.LineString or ndarray or iterable of tuple of number) – The points to add to this line string.

Returns New line string with concatenated points. The label of this line string will be kept.

Return type imgaug.augmentables.lines.LineString

contains (self, other, max_distance=0.0001)
Estimate whether a point is on this line string.
This method uses a maximum distance to estimate whether a point is on a line string.

Parameters

- other (tuple of number or imgaug.augmentables.kps.Keypoint) – Point to check for.
- max_distance (float) – Maximum allowed euclidean distance between the point and the closest point on the line. If the threshold is exceeded, the point is not considered to fall on the line.

Returns True if the point is on the line string, False otherwise.

Return type bool

coords_almost_equals (self, other, max_distance=0.0001, points_per_edge=8)
Compare this and another LineString’s coordinates.

This is an approximate method based on pointwise distances and can in rare corner cases produce wrong outputs.

Parameters

- other (imgaug.augmentables.lines.LineString or tuple of number or ndarray or list of ndarray or list of tuple of number) – The other line string or its coordinates.
- max_distance (float, optional) – Max distance of any point from the other line string before the two line strings are evaluated to be unequal.
- points_per_edge (int, optional) – How many points to interpolate on each edge.

Returns Whether the two LineString’s coordinates are almost identical, i.e. the max distance is below the threshold. If both have no coordinates, True is returned. If only one has no coordinates, False is returned. Beyond that, the number of points is not evaluated.

Return type bool
copy (self, coords=None, label=None)
Create a shallow copy of this line string.

Parameters
• coords (None or iterable of tuple of number or ndarray) – If not None, then the coords of
the copied object will be set to this value.
• label (None or str) – If not None, then the label of the copied object will be set to this
value.

Returns Shallow copy.
Return type imgaug.augmentables.lines.LineString
deepcopy (self, coords=None, label=None)
Create a deep copy of this line string.

Parameters
• coords (None or iterable of tuple of number or ndarray) – If not None, then the coords of
the copied object will be set to this value.
• label (None or str) – If not None, then the label of the copied object will be set to this
value.

Returns Deep copy.
Return type imgaug.augmentables.lines.LineString
draw_heatmap_array (self, image_shape, alpha_lines=1.0, alpha_points=1.0, size_lines=1,
size_points=0, antialiased=True, raise_if_out_of_image=False)
Draw the line segments and points of the line string as a heatmap array.

Parameters
• image_shape (tuple of int) – The shape of the image onto which to draw the line mask.
• alpha_lines (float, optional) – Opacity of the line string. Higher values denote a more
visible line string.
• alpha_points (float, optional) – Opacity of the line string points. Higher values denote a
more visible points.
• size_lines (int, optional) – Thickness of the line segments.
• size_points (int, optional) – Size of the points in pixels.
• antialiased (bool, optional) – Whether to draw the line with anti-aliasing activated.
• raise_if_out_of_image (bool, optional) – Whether to raise an error if the line string is
fully outside of the image. If set to False, no error will be raised and only the parts
inside the image will be drawn.

Returns float32 array of shape image_shape (no channel axis) with drawn line segments and
points. All values are in the interval [0.0, 1.0].
Return type ndarray
draw_lines_heatmap_array (self, image_shape, alpha=1.0, size=1, antialiased=True,
raise_if_out_of_image=False)
Draw the line segments of this line string as a heatmap array.

Parameters
• image_shape (tuple of int) – The shape of the image onto which to draw the line mask.
• **alpha** *(float, optional)* – Opacity of the line string. Higher values denote a more visible line string.

• **size** *(int, optional)* – Thickness of the line segments.

• **antialiased** *(bool, optional)* – Whether to draw the line with anti-aliasing activated.

• **raise_if_out_of_image** *(bool, optional)* – Whether to raise an error if the line string is fully outside of the image. If set to **False**, no error will be raised and only the parts inside the image will be drawn.

Returns float32 array of shape `image_shape` (no channel axis) with drawn line string. All values are in the interval `[0.0, 1.0]`.

Return type `ndarray`

draw_lines_on_image *(self, image, color=(0, 255, 0), alpha=1.0, size=3, antialiased=True, raise_if_out_of_image=False)*

Draw the line segments of this line string on a given image.

Parameters

• **image** *(ndarray or tuple of int)* – The image onto which to draw. Expected to be `uint8` and of shape `(H, W, C)` with `C` usually being 3 (other values are not tested). If a tuple, expected to be `(H, W, C)` and will lead to a new `uint8` array of zeros being created.

• **color** *(int or iterable of int)* – Color to use as RGB, i.e. three values.

• **alpha** *(float, optional)* – Opacity of the line string. Higher values denote a more visible line string.

• **size** *(int, optional)* – Thickness of the line segments.

• **antialiased** *(bool, optional)* – Whether to draw the line with anti-aliasing activated.

• **raise_if_out_of_image** *(bool, optional)* – Whether to raise an error if the line string is fully outside of the image. If set to **False**, no error will be raised and only the parts inside the image will be drawn.

Returns `image` with line drawn on it.

Return type `ndarray`

draw_mask *(self, image_shape, size_lines=1, size_points=0, raise_if_out_of_image=False)*

Draw this line segment as a binary image mask.

Parameters

• **image_shape** *(tuple of int)* – The shape of the image onto which to draw the line mask.

• **size_lines** *(int, optional)* – Thickness of the line segments.

• **size_points** *(int, optional)* – Size of the points in pixels.

• **raise_if_out_of_image** *(bool, optional)* – Whether to raise an error if the line string is fully outside of the image. If set to **False**, no error will be raised and only the parts inside the image will be drawn.

Returns Boolean line mask of shape `image_shape` (no channel axis).

Return type `ndarray`

draw_on_image *(self, image, color=(0, 255, 0), color_lines=None, color_points=None, alpha=1.0, alpha_lines=None, alpha_points=None, size=1, size_lines=None, size_points=None, antialiased=True, raise_if_out_of_image=False)*

Draw this line string onto an image.
Parameters

- **image** *(ndarray)* — The \((H,W,C)\)* uint8 image onto which to draw the line string.
- **color** *(iterable of int, optional)* — Color to use as RGB, i.e. three values. The color of the line and points are derived from this value, unless they are set.
- **color_lines** *(None or iterable of int)* — Color to use for the line segments as RGB, i.e. three values. If None, this value is derived from color.
- **color_points** *(None or iterable of int)* — Color to use for the points as RGB, i.e. three values. If None, this value is derived from 0.5 * color.
- **alpha** *(float, optional)* — Opacity of the line string. Higher values denote more visible points. The alphas of the line and points are derived from this value, unless they are set.
- **alpha_lines** *(None or float, optional)* — Opacity of the line string. Higher values denote more visible line string. If None, this value is derived from alpha.
- **alpha_points** *(None or float, optional)* — Opacity of the line string points. Higher values denote more visible points. If None, this value is derived from alpha.
- **size** *(int, optional)* — Size of the line string. The sizes of the line and points are derived from this value, unless they are set.
- **size_lines** *(None or int, optional)* — Thickness of the line segments. If None, this value is derived from size.
- **size_points** *(None or int, optional)* — Size of the points in pixels. If None, this value is derived from 3 * size.
- **antialiased** *(bool, optional)* — Whether to draw the line with anti-aliasing activated. This does currently not affect the point drawing.
- **raise_if_out_of_image** *(bool, optional)* — Whether to raise an error if the line string is fully outside of the image. If set to False, no error will be raised and only the parts inside the image will be drawn.

Returns Image with line string drawn on it.

Return type ndarray

draw_points_heatmap_array *(self, image_shape, alpha=1.0, size=1, raise_if_out_of_image=False)*

Draw the points of this line string as a heatmap array.

Parameters

- **image_shape** *(tuple of int)* — The shape of the image onto which to draw the point mask.
- **alpha** *(float, optional)* — Opacity of the line string points. Higher values denote a more visible points.
- **size** *(int, optional)* — Size of the points in pixels.
- **raise_if_out_of_image** *(bool, optional)* — Whether to raise an error if the line string is fully outside of the image. If set to False, no error will be raised and only the parts inside the image will be drawn.

Returns float32 array of shape image_shape (no channel axis) with drawn line string points. All values are in the interval \([0.0, 1.0]\).

Return type ndarray
**draw_points_on_image** (self, image, color=(0, 128, 0), alpha=1.0, size=3, copy=True, raise_if_out_of_image=False)

Draw the points of this line string onto a given image.

**Parameters**

- **image** *(ndarray or tuple of int)* – The image onto which to draw. Expected to be uint8 and of shape (H, W, C) with C usually being 3 (other values are not tested). If a tuple, expected to be (H, W, C) and will lead to a new uint8 array of zeros being created.
- **color** *(iterable of int)* – Color to use as RGB, i.e. three values.
- **alpha** *(float, optional)* – Opacity of the line string points. Higher values denote a more visible points.
- **size** *(int, optional)* – Size of the points in pixels.
- **copy** *(bool, optional)* – Whether it is allowed to draw directly in the input array (False) or it has to be copied (True). The routine may still have to copy, even if copy=False was used. Always use the return value.
- **raise_if_out_of_image** *(bool, optional)* – Whether to raise an error if the line string is fully outside of the image. If set to False, no error will be raised and only the parts inside the image will be drawn.

**Returns** float32 array of shape image_shape (no channel axis) with drawn line string points. All values are in the interval [0.0, 1.0].

**Return type** ndarray

**extract_from_image** (self, image, size=1, pad=True, pad_max=None, antialiased=True, prevent_zero_size=True)

Extract all image pixels covered by the line string.

This will only extract pixels overlapping with the line string. As a rectangular image array has to be returned, non-overlapping pixels will be set to zero.

This function will by default zero-pad the image if the line string is partially/fully outside of the image. This is for consistency with the same methods for bounding boxes and polygons.

**Parameters**

- **image** *(ndarray)* – The image of shape (H,W,[C]) from which to extract the pixels within the line string.
- **size** *(int, optional)* – Thickness of the line.
- **pad** *(bool, optional)* – Whether to zero-pad the image if the object is partially/fully outside of it.
- **pad_max** *(None or int, optional)* – The maximum number of pixels that may be zero-padded on any side, i.e. if this has value N the total maximum of added pixels is 4*N. This option exists to prevent extremely large images as a result of single points being moved very far away during augmentation.
- **antialiased** *(bool, optional)* – Whether to apply anti-aliasing to the line string.
- **prevent_zero_size** *(bool, optional)* – Whether to prevent height or width of the extracted image from becoming zero. If this is set to True and height or width of the line string is below 1, the height/width will be increased to 1. This can be useful to prevent problems, e.g. with image saving or plotting. If it is set to False, images will be returned as (H', W') or (H', W', 3) with H or W potentially being 0.
Returns Pixels overlapping with the line string. Zero-padded if the line string is partially/fully outside of the image and pad=True. If prevent_zero_size is activated, it is guaranteed that H'>0 and W'>0, otherwise only H'>=0 and W'>=0.

Return type (H',W') ndarray or (H',W',C) ndarray

find_intersections_with (self, other)
Find all intersection points between this line string and other.

Parameters
other (tuple of number or list of tuple of number or list of LineString or LineString) – The other geometry to use during intersection tests.

Returns All intersection points. One list per pair of consecutive start and end point, i.e. N-I lists of N points. Each list may be empty or may contain multiple points.

Return type list of list of tuple of number

get_pointwise_inside_image_mask (self, image)
Determine per point whether it is inside of a given image plane.

Parameters
image (ndarray or tuple of int) – Either an image with shape (H,W,[C]) or a tuple denoting such an image shape.

Returns (N,) bool array with one value for each of the N points indicating whether it is inside of the provided image plane (True) or not (False).

Return type ndarray

height
Compute the height of a bounding box encapsulating the line.

The height is computed based on the two points with lowest and largest y-coordinates.

Returns The height of the line string.

Return type float

is_fully_within_image (self, image, default=False)
Estimate whether the line string is fully inside an image plane.

Parameters
• image (ndarray or tuple of int) – Either an image with shape (H,W,[C]) or a tuple denoting such an image shape.
• default (any) – Default value to return if the line string contains no points.

Returns True if the line string is fully inside the image area. False otherwise. Will return default if this line string contains no points.

Return type bool or any

is_out_of_image (self, image, fully=True, partly=False, default=True)
Estimate whether the line is partially/fully outside of the image area.

Parameters
• image (ndarray or tuple of int) – Either an image with shape (H,W,[C]) or a tuple denoting such an image shape.
• fully (bool, optional) – Whether to return True if the line string is fully outside of the image area.
• partly (bool, optional) – Whether to return True if the line string is at least partially outside of the image area.
• **default** *(any)* – Default value to return if the line string contains no points.

**Returns**  
- **True** if the line string is partially/fully outside of the image area, depending on defined parameters.  
- **False** otherwise. Will return **default** if this line string contains no points.

**Return type**  
bool or any

**is_partly_within_image** *(self, image, default=False)*  
Estimate whether the line string is at least partially inside the image.

**Parameters**
- **image** *(ndarray or tuple of int)* – Either an image with shape *(H,W,[C])* or a tuple denoting such an image shape.  
- **default** *(any)* – Default value to return if the line string contains no points.

**Returns**  
- **True** if the line string is at least partially inside the image area.  
- **False** otherwise. Will return **default** if this line string contains no points.

**Return type**  
bool or any

**length**
Compute the total euclidean length of the line string.

**Returns**  
The length based on euclidean distance, i.e. the sum of the lengths of each line segment.

**Return type**  
float

**project** *(self, from_shape, to_shape)*  
Project the line string onto a differently shaped image.

E.g. if a point of the line string is on its original image at *(x=10 of 100 pixels)* and *(y=20 of 100 pixels)* and is projected onto a new image with size *(width=200, height=200)*, its new position will be *(x=20, y=40)*.

This is intended for cases where the original image is resized. It cannot be used for more complex changes (e.g. padding, cropping).

**Parameters**
- **from_shape** *(tuple of int or ndarray)* – Shape of the original image. (Before resize.)  
- **to_shape** *(tuple of int or ndarray)* – Shape of the new image. (After resize.)

**Returns**  
Line string with new coordinates.

**Return type**  
`imgaug.augmentables.lines.LineString`

**project** *(self, from_shape, to_shape)*  
Project the line string onto a differently shaped image in-place.

E.g. if a point of the line string is on its original image at *(x=10 of 100 pixels)* and *(y=20 of 100 pixels)* and is projected onto a new image with size *(width=200, height=200)*, its new position will be *(x=20, y=40)*.

This is intended for cases where the original image is resized. It cannot be used for more complex changes (e.g. padding, cropping).

Added in 0.4.0.

**Parameters**
- **from_shape** *(tuple of int or ndarray)* – Shape of the original image. (Before resize.)  
- **to_shape** *(tuple of int or ndarray)* – Shape of the new image. (After resize.)
Returns Line string with new coordinates. The object may have been modified in-place.

Return type `imgaug.augmentables.lines.LineString`

**shift** *(self, x=0, y=0, top=None, right=None, bottom=None, left=None)*

Move this line string along the x/y-axis.

The origin \((0, 0)\) is at the top left of the image.

Parameters

- **x** *(number, optional)* – Value to be added to all x-coordinates. Positive values shift towards the right images.
- **y** *(number, optional)* – Value to be added to all y-coordinates. Positive values shift towards the bottom images.
- **top** *(None or int, optional)* – Deprecated since 0.4.0. Amount of pixels by which to shift this object from the top (towards the bottom).
- **right** *(None or int, optional)* – Deprecated since 0.4.0. Amount of pixels by which to shift this object from the right (towards the left).
- **bottom** *(None or int, optional)* – Deprecated since 0.4.0. Amount of pixels by which to shift this object from the bottom (towards the top).
- **left** *(None or int, optional)* – Deprecated since 0.4.0. Amount of pixels by which to shift this object from the left (towards the right).

Returns result – Shifted line string.

Return type `imgaug.augmentables.lines.LineString`

**shift_** *(self, x=0, y=0)*

Move this line string along the x/y-axis in-place.

The origin \((0, 0)\) is at the top left of the image.

Added in 0.4.0.

Parameters

- **x** *(number, optional)* – Value to be added to all x-coordinates. Positive values shift towards the right images.
- **y** *(number, optional)* – Value to be added to all y-coordinates. Positive values shift towards the bottom images.

Returns result – Shifted line string. The object may have been modified in-place.

Return type `imgaug.augmentables.lines.LineString`

**subdivide** *(self, points_per_edge)*

Derive a new line string with \(N\) interpolated points per edge.

The interpolated points have (per edge) regular distances to each other.

For each edge between points \(A\) and \(B\) this adds points at \(A + \left( \frac{i}{(1+N)} \right) \times (B - A)\), where \(i\) is the index of the added point and \(N\) is the number of points to add per edge.

Calling this method two times will split each edge at its center and then again split each newly created edge at their center. It is equivalent to calling **subdivide**(3).

Parameters **points_per_edge** *(int)* – Number of points to interpolate on each edge.

Returns Line string with subdivided edges.
Return type `imgaug.augmentables.lines.LineString` to_bounding_box (self)
Generate a bounding box encapsulating the line string.

Returns Bounding box encapsulating the line string. None if the line string contained no points.
Return type None or `imgaug.augmentables.bbs.BoundingBox` to_heatmap (self, image_shape, size_lines=1, size_points=0, antialiased=True, raise_if_out_of_image=False)
Generate a heatmap object from the line string.

This is similar to `draw_lines_heatmap_array()`, executed with alpha=1.0. The result is wrapped in a `HeatmapsOnImage` object instead of just an array. No points are drawn.

Parameters
- **image_shape** (tuple of int) – The shape of the image onto which to draw the line mask.
- **size_lines** (int, optional) – Thickness of the line.
- **size_points** (int, optional) – Size of the points in pixels.
- **antialiased** (bool, optional) – Whether to draw the line with anti-aliasing activated.
- **raise_if_out_of_image** (bool, optional) – Whether to raise an error if the line string is fully outside of the image. If set to False, no error will be raised and only the parts inside the image will be drawn.

Returns Heatmap object containing drawn line string.
Return type `imgaug.augmentables.heatmaps.HeatmapsOnImage` to_keypoints (self)
Convert the line string points to keypoints.

Returns Points of the line string as keypoints.
Return type list of `imgaug.augmentables.kps.Keypoint` to_polygon (self)
Generate a polygon from the line string points.

Returns Polygon with the same corner points as the line string. Note that the polygon might be invalid, e.g. contain less than 3 points or have self-intersections.
Return type `imgaug.augmentables.polys.Polygon` to_segmentation_map (self, image_shape, size_lines=1, size_points=0, raise_if_out_of_image=False)
Generate a segmentation map object from the line string.

This is similar to `draw_mask()`. The result is wrapped in a `SegmentationMapsOnImage` object instead of just an array.

Parameters
- **image_shape** (tuple of int) – The shape of the image onto which to draw the line mask.
- **size_lines** (int, optional) – Thickness of the line.
- **size_points** (int, optional) – Size of the points in pixels.
- **raise_if_out_of_image** (bool, optional) – Whether to raise an error if the line string is fully outside of the image. If set to False, no error will be raised and only the parts inside the image will be drawn.
Returns  Segmentation map object containing drawn line string.
Return type  `imgaug.augmentables.segmaps.SegmentationMapsOnImage`

**width**
Compute the width of a bounding box encapsulating the line.
The width is computed based on the two points with lowest and largest x-coordinates.

**Returns**  The width of the line string.
**Return type**  `float`

**xx**
Get an array of x-coordinates of all points of the line string.

**Returns**  `float32` x-coordinates of the line string points.
**Return type**  `ndarray`

**xx_int**
Get an array of discrete x-coordinates of all points.
The conversion from `float32` coordinates to `int32` is done by first rounding the coordinates to the closest integer and then removing everything after the decimal point.

**Returns**  `int32` x-coordinates of the line string points.
**Return type**  `ndarray`

**yy**
Get an array of y-coordinates of all points of the line string.

**Returns**  `float32` y-coordinates of the line string points.
**Return type**  `ndarray`

**yy_int**
Get an array of discrete y-coordinates of all points.
The conversion from `float32` coordinates to `int32` is done by first rounding the coordinates to the closest integer and then removing everything after the decimal point.

**Returns**  `int32` y-coordinates of the line string points.
**Return type**  `ndarray`

```python
class imgaug.augmentables.lines.LineStringsOnImage(line_strings, shape)
Bases: imgaug.augmentables.base.IAugmentable
```
Object that represents all line strings on a single image.

**Parameters**
- **line_strings** (`list of imgaug.augmentables.lines.LineString`) – List of line strings on the image.
- **shape** (`tuple of int or ndarray`) – The shape of the image on which the objects are placed. Either an image with shape `(H, W, [C])` or a `tuple` denoting such an image shape.

**Examples**
```python
>>> import numpy as np
>>> from imgaug.augmentables.lines import LineString, LineStringsOnImage

>>> image = np.zeros((100, 100))
>>> lss = [
>>>     LineString([(0, 0), (10, 0)]),
>>>     LineString([(10, 20), (30, 30), (50, 70)])
>>> ]
>>> lsoi = LineStringsOnImage(lss, shape=image.shape)
```

### Attributes

- **empty** Estimate whether this object contains zero line strings.
- **items** Get the line strings in this container.

### Methods

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</table>
| remove_out_of_image_fraction(self, fraction) | Remove all LS with an out of image fraction of at  
fraction |
| shift_(self, x, y, top, right, bottom, left)| Move the line strings along the x/y-axis in-place.                          |
| to_keypoints_on_image_(self)               | Convert the line strings to one KeypointsOnImage instance.                  |
| to_xy_array_(self)                         | Convert all line string coordinates to one array of shape \((N,2)\).       |
| to_xy_array_(self, dtype)                  | Convert this object to an iterable of \((M, 2)\) arrays of points.         |
clip_out_of_image (self)
Clip off all parts of the line strings that are outside of an image.

Note: The result can contain fewer line strings than the input did. That happens when a polygon is fully outside of the image plane.

Note: The result can also contain more line strings than the input did. That happens when distinct parts of a line string are only connected by line segments that are outside of the image plane and hence will be clipped off, resulting in two or more unconnected line string parts that are left in the image plane.

Returns Line strings, clipped to fall within the image dimensions. The count of output line strings may differ from the input count.
Return type imgaug.augmentables.lines.LineStringsOnImage

clip_out_of_image_ (self)
Clip off all parts of the LSs that are outside of an image in-place.

Note: The result can contain fewer line strings than the input did. That happens when a polygon is fully outside of the image plane.

Note: The result can also contain more line strings than the input did. That happens when distinct parts of a line string are only connected by line segments that are outside of the image plane and hence will be clipped off, resulting in two or more unconnected line string parts that are left in the image plane.

Added in 0.4.0.

Returns Line strings, clipped to fall within the image dimensions. The count of output line strings may differ from the input count.
Return type imgaug.augmentables.lines.LineStringsOnImage

copy (self, line_strings=None, shape=None)
Create a shallow copy of this object.

Parameters

• line_strings (None or list of imgaug.augmentables.lines.LineString, optional) – List of line strings on the image. If not None, then the line_strings attribute of the copied object will be set to this value.

• shape (None or tuple of int or ndarray, optional) – The shape of the image on which the objects are placed. Either an image with shape (H, W, [C]) or a tuple denoting such an image shape. If not None, then the shape attribute of the copied object will be set to this value.

Returns Shallow copy.
Return type imgaug.augmentables.lines.LineStringsOnImage
deepcopy (self, line_strings=None, shape=None)
Create a deep copy of the object.

Parameters
• **line_strings** (*None* or list of *imgaug.augmentables.lines.LineString*, *optional*) – List of line strings on the image. If not *None*, then the **line_strings** attribute of the copied object will be set to this value.

• **shape** (*None* or tuple of *int* or *ndarray*, *optional*) – The shape of the image on which the objects are placed. Either an image with shape \((H, W, [C])\) or a tuple denoting such an image shape. If not *None*, then the **shape** attribute of the copied object will be set to this value.

**Returns** Deep copy.

**Return type** `imgaug.augmentables.lines.LineStringsOnImage`

### draw_on_image

`draw_on_image` *(self, image, color=(0, 255, 0), color_lines=None, color_points=None, alpha=1.0, alpha_lines=None, alpha_points=None, size=1, size_lines=None, size_points=None, antialiased=True, raise_if_out_of_image=False)*

Draw all line strings onto a given image.

**Parameters**

• **image** (*ndarray*) – The \((H, W, C)\) uint8 image onto which to draw the line strings.

• **color** (*iterable of *int*, *optional*) – Color to use as RGB, i.e. three values. The color of the lines and points are derived from this value, unless they are set.

• **color_lines** (*None* or *iterable of *int*) – Color to use for the line segments as RGB, i.e. three values. If *None*, this value is derived from **color**.

• **color_points** (*None* or *iterable of *int*) – Color to use for the points as RGB, i.e. three values. If *None*, this value is derived from \(0.5 \times \text{color}\).

• **alpha** (*float*, *optional*) – Opacity of the line strings. Higher values denote more visible points. The alphas of the line and points are derived from this value, unless they are set.

• **alpha_lines** (*None* or *float*, *optional*) – Opacity of the line strings. Higher values denote more visible line string. If *None*, this value is derived from **alpha**.

• **alpha_points** (*None* or *float*, *optional*) – Opacity of the line string points. Higher values denote more visible points. If *None*, this value is derived from **alpha**.

• **size** (*int*, *optional*) – Size of the line strings. The sizes of the line and points are derived from this value, unless they are set.

• **size_lines** (*None* or *int*, *optional*) – Thickness of the line segments. If *None*, this value is derived from **size**.

• **size_points** (*None* or *int*, *optional*) – Size of the points in pixels. If *None*, this value is derived from \(3 \times \text{size}\).

• **antialiased** (*bool*, *optional*) – Whether to draw the lines with anti-aliasing activated. This does currently not affect the point drawing.

• **raise_if_out_of_image** (*bool*, *optional*) – Whether to raise an error if a line string is fully outside of the image. If set to *False*, no error will be raised and only the parts inside the image will be drawn.

**Returns** Image with line strings drawn on it.

**Return type** `ndarray`

### empty

`empty` – Estimate whether this object contains zero line strings.

**Returns** *True* if this object contains zero line strings.
Return type  bool

fill_from_xy_array_(self, xy)
Modify the corner coordinates of all line strings in-place.

Note: This currently expects that \(xy\) contains exactly as many coordinates as the line strings within this instance have corner points. Otherwise, an \(AssertionError\) will be raised.

Added in 0.4.0.

Parameters  **xy** ((\(N, 2\) ndarray or iterable of iterable of number) – XY-Coordinates of \(N\) corner points. \(N\) must match the number of corner points in all line strings within this instance.

Returns  This instance itself, with updated coordinates. Note that the instance was modified in-place.

Return type  \(LineStringsOnImage\)

classmethod from_xy_arrays (xy, shape)
Convert an \((N, M, 2)\) ndarray to a \(LineStringsOnImage\) object.

This is the inverse of \(to_xy_array()\).

Parameters

- **xy** ((\(N,M,2\) ndarray or iterable of \((M,2)\) ndarray) – Array containing the point coordinates \(N\) line strings with each \(M\) points given as \((x,y)\) coordinates. \(M\) may differ if an iterable of arrays is used. Each array should usually be of dtype \(float32\).

- **shape** (tuple of int) – \((H,W,[C])\) shape of the image on which the line strings are placed.

Returns  Object containing a list of \(LineString\) objects following the provided point coordinates.

Return type  \(imgaug.augmentables.lines.LineStringsOnImage\)

invert_to_keypoints_on_image_(self, kpsoi)
Invert the output of \(to_keypoints_on_image()\) in-place.

This function writes in-place into this \(LineStringsOnImage\) instance.

Added in 0.4.0.

Parameters  **kpsoi** (\(imgaug.augmentables.kps.KeypointsOnImages\)) – Keypoints to convert back to line strings, i.e. the outputs of \(to_keypoints_on_image()\).

Returns  Line strings container with updated coordinates. Note that the instance is also updated in-place.

Return type  \(LineStringsOnImage\)

items
Get the line strings in this container.

Added in 0.4.0.

Returns  Line strings within this container.

Return type  list of \(LineString\)

on (self, image)
Project the line strings from one image shape to a new one.
Parameters image (ndarray or tuple of int) – The new image onto which to project. Either an image with shape $$(H, W, [C])$$ or a tuple denoting such an image shape.

Returns Object containing all projected line strings.

Return type imgaug.augmentables.lines.LineStrings

on_ (self, image)
Project the line strings from one image shape to a new one in-place.
Added in 0.4.0.

Parameters image (ndarray or tuple of int) – The new image onto which to project. Either an image with shape $$(H, W, [C])$$ or a tuple denoting such an image shape.

Returns Object containing all projected line strings. The object and its items may have been modified in-place.

Return type imgaug.augmentables.lines.LineStrings

remove_out_of_image (self, fully=True, partly=False)
Remove all line strings that are fully/partially outside of an image.

Parameters
  • fully (bool, optional) – Whether to remove line strings that are fully outside of the image.
  • partly (bool, optional) – Whether to remove line strings that are partially outside of the image.

Returns Reduced set of line strings. Those that are fully/partially outside of the given image plane are removed.

Return type imgaug.augmentables.lines.LineStringsOnImage

remove_out_of_image_ (self, fully=True, partly=False)
Remove all LS that are fully/partially outside of an image in-place.
Added in 0.4.0.

Parameters
  • fully (bool, optional) – Whether to remove line strings that are fully outside of the image.
  • partly (bool, optional) – Whether to remove line strings that are partially outside of the image.

Returns Reduced set of line strings. Those that are fully/partially outside of the given image plane are removed. The object and its items may have been modified in-place.

Return type imgaug.augmentables.lines.LineStringsOnImage

remove_out_of_image_fraction (self, fraction)
Remove all LS with an out of image fraction of at least fraction.

Parameters fraction (number) – Minimum out of image fraction that a line string has to have in order to be removed. A fraction of 1.0 removes only line strings that are 100% outside of the image. A fraction of 0.0 removes all line strings.

Returns Reduced set of line strings, with those that had an out of image fraction greater or equal the given one removed.

Return type imgaug.augmentables.lines.LineStringsOnImage
**remove_out_of_image_fraction** *(self, fraction)*

Remove all LS with an OOI fraction of at least `fraction` in-place.

'OOI' is the abbreviation for 'out of image'.

Added in 0.4.0.

**Parameters**

- **fraction** *(number)* – Minimum out of image fraction that a line string has to have in order to be removed. A fraction of 1.0 removes only line strings that are 100% outside of the image. A fraction of 0.0 removes all line strings.

**Returns** Reduced set of line strings, with those that had an out of image fraction greater or equal the given one removed. The object and its items may have been modified in-place.

**Return type** `imgaug.augmentables.lines.LineStringsOnImage`

**shift** *(self, x=0, y=0, top=None, right=None, bottom=None, left=None)*

Move the line strings along the x/y-axis.

The origin (0, 0) is at the top left of the image.

**Parameters**

- **x** *(number, optional)* – Value to be added to all x-coordinates. Positive values shift towards the right images.
- **y** *(number, optional)* – Value to be added to all y-coordinates. Positive values shift towards the bottom images.
- **top** *(None or int, optional)* – Deprecated since 0.4.0. Amount of pixels by which to shift all objects from the top (towards the bottom).
- **right** *(None or int, optional)* – Deprecated since 0.4.0. Amount of pixels by which to shift all objects from the right (towards the left).
- **bottom** *(None or int, optional)* – Deprecated since 0.4.0. Amount of pixels by which to shift all objects from the bottom (towards the top).
- **left** *(None or int, optional)* – Deprecated since 0.4.0. Amount of pixels by which to shift all objects from the left (towards the right).

**Returns** Shifted line strings.

**Return type** `imgaug.augmentables.lines.LineStringsOnImage`

**shift** *(self, x=0, y=0)*

Move the line strings along the x/y-axis in-place.

The origin (0, 0) is at the top left of the image.

Added in 0.4.0.

**Parameters**

- **x** *(number, optional)* – Value to be added to all x-coordinates. Positive values shift towards the right images.
- **y** *(number, optional)* – Value to be added to all y-coordinates. Positive values shift towards the bottom images.

**Returns** Shifted line strings. The object and its items may have been modified in-place.

**Return type** `imgaug.augmentables.lines.LineStringsOnImage`
to_keypoints_on_image(self)
    Convert the line strings to one KeypointsOnImage instance.
    Added in 0.4.0.
    Returns A keypoints instance containing \(N\) coordinates for a total of \(N\) points in the coords
    attributes of all line strings. Order matches the order in line_strings and coords
    attributes.
    Return type `imgaug.augmentables.kps.KeypointsOnImage`

to_xy_array(self)
    Convert all line string coordinates to one array of shape \((N, 2)\).
    Added in 0.4.0.
    Returns Array containing all xy-coordinates of all line strings within this instance.
    Return type \((N, 2)\) ndarray

to_xy_arrays(self, dtype=<class 'numpy.float32'>)
    Convert this object to an iterable of \((M, 2)\) arrays of points.
    This is the inverse of from_xy_array().
    Parameters dtype (numpy.dtype, optional) – Desired output datatype of the ndarray.
    Returns The arrays of point coordinates, each given as \((M, 2)\).
    Return type list of ndarray

13.13 imgaug.augmentables.normalization

Functions dealing with normalization of user input data to imgaug classes.

imgaug.augmentables.normalization.estimate_bounding_boxes_norm_type(bounding_boxes)
imgaug.augmentables.normalization.estimate_heatmaps_norm_type(heatmaps)
imgaug.augmentables.normalization.estimate_keypoints_norm_type(keypoints)
imgaug.augmentables.normalization.estimate_line_strings_norm_type(line_strings)
imgaug.augmentables.normalization.estimate_normalization_type(inputs)
imgaug.augmentables.normalization.estimate_polygons_norm_type(polygons)
imgaug.augmentables.normalization.estimate_segmaps_norm_type(segmentation_maps)
imgaug.augmentables.normalization.find_first_nonempty(attr, parents=None)
imgaug.augmentables.normalization.invert_normalize_bounding_boxes(bounding_boxes, bounding_boxes_old)
imgaug.augmentables.normalization.invert_normalize_heatmaps(heatmaps, heatmaps_old)
imgaug.augmentables.normalization.invert_normalize_images(images, images_old)
imgaug.augmentables.normalization.invert_normalize_keypoints(keypoints, keypoints_old)
imgaug.augmentables.normalization.invert_normalize_line_strings(line_strings, line_strings_old)
Classes dealing with polygons.

class imgaug.augmentables.polys.MultiPolygon(geoms)
    Bases: object
    Class that represents several polygons.

    Parameters
    geoms (list of imgaug.augmentables.polys.Polygon) – List of the polygons.

    Methods

    from_shapely(geometry[, label]) Create a MultiPolygon from a shapely object.

    static from_shapely(geometry, label=None)
    Create a MultiPolygon from a shapely object.

    This also creates all necessary Polygon's contained in this MultiPolygon.

    Parameters
    • geometry (shapely.geometry.MultiPolygon or shapely.geometry.Polygon or
      shapely.geometry.collection.GeometryCollection) – The object to convert to a Mul-
      tiPolygon.

    • label (None or str, optional) – A label assigned to all Polygons within the MultiPolygon.

    Returns
    The derived MultiPolygon.

    Return type imgaug.augmentables.polys.MultiPolygon

class imgaug.augmentables.polys.Polygon(exterior, label=None)
    Bases: object
    Class representing polygons.
Each polygon is parameterized by its corner points, given as absolute x- and y-coordinates with sub-pixel accuracy.

**Parameters**

- **exterior** (list of `imgaug.augmentables.kps.Keypoint` or list of tuple of float or (N,2) ndarray)
  - List of points defining the polygon. May be either a list of `Keypoint` objects or a list of tuples in xy-form or a numpy array of shape (N,2) for N points in xy-form. All coordinates are expected to be the absolute subpixel-coordinates on the image, given as floats, e.g. \(x=10.7\) and \(y=3.4\) for a point at coordinates \((10.7, 3.4)\). Their order is expected to be clock-wise. They are expected to not be closed (i.e. first and last coordinate differ).

- **label** (None or str, optional) – Label of the polygon, e.g. a string representing the class.

**Attributes**

- **area** Compute the area of the polygon.
- **coords** Alias for attribute exterior.
- **height** Compute the height of a bounding box encapsulating the polygon.
- **is_valid** Estimate whether the polygon has a valid geometry.
- **width** Compute the width of a bounding box encapsulating the polygon.
- **xx** Get the x-coordinates of all points on the exterior.
- **xx_int** Get the discretized x-coordinates of all points on the exterior.
- **yy** Get the y-coordinates of all points on the exterior.
- **yy_int** Get the discretized y-coordinates of all points on the exterior.

**Methods**

- `almost_equals(self, other[, max_distance, ...])` Estimate if this polygon’s and another’s geometry/labels are similar.
- `change_first_point_by_coords(self, x, y[, ...])` Reorder exterior points so that the point closest to given x/y is first.
- `change_first_point_by_index(self, point_idx)` Reorder exterior points so that the point with given index is first.
- `clip_out_of_image(self, image)` Cut off all parts of the polygon that are outside of an image.
- `compute_out_of_image_area(self, image)` Compute the area of the BB that is outside of the image plane.
- `compute_out_of_image_fraction(self, image)` Compute fraction of polygon area outside of the image plane.
- `coords_almost_equals(self, other[, ...])` Alias for `Polygon.exterior_almost_equals()`. Create a shallow copy of this object.
- `cut_out_of_image(self, image)` Deprecated.
- `deepcopy(self[, exterior, label])` Create a deep copy of this object.
- `draw_on_image(self[, image[, color, ...]])` Draw the polygon on an image.
- `exterior_almost_equals(self, other[, ...])` Estimate if this and another polygon’s exterior are almost identical.

Continued on next page
### extract_from_image

**Function:** 
`extract_from_image(self, image)`

**Description:**
Extract all image pixels within the polygon area.

### find_closest_point_index

**Function:** 
`find_closest_point_index(self, x, y[, ...])`

**Description:**
Find the index of the exterior point closest to given coordinates.

### from_shapely

**Function:** 
`from_shapely(polygon_shapely[, label])`

**Description:**
Create a polygon from a Shapely Polygon.

### is_fully_within_image

**Function:** 
`is_fully_within_image(self, image)`

**Description:**
Estimate whether the polygon is fully inside an image plane.

### is_out_of_image

**Function:** 
`is_out_of_image(self, image[, fully, partly])`

**Description:**
Estimate whether the polygon is partially/fully outside of an image.

### is_partly_within_image

**Function:** 
`is_partly_within_image(self, image)`

**Description:**
Estimate whether the polygon is at least partially inside an image.

### project

**Function:** 
`project(self, from_shape, to_shape)`

**Description:**
Project the polygon onto an image with different shape.

### project_

**Function:** 
`project_(self, from_shape, to_shape)`

**Description:**
Project the polygon onto an image with different shape in-place.

### shift

**Function:** 
`shift(self[, x, y, top, right, bottom, left])`

**Description:**
Move this polygon along the x/y-axis.

### shift_

**Function:** 
`shift_(self[, x, y])`

**Description:**
Move this polygon along the x/y-axis in-place.

### subdivide

**Function:** 
`subdivide(self, points_per_edge)`

**Description:**
Derive a new polygon with \(N\) interpolated points per edge.

### subdivide_

**Function:** 
`subdivide_(self, points_per_edge)`

**Description:**
Derive a new polygon with \(N\) interpolated points per edge in-place.

### to_bounding_box

**Function:** 
`to_bounding_box(self)`

**Description:**
Convert this polygon to a bounding box containing the polygon.

### to_keypoints

**Function:** 
`to_keypoints(self)`

**Description:**
Convert this polygon’s exterior to Keypoint instances.

### to_line_string

**Function:** 
`to_line_string(self[, closed])`

**Description:**
Convert this polygon’s exterior to a LineString instance.

### to_shapely_line_string

**Function:** 
`to_shapely_line_string(self[, closed, ...])`

**Description:**
Convert this polygon to a Shapely LineString object.

### to_shapely_polygon

**Function:** 
`to_shapely_polygon(self)`

**Description:**
Convert this polygon to a Shapely Polygon.

---

**almost_equals** 

**Function:** 
`almost_equals(self, other, max_distance=0.0001, points_per_edge=8)`

**Description:**
Estimate if this polygon’s and another’s geometry/labels are similar.

This is the same as `exterior_almost_equals()` but additionally compares the labels.

**Parameters**

- **other** (imgaug.augmentables.polys.Polygon) – The other object to compare against. Expected to be a Polygon.
- **max_distance** (float, optional) – See `exterior_almost_equals()`.
- **points_per_edge** (int, optional) – See `exterior_almost_equals()`.

**Returns** True if the coordinates are almost equal and additionally the labels are equal. Otherwise False.

**Return type** bool

### area

**Function:** 
Compute the area of the polygon.

**Returns** Area of the polygon.

**Return type** number
**change_first_point_by_coords** (self, x, y, max_distance=0.0001, raise_if_too_far_away=True)

Reorder exterior points so that the point closest to given x/y is first.

This method takes a given (x, y) coordinate, finds the closest corner point on the exterior and reorders all exterior corner points so that the found point becomes the first one in the array.

If no matching points are found, an exception is raised.

**Parameters**

- **x** (number) – X-coordinate of the point.
- **y** (number) – Y-coordinate of the point.
- **max_distance** (None or number, optional) – Maximum distance past which possible matches are ignored. If None the distance limit is deactivated.
- **raise_if_too_far_away** (bool, optional) – Whether to raise an exception if the closest found point is too far away (True) or simply return an unchanged copy if this object (False).

**Returns** Copy of this polygon with the new point order.

**Return type** `imgaug.augmentables.polys.Polygon`

**change_first_point_by_index** (self, point_idx)

Reorder exterior points so that the point with given index is first.

This method takes a given index and reorders all exterior corner points so that the point with that index becomes the first one in the array.

An `AssertionError` will be raised if the index does not match any exterior point’s index or the exterior does not contain any points.

**Parameters** **point_idx** (int) – Index of the desired starting point.

**Returns** Copy of this polygon with the new point order.

**Return type** `imgaug.augmentables.polys.Polygon`

**clip_out_of_image** (self, image)

Cut off all parts of the polygon that are outside of an image.

This operation may lead to new points being created. As a single polygon may be split into multiple new polygons, the result is always a list, which may contain more than one output polygon.

This operation will return an empty list if the polygon is completely outside of the image plane.

**Parameters** **image** (tuple of int, ndarray) – Image dimensions to use for the clipping of the polygon. If an ndarray, its shape will be used. If a tuple, it is assumed to represent the image shape and must contain at least two int s.

**Returns** Polygon, clipped to fall within the image dimensions. Returned as a list, because the clipping can split the polygon into multiple parts. The list may also be empty, if the polygon was fully outside of the image plane.

**Return type** list of `imgaug.augmentables.polys.Polygon`

**compute_out_of_image_area** (self, image)

Compute the area of the BB that is outside of the image plane.

Added in 0.4.0.
Parameters `image` ((H,W,...) ndarray or tuple of int) – Image dimensions to use. If an ndarray, its shape will be used. If a tuple, it is assumed to represent the image shape and must contain at least two integers.

Returns Total area of the bounding box that is outside of the image plane. Can be 0.0.

Return type float

`compute_out_of_image_fraction` (self, image)
Compute fraction of polygon area outside of the image plane.

This estimates \( f = \frac{A_{ooi}}{A} \), where \( A_{ooi} \) is the area of the polygon that is outside of the image plane, while \( A \) is the total area of the bounding box.

Added in 0.4.0.

Parameters `image` ((H,W,...) ndarray or tuple of int) – Image dimensions to use. If an ndarray, its shape will be used. If a tuple, it is assumed to represent the image shape and must contain at least two integers.

Returns Fraction of the polygon area that is outside of the image plane. Returns 0.0 if the polygon is fully inside of the image plane or has zero points. If the polygon has an area of zero, the polygon is treated similarly to a LineString, i.e. the fraction of the line that is outside the image plane is returned.

Return type float

`coords`
Alias for attribute `exterior`.

Added in 0.4.0.

Returns An (N, 2) float32 ndarray containing the coordinates of this polygon. This identical to the attribute `exterior`.

Return type ndarray

`coords_almost_equals` (self, other, max_distance=0.0001, points_per_edge=8)
Alias for `Polygon.exterior_almost_equals()`.

Parameters

- `other` (imgaug.augmentables.polys.Polygon or (N,2) ndarray or list of tuple) – See `exterior_almost_equals()`.
- `max_distance` (number, optional) – See `exterior_almost_equals()`.
- `points_per_edge` (int, optional) – See `exterior_almost_equals()`.

Returns Whether the two polygon’s exteriors can be viewed as equal (approximate test).

Return type bool

`copy` (self, exterior=None, label=None)
Create a shallow copy of this object.

Parameters

- `exterior` (list of imgaug.augmentables.kps.Keypoint or list of tuple or (N,2) ndarray, optional) – List of points defining the polygon. See `__init__()` for details.
- `label` (None or str, optional) – If not None, the label of the copied object will be set to this value.

Returns Shallow copy.
Return type `imgaug.augmentables.polys.Polygon`

cut_out_of_image (self, image)

Deprecation: Use Polygon.clip_out_of_image() instead. clip_out_of_image() has the exactly same interface.

Cut off all parts of the polygon that are outside of an image.

deeppcopy (self, exterior=None, label=None)

Create a deep copy of this object.

Parameters

- exterior (list of Keypoint or list of tuple or (N,2) ndarray, optional) – List of points defining the polygon. See imgaug.augmentables.polys.Polygon.__init__ for details.

- label (None or str) – If not None, the label of the copied object will be set to this value.

Returns Deep copy.

Return type `imgaug.augmentables.polys.Polygon`

draw_on_image (self, image, color=(0, 255, 0), color_face=None, color_lines=None, color_points=None, alpha=1.0, alpha_face=None, alpha_lines=None, alpha_points=None, size=1, size_lines=None, size_points=None, raise_if_out_of_image=False)

Draw the polygon on an image.

Parameters

- image ((H,W,C) ndarray) – The image onto which to draw the polygon. Usually expected to be of dtype uint8, though other dtypes are also handled.

- color (iterable of int, optional) – The color to use for the whole polygon. Must correspond to the channel layout of the image. Usually RGB. The values for color_face, color_lines and color_points will be derived from this color if they are set to None. This argument has no effect if color_face, color_lines and color_points are all set anything other than None.

- color_face (None or iterable of int, optional) – The color to use for the inner polygon area (excluding perimeter). Must correspond to the channel layout of the image. Usually RGB. If this is None, it will be derived from color * 1.0.

- color_lines (None or iterable of int, optional) – The color to use for the line (aka perimeter/border) of the polygon. Must correspond to the channel layout of the image. Usually RGB. If this is None, it will be derived from color * 0.5.

- color_points (None or iterable of int, optional) – The color to use for the corner points of the polygon. Must correspond to the channel layout of the image. Usually RGB. If this is None, it will be derived from color * 0.5.

- alpha (float, optional) – The opacity of the whole polygon, where 1.0 denotes a completely visible polygon and 0.0 an invisible one. The values for alpha_face, alpha_lines and alpha_points will be derived from this alpha value if they are set to None. This argument has no effect if alpha_face, alpha_lines and alpha_points are all set anything other than None.

- alpha_face (None or number, optional) – The opacity of the polygon’s inner area (excluding the perimeter), where 1.0 denotes a completely visible inner area and 0.0 an invisible one. If this is None, it will be derived from alpha * 0.5.

- alpha_lines (None or number, optional) – The opacity of the polygon’s line (aka perimeter/border), where 1.0 denotes a completely visible line and 0.0 an invisible one. If this is None, it will be derived from alpha * 1.0.
**alpha_points** *(None or number, optional)* — The opacity of the polygon’s corner points, where 1.0 denotes completely visible corners and 0.0 invisible ones. If this is None, it will be derived from $\alpha \times 1.0$.

**size** *(int, optional)* — Size of the polygon. The sizes of the line and points are derived from this value, unless they are set.

**size_lines** *(None or int, optional)* — Thickness of the polygon’s line (aka perimeter/border). If None, this value is derived from size.

**size_points** *(int, optional)* — Size of the points in pixels. If None, this value is derived from $3 \times \text{size}$.

**raise_if_out_of_image** *(bool, optional)* — Whether to raise an error if the polygon is fully outside of the image. If set to False, no error will be raised and only the parts inside the image will be drawn.

**Returns** Image with the polygon drawn on it. Result dtype is the same as the input dtype.

**Return type** *(H,W,C) ndarray*

---

**exterior_almost_equals** *(self, other, max_distance=0.0001, points_per_edge=8)*

Estimate if this and another polygon’s exterior are almost identical. The two exteriors can have different numbers of points, but any point randomly sampled on the exterior of one polygon should be close to the closest point on the exterior of the other polygon.

**Parameters**

- **other** *(imgaug.augmentables.polys.Polygon or (N,2) ndarray or list of tuple)* — The other polygon with which to compare the exterior. If this is an ndarray, it is assumed to represent an exterior. It must then have dtype float32 and shape $(N,2)$ with the second dimension denoting xy-coordinates. If this is a list of tuples, it is assumed to represent an exterior. Each tuple then must contain exactly two numbers, denoting xy-coordinates.

- **max_distance** *(number, optional)* — The maximum euclidean distance between a point on one polygon and the closest point on the other polygon. If the distance is exceeded for any such pair, the two exteriors are not viewed as equal. The points are either the points contained in the polygon’s exterior ndarray or interpolated points between these.

- **points_per_edge** *(int, optional)* — How many points to interpolate on each edge.

**Returns** Whether the two polygon’s exteriors can be viewed as equal (approximate test).

**Return type** *bool*

---

**extract_from_image** *(self, image)*

Extract all image pixels within the polygon area.

This method returns a rectangular image array. All pixels within that rectangle that do not belong to the polygon area will be filled with zeros (i.e. they will be black). The method will also zero-pad the image if the polygon is partially/fully outside of the image.

**Parameters**

- **image** *(H,W) ndarray or (H,W,C) ndarray)* — The image from which to extract the pixels within the polygon.
**Returns**  Pixels within the polygon. Zero-padded if the polygon is partially/fully outside of the image.

**Return type**  (H’,W’) ndarray or (H’,W’,C) ndarray

### find_closest_point_index

```python
find_closest_point_index(self, x, y, return_distance=False)
```

Find the index of the exterior point closest to given coordinates.

“Closeness” is here defined based on euclidean distance. This method will raise an `AssertionError` if the exterior contains no points.

**Parameters**

- **x**  (number) – X-coordinate around which to search for close points.
- **y**  (number) – Y-coordinate around which to search for close points.
- **return_distance**  (bool, optional) – Whether to also return the distance of the closest point.

**Returns**

- **int** – Index of the closest point.
- **number** – Euclidean distance to the closest point. This value is only returned if `return_distance` was set to `True`.

### static from_shapely

```python
static from_shapely(polygon_shapely, label=None)
```

Create a polygon from a `ShapelyPolygon`.

**Note:** This will remove any holes in the shapely polygon.

**Parameters**

- **polygon_shapely**  (`shapely.geometry.Polygon`) – The shapely polygon.
- **label**  (`None or str, optional`) – The label of the new polygon.

**Returns**  A polygon with the same exterior as the `ShapelyPolygon`.

**Return type**  `imgaug.augmentables.polys.Polygon`

### height

Compute the height of a bounding box encapsulating the polygon.

The height is computed based on the two exterior coordinates with lowest and largest x-coordinates.

**Returns**  Height of the polygon.

**Return type**  number

### is_fully_within_image

```python
is_fully_within_image(self, image)
```

Estimate whether the polygon is fully inside an image plane.

**Parameters**

- **image**  (`(H,W,...) ndarray or tuple of int`) – Image dimensions to use. If an `ndarray`, its shape will be used. If a `tuple`, it is assumed to represent the image shape and must contain at least two `int` s.

**Returns**  `True` if the polygon is fully inside the image area. `False` otherwise.

**Return type**  bool

### is_out_of_image

```python
is_out_of_image(self, image, fully=True, partly=False)
```

Estimate whether the polygon is partially/fully outside of an image.
Parameters

- **image** *(ndarray or tuple of int)* – Image dimensions to use. If an ndarray, its shape will be used. If a tuple, it is assumed to represent the image shape and must contain at least two integers.

- **fully** *(bool, optional)* – Whether to return True if the polygon is fully outside of the image area.

- **partly** *(bool, optional)* – Whether to return True if the polygon is at least partially outside of the image area.

**Returns** True if the polygon is partially/fully outside of the image area, depending on defined parameters. False otherwise.

**Return type** bool

**is_partly_within_image** *(self, image)*

Estimate whether the polygon is at least partially inside an image.

**Parameters**

- **image** *(ndarray or tuple of int)* – Image dimensions to use. If an ndarray, its shape will be used. If a tuple, it is assumed to represent the image shape and must contain at least two integers.

**Returns** True if the polygon is at least partially inside the image area. False otherwise.

**Return type** bool

**is_valid**

Estimate whether the polygon has a valid geometry.

To be considered valid, the polygon must be made up of at least 3 points and have a concave shape, i.e., line segments may not intersect or overlap. Multiple consecutive points are allowed to have the same coordinates.

**Returns** True if polygon has at least 3 points and is concave, otherwise False.

**Return type** bool

**project** *(self, from_shape, to_shape)*

Project the polygon onto an image with different shape.

The relative coordinates of all points remain the same. E.g., a point at \((x=20, y=20)\) on an image \((\text{width}=100, \text{height}=200)\) will be projected on a new image \((\text{width}=200, \text{height}=100)\) to \((x=40, y=10)\).

This is intended for cases where the original image is resized. It cannot be used for more complex changes (e.g., padding, cropping).

**Parameters**

- **from_shape** *(tuple of int)* – Shape of the original image. (Before resize.)

- **to_shape** *(tuple of int)* – Shape of the new image. (After resize.)

**Returns** Polygon object with new coordinates.

**Return type** imgaug.augmentables.polys_polygon

**project** *(self, from_shape, to_shape)*

Project the polygon onto an image with different shape in-place.

The relative coordinates of all points remain the same. E.g., a point at \((x=20, y=20)\) on an image \((\text{width}=100, \text{height}=200)\) will be projected on a new image \((\text{width}=200, \text{height}=100)\) to \((x=40, y=10)\).
This is intended for cases where the original image is resized. It cannot be used for more complex changes (e.g. padding, cropping).

Added in 0.4.0.

**Parameters**

- **from_shape** *(tuple of int)* – Shape of the original image. (Before resize.)
- **to_shape** *(tuple of int)* – Shape of the new image. (After resize.)

**Returns** Polygon object with new coordinates. The object may have been modified in-place.

**Return type** `imgaug.augmentables.polys.Polygon`

### shift(self, x=0, y=0, top=None, right=None, bottom=None, left=None)

Move this polygon along the x/y-axis.

The origin *(0, 0)* is at the top left of the image.

**Parameters**

- **x** *(number, optional)* – Value to be added to all x-coordinates. Positive values shift towards the right images.
- **y** *(number, optional)* – Value to be added to all y-coordinates. Positive values shift towards the bottom images.
- **top** *(None or int, optional)* – Deprecated since 0.4.0. Amount of pixels by which to shift this object from the top (towards the bottom).
- **right** *(None or int, optional)* – Deprecated since 0.4.0. Amount of pixels by which to shift this object from the right (towards the left).
- **bottom** *(None or int, optional)* – Deprecated since 0.4.0. Amount of pixels by which to shift this object from the bottom (towards the top).
- **left** *(None or int, optional)* – Deprecated since 0.4.0. Amount of pixels by which to shift this object from the left (towards the right).

**Returns** Shifted polygon.

**Return type** `imgaug.augmentables.polys.Polygon`

### shift_(self, x=0, y=0)

Move this polygon along the x/y-axis in-place.

The origin *(0, 0)* is at the top left of the image.

Added in 0.4.0.

**Parameters**

- **x** *(number, optional)* – Value to be added to all x-coordinates. Positive values shift towards the right images.
- **y** *(number, optional)* – Value to be added to all y-coordinates. Positive values shift towards the bottom images.

**Returns** Shifted polygon. The object may have been modified in-place.

**Return type** `imgaug.augmentables.polys.Polygon`

### subdivide(self, points_per_edge)

Derive a new polygon with \( N \) interpolated points per edge.

See `subdivide()` for details.
Added in 0.4.0.

**Parameters**  
points_per_edge *(int)* – Number of points to interpolate on each edge.  

**Returns**  
Polygon with subdivided edges.  

**Return type**  
*imgaug.augmentables.polys.Polygon*

**subdivide_(self, points_per_edge)**
Derive a new poly with \( N \) interpolated points per edge in-place.

See *subdivide()* for details.

Added in 0.4.0.

**Parameters**  
points_per_edge *(int)* – Number of points to interpolate on each edge.  

**Returns**  
Polygon with subdivided edges. The object may have been modified in-place.  

**Return type**  
*imgaug.augmentables.polys.Polygon*

**to_bounding_box**(self)**
Convert this polygon to a bounding box containing the polygon.

**Returns**  
Bounding box that tightly encapsulates the polygon.  

**Return type**  
*imgaug.augmentables.bbs.BoundingBox*

**to_keypoints**(self)**
Convert this polygon’s exterior to *Keypoint* instances.

**Returns**  
Exterior vertices as *Keypoint* instances.  

**Return type**  
list of *imgaug.augmentables.kps.Keypoint*

**to_line_string**(self, closed=True)**
Convert this polygon’s exterior to a *LineString* instance.

**Parameters**  
- closed *(bool, optional)* – Whether to close the line string, i.e. to add the first point of the exterior also as the last point at the end of the line string. This has no effect if the polygon has a single point or zero points.  

**Returns**  
Exterior of the polygon as a line string.  

**Return type**  
*imgaug.augmentables.lines.LineString*

**to_shapely_line_string**(self, closed=False, interpolate=0)**
Convert this polygon to a *ShapelyLineString* object.

**Parameters**  
- closed *(bool, optional)* – Whether to return the line string with the last point being identical to the first point.  
- interpolate *(int, optional)* – Number of points to interpolate between any pair of two consecutive points. These points are added to the final line string.  

**Returns**  
The *ShapelyLineString* matching the polygon’s exterior.  

**Return type**  
*shapely.geometry.LineString*

**to_shapely_polygon**(self)**
Convert this polygon to a *ShapelyPolygon*.

**Returns**  
The *ShapelyPolygon* matching this polygon’s exterior.  

**Return type**  
*shapely.geometry.Polygon*
width
Compute the width of a bounding box encapsulating the polygon.
The width is computed based on the two exterior coordinates with lowest and largest x-coordinates.

Returns Width of the polygon.
Return type number

xx
Get the x-coordinates of all points on the exterior.

Returns float32 x-coordinates array of all points on the exterior.
Return type (N,2) ndarray

xx_int
Get the discretized x-coordinates of all points on the exterior.
The conversion from float32 coordinates to int32 is done by first rounding the coordinates to the
closest integer and then removing everything after the decimal point.

Returns int32 x-coordinates of all points on the exterior.
Return type (N,2) ndarray

yy
Get the y-coordinates of all points on the exterior.

Returns float32 y-coordinates array of all points on the exterior.
Return type (N,2) ndarray

yy_int
Get the discretized y-coordinates of all points on the exterior.
The conversion from float32 coordinates to int32 is done by first rounding the coordinates to the
closest integer and then removing everything after the decimal point.

Returns int32 y-coordinates of all points on the exterior.
Return type (N,2) ndarray

class imgaug.augmentables.polys.PolygonsOnImage (polygons, shape)
Bases: imgaug.augmentables.base.IAugmentable

Container for all polygons on a single image.

Parameters

• polygons (list of imgaug.augmentables.polys.Polygon) – List of polygons on the image.

• shape (tuple of int or ndarray) – The shape of the image on which the objects are placed.
  Either an image with shape (H, W, [C]) or a tuple denoting such an image shape.

Examples

```python
>>> import numpy as np
>>> from imgaug.augmentables.polys import Polygon, PolygonsOnImage
>>> image = np.zeros((100, 100))
>>> polys = [
>>>     Polygon([(0.5, 0.5), (100.5, 0.5), (100.5, 100.5), (0.5, 100.5)]),
>>>     Polygon([(50.5, 0.5), (100.5, 50.5), (50.5, 100.5), (0.5, 50.5)])
```
```python
>>> |  
>>> polys_oi = PolysOnImage(polys, shape=image.shape)
```

**Attributes**

- **empty** Estimate whether this object contains zero polygons.
- **items** Get the polygons in this container.

**Methods**

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**Note:** The result can contain fewer polygons than the input did. That happens when a polygon is fully outside of the image plane.
**Note:** The result can also contain *more* polygons than the input did. That happens when distinct parts of a polygon are only connected by areas that are outside of the image plane and hence will be clipped off, resulting in two or more unconnected polygon parts that are left in the image plane.

**Returns** Polygons, clipped to fall within the image dimensions. The count of output polygons may differ from the input count.

**Return type** `imgaug.augmentables.polys.PolygonsOnImage`

```python
clip_out_of_image(self)
```

Clip off all parts from all polygons that are OOI in-place.

‘OOI’ is the abbreviation for ‘out of image’.

**Note:** The result can contain fewer polygons than the input did. That happens when a polygon is fully outside of the image plane.

**Added in 0.4.0.**

**Returns** Polygons, clipped to fall within the image dimensions. The count of output polygons may differ from the input count. The object and its items may have been modified in-place.

**Return type** `imgaug.augmentables.polys.PolygonsOnImage`

```python
copy(self, polygons=None, shape=None)
```

Create a shallow copy of this object.

**Parameters**

- **polygons** *(None or list of imgaug.augmentables.polys.Polygons, optional)* – List of polygons on the image. If not None, then the polygons attribute of the copied object will be set to this value.

- **shape** *(None or tuple of int or ndarray, optional)* – The shape of the image on which the objects are placed. Either an image with shape \((H, W, [C])\) or a tuple denoting such an image shape. If not None, then the shape attribute of the copied object will be set to this value.

**Returns** Shallow copy.

**Return type** `imgaug.augmentables.polys.PolygonsOnImage`

```python
deepecopy(self, polygons=None, shape=None)
```

Create a deep copy of this object.

**Parameters**

- **polygons** *(None or list of imgaug.augmentables.polys.Polygons, optional)* – List of polygons on the image. If not None, then the polygons attribute of the copied object will be set to this value.
• **shape** (*None* or *tuple* of *int* or *ndarray*, *optional*) – The shape of the image on which the objects are placed. Either an image with shape \((H, W, [C])\) or a tuple denoting such an image shape. If not *None*, then the *shape* attribute of the copied object will be set to this value.

**Returns** Deep copy.

**Return type** `imgaug.augmentables.polys.PolygonsOnImage`

**draw_on_image** (*self*, *image*, *color=(0, 255, 0)*, *color_face=None*, *color_lines=None*, *color_points=None*, *alpha=1.0*, *alpha_face=None*, *alpha_lines=None*, *alpha_points=None*, *size=1*, *size_lines=None*, *size_points=None*, *raise_if_out_of_image=False*)

Draw all polygons onto a given image.

**Parameters**

• **image** (*\((H,W,C)\*ndarray*) – The image onto which to draw the bounding boxes. This image should usually have the same shape as set in *PolygonsOnImage.shape*.

• **color** (*iterable* of *int*, *optional*) – The color to use for the whole polygons. Must correspond to the channel layout of the image. Usually RGB. The values for *color_face*, *color_lines* and *color_points* will be derived from this color if they are set to *None*. This argument has no effect if *color_face*, *color_lines* and *color_points* are all set anything other than *None*.

• **color_face** (*None* or *iterable* of *int*, *optional*) – The color to use for the inner polygon areas (excluding perimeters). Must correspond to the channel layout of the image. Usually RGB. If this is *None*, it will be derived from *color* *1.0*.

• **color_lines** (*None* or *iterable* of *int*, *optional*) – The color to use for the lines (aka perimeters/borders) of the polygons. Must correspond to the channel layout of the image. Usually RGB. If this is *None*, it will be derived from *color* *0.5*.

• **color_points** (*None* or *iterable* of *int*, *optional*) – The color to use for the corner points of the polygons. Must correspond to the channel layout of the image. Usually RGB. If this is *None*, it will be derived from *color* *0.5*.

• **alpha** (*float*, *optional*) – The opacity of the whole polygons, where 1.0 denotes completely visible polygons and 0.0 invisible ones. The values for *alpha_face*, *alpha_lines* and *alpha_points* will be derived from this alpha value if they are set to *None*. This argument has no effect if *alpha_face*, *alpha_lines* and *alpha_points* are all set anything other than *None*.

• **alpha_face** (*None* or *number*, *optional*) – The opacity of the polygon’s inner areas (excluding the perimeters), where 1.0 denotes completely visible inner areas and 0.0 invisible ones. If this is *None*, it will be derived from *alpha* *0.5*.

• **alpha_lines** (*None* or *number*, *optional*) – The opacity of the polygon’s lines (aka perimeters/borders), where 1.0 denotes completely visible perimeters and 0.0 invisible ones. If this is *None*, it will be derived from *alpha* *1.0*.

• **alpha_points** (*None* or *number*, *optional*) – The opacity of the polygon’s corner points, where 1.0 denotes completely visible corners and 0.0 invisible ones. Currently this is an on/off choice, i.e. only 0.0 or 1.0 are allowed. If this is *None*, it will be derived from *alpha* *1.0*.

• **size** (*int*, *optional*) – Size of the polygons. The sizes of the line and points are derived from this value, unless they are set.

• **size_lines** (*None* or *int*, *optional*) – Thickness of the polygon lines (aka perimeter/border). If *None*, this value is derived from *size*. 


• **size_points** (*int, optional*) – The size of all corner points. If set to C, each corner point will be drawn as a square of size $C \times C$.

• **raise_if_out_of_image** (*bool, optional*) – Whether to raise an error if any polygon is fully outside of the image. If set to False, no error will be raised and only the parts inside the image will be drawn.

Returns Image with drawn polygons.

Return type (H,W,C) ndarray

`empty`

Estimate whether this object contains zero polygons.

Returns True if this object contains zero polygons.

Return type bool

`fill_from_xy_array_` *(self, xy)*

Modify the corner coordinates of all polygons in-place.

Note: This currently expects that *xy* contains exactly as many coordinates as the polygons within this instance have corner points. Otherwise, an `AssertionError` will be raised.

Warning: This does not validate the new coordinates or repair the resulting polygons. If bad coordinates are provided, the result will be invalid polygons (e.g. self-intersections).

Added in 0.4.0.

Parameters xy (*(N, 2) ndarray or iterable of iterable of number*) – XY-Coordinates of N corner points. N must match the number of corner points in all polygons within this instance.

Returns This instance itself, with updated coordinates. Note that the instance was modified in-place.

Return type `PolygonsOnImage`

`invert_to_keypoints_on_image_` *(self, kpsoi)*

Invert the output of `to_keypoints_on_image()` in-place.

This function writes in-place into this `PolygonsOnImage` instance.

Added in 0.4.0.

Parameters kpsoi (*imgaug.augmentables.kps.KeypointsOnImages*) – Keypoints to convert back to polygons, i.e. the outputs of `to_keypoints_on_image()`.

Returns Polygons container with updated coordinates. Note that the instance is also updated in-place.

Return type `PolygonsOnImage`

`items`

Get the polygons in this container.

Added in 0.4.0.

Returns Polygons within this container.

Return type list of Polygon
on (self, image)
Project all polygons from one image shape to a new one.

Parameters image (ndarray or tuple of int) – New image onto which the polygons are to be projected. May also simply be that new image’s shape tuple.

Returns Object containing all projected polygons.
Return type imgaug.augmentables.polys.PolygonsOnImage

on_ (self, image)
Project all polygons from one image shape to a new one in-place.
Added in 0.4.0.

Parameters image (ndarray or tuple of int) – New image onto which the polygons are to be projected. May also simply be that new image’s shape tuple.

Returns Object containing all projected polygons. The object and its items may have been modified in-place.
Return type imgaug.augmentables.polys.PolygonsOnImage

remove_out_of_image (self, fully=True, partly=False)
Remove all polygons that are fully/partially outside of an image.

Parameters
• fully (bool, optional) – Whether to remove polygons that are fully outside of the image.
• partly (bool, optional) – Whether to remove polygons that are partially outside of the image.

Returns Reduced set of polygons. Those that are fully/partially outside of the given image plane are removed.
Return type imgaug.augmentables.polys.PolygonsOnImage

remove_out_of_image_ (self, fully=True, partly=False)
Remove all polygons that are fully/partially OOI in-place.
‘OOI’ is the abbreviation for ‘out of image’.
Added in 0.4.0.

Parameters
• fully (bool, optional) – Whether to remove polygons that are fully outside of the image.
• partly (bool, optional) – Whether to remove polygons that are partially outside of the image.

Returns Reduced set of polygons. Those that are fully/partially outside of the given image plane are removed. The object and its items may have been modified in-place.
Return type imgaug.augmentables.polys.PolygonsOnImage

remove_out_of_image_fraction (self, fraction)
Remove all Polys with an out of image fraction of >=fraction.
Added in 0.4.0.

Parameters fraction (number) – Minimum out of image fraction that a polygon has to have in order to be removed. A fraction of 1.0 removes only polygons that are 100% outside of the image. A fraction of 0.0 removes all polygons.
Returns Reduced set of polygons, with those that had an out of image fraction greater or equal the given one removed.

Return type `imgaug.augmentables.polys.PolygonsOnImage`

`remove_out_of_image_fraction_(self, fraction)`
Remove all Polys with an OOI fraction of \( \geq \text{fraction} \) in-place.
Added in 0.4.0.

Parameters fraction (number) – Minimum out of image fraction that a polygon has to have in order to be removed. A fraction of 1.0 removes only polygons that are 100% outside of the image. A fraction of 0.0 removes all polygons.

Returns Reduced set of polygons, with those that had an out of image fraction greater or equal the given one removed. The object and its items may have been modified in-place.

Return type `imgaug.augmentables.polys.PolygonsOnImage`

`shift (self, x=0, y=0, top=None, right=None, bottom=None, left=None)`
Move the polygons along the x/y-axis.
The origin (0, 0) is at the top left of the image.

Parameters

- x (number, optional) – Value to be added to all x-coordinates. Positive values shift towards the right images.
- y (number, optional) – Value to be added to all y-coordinates. Positive values shift towards the bottom images.
- top (None or int, optional) – Deprecated since 0.4.0. Amount of pixels by which to shift all objects from the top (towards the bottom).
- right (None or int, optional) – Deprecated since 0.4.0. Amount of pixels by which to shift all objects from the right (towards the left).
- bottom (None or int, optional) – Deprecated since 0.4.0. Amount of pixels by which to shift all objects from the bottom (towards the top).
- left (None or int, optional) – Deprecated since 0.4.0. Amount of pixels by which to shift all objects from the left (towards the right).

Returns Shifted polygons.

Return type `imgaug.augmentables.polys.PolygonsOnImage`

`shift_ (self, x=0, y=0)`
Move the polygons along the x/y-axis in-place.
The origin (0, 0) is at the top left of the image.
Added in 0.4.0.

Parameters

- x (number, optional) – Value to be added to all x-coordinates. Positive values shift towards the right images.
- y (number, optional) – Value to be added to all y-coordinates. Positive values shift towards the bottom images.

Returns Shifted polygons.

Return type `imgaug.augmentables.polys.PolygonsOnImage`
subdivide\(\) \(self, points\_per\_edge\) 
Interpolate \(N\) points on each polygon.
Added in 0.4.0.

Parameters points\_per\_edge \(\) (int) -- Number of points to interpolate on each edge.

Returns Subdivided polygons.

Return type \(\) `imgaug.augmentables.polys.PolygonsOnImage`

subdivide\_\(\) \(self, points\_per\_edge\) 
Interpolate \(N\) points on each polygon.
Added in 0.4.0.

Parameters points\_per\_edge \(\) (int) -- Number of points to interpolate on each edge.

Returns Subdivided polygons.

Return type \(\) `imgaug.augmentables.polys.PolygonsOnImage`

to\_keypoints\_on\_image\(\) \(self\) 
Convert the polygons to one KeypointsOnImage instance.
Added in 0.4.0.

Returns A keypoints instance containing \(N\) coordinates for a total of \(N\) points in all exteriors of the polygons within this container. Order matches the order in polygons.

Return type \(\) `imgaug.augmentables.kps.KeypointsOnImage`

to\_xy\_array\(\) \(self\) 
Convert all polygon coordinates to one array of shape \((N, 2)\).
Added in 0.4.0.

Returns Array containing all xy-coordinates of all polygons within this instance.

Return type \(\) `(N, 2)` ndarray

`imgaug.augmentables.polys.recover\_psois\_\(\) \(psois, psois\_orig, recoverer, random\_state\) 
Apply a polygon recoverer to input polygons in-place.

Parameters

- psois \(\) (list of imgaug.augmentables.polys.PolygonsOnImage or imgaug.augmentables.polys.PolygonsOnImage) -- The possibly broken polygons, e.g. after augmentation. The recoverer is applied to them.

- psois\_orig \(\) (list of imgaug.augmentables.polys.PolygonsOnImage or imgaug.augmentables.polys.PolygonsOnImage) -- Original polygons that were later changed to psois. They are an extra input to recoverer.

- recoverer \(\) (imgaug.augmentables.polys._ConcavePolygonRecoverer) -- The polygon recoverer used to repair broken input polygons.

- random\_state \(\) (None or int or RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState) -- An RNG to use during the polygon recovery.

Returns List of repaired polygons. Note that this is psois, which was changed in-place.

Return type \(\) list of imgaug.augmentables.polys.PolygonsOnImage or imgaug.augmentables.polys.PolygonsOnImage
13.15 imgaug.augmentables.segmaps

Classes dealing with segmentation maps.

E.g. masks, semantic or instance segmentation maps.

```python
imgaug.augmentables.segmaps.SegmentationMapOnImage(*args, **kwargs)

Depreciated. Use SegmentationMapsOnImage instead. (Note the plural ‘Maps’ instead of old ‘Map’).

Object representing a segmentation map associated with an image.

class imgaug.augmentables.segmaps.SegmentationMapsOnImage(arr, shape, nb_classes=None)

Bases: imgaug.augmentables.base.IAugmentable

Object representing a segmentation map associated with an image.

Variables

DEFAULT_SEGMENT_COLORS (list of tuple of int) – Standard RGB colors to use during drawing, ordered by class index.

Parameters

• arr ((H,W) ndarray or (H,W,C) ndarray) – Array representing the segmentation map(s). May have dtypes bool, int or uint.

• shape (tuple of int) – Shape of the image on which the segmentation map(s) is/are placed. Not the shape of the segmentation map(s) array, unless it is identical to the image shape (note the likely difference between the arrays in the number of channels). This is expected to be (H, W) or (H, W, C) with C usually being 3. If there is no corresponding image, use (H_arr, W_arr) instead, where H_arr is the height of the segmentation map(s) array (analogous W_arr).

• nb_classes (None or int, optional) – Deprecated.

Methods

copy(self[, arr, shape])

Create a shallow copy of the segmentation map object.

deeepcopy(self[, arr, shape])

Create a deep copy of the segmentation map object.

draw(self[, size, colors])

Render the segmentation map as an RGB image.

draw_on_image(self, image[, alpha, resize, ...])

Draw the segmentation map as an overlay over an image.

get_arr(self)

Return the seg.map array, with original dtype and shape ndim.

get_arr_int(self, *args, **kwargs)

Deprecated.

pad(self[, top, right, bottom, left, mode, cval])

Pad the segmentation maps at their top/right/bottom/left side.

pad_to_aspect_ratio(self, aspect_ratio[, ...])

Pad the segmentation maps until they match a target aspect ratio.

resize(self, sizes[, interpolation])

Resize the seg.map(s) array given a target size and interpolation.

scale(self, *args, **kwargs)

Deprecated.

DEFAULT_SEGMENT_COLORS = [(0, 0, 0), (230, 25, 75), (60, 180, 75), (255, 225, 25), (0, 130, 200), (245, 130, 48), (145, 25, 127), (85, 55, 20), (127, 125, 100), (64, 0, 0), (85, 127, 97), (64, 64, 0), (127, 107, 90), (0, 0, 64), (64, 64, 64)]

copy(self, arr=None, shape=None)

Create a shallow copy of the segmentation map object.
Parameters

- **arr** (*None or (H,W) ndarray or (H,W,C) ndarray, optional*) – Optionally the `arr` attribute to use for the new segmentation map instance. Will be copied from the old instance if not provided. See `__init__()` for details.

- **shape** (*None or tuple of int, optional*) – Optionally the `shape` attribute to use for the the new segmentation map instance. Will be copied from the old instance if not provided. See `__init__()` for details.

Returns Shallow copy.

Return type `imgaug.augmentables.segmaps.SegmentationMapsOnImage`

depcopy (`self`, `arr=None`, `shape=None`)

Create a deep copy of the segmentation map object.

Parameters

- **arr** (*None or (H,W) ndarray or (H,W,C) ndarray, optional*) – Optionally the `arr` attribute to use for the new segmentation map instance. Will be copied from the old instance if not provided. See `__init__()` for details.

- **shape** (*None or tuple of int, optional*) – Optionally the `shape` attribute to use for the the new segmentation map instance. Will be copied from the old instance if not provided. See `__init__()` for details.

Returns Deep copy.

Return type `imgaug.augmentables.segmaps.SegmentationMapsOnImage`

draw (`self`, `size=None`, `colors=None`)

Render the segmentation map as an RGB image.

Parameters

- **size** (*None or float or iterable of int or iterable of float, optional*) – Size of the rendered RGB image as `(height, width)`. See `imresize_single_image()` for details. If set to None, no resizing is performed and the size of the segmentation map array is used.

- **colors** (*None or list of tuple of int, optional*) – Colors to use. One for each class to draw. If None, then default colors will be used.

Returns Rendered segmentation map (dtype is `uint8`). One per `C` in the original input array `(H,W,C)`.

Return type list of `(H,W,3)` ndarray

draw_on_image (`self`, `image`, `alpha=0.75`, `resize=’segmentation_map’, colors=None`, `draw_background=False`, `background_class_id=0`, `background_threshold=None`)

Draw the segmentation map as an overlay over an image.

Parameters

- **image** (*`(H,W,3) ndarray`*) – Image onto which to draw the segmentation map. Expected dtype is `uint8`.

- **alpha** (*`float, optional`*) – Alpha/opacity value to use for the mixing of image and segmentation map. Larger values mean that the segmentation map will be more visible and the image less visible.

- **resize** (*`’segmentation_map’, ‘image’, optional`*) – In case of size differences between the image and segmentation map, either the image or the segmentation map can be resized. This parameter controls which of the two will be resized to the other’s size.
• **colors** *(None or list of tuple of int, optional)* – Colors to use. One for each class to draw. If None, then default colors will be used.

• **draw_background** *(bool, optional)* – If True, the background will be drawn like any other class. If False, the background will not be drawn, i.e. the respective background pixels will be identical with the image’s RGB color at the corresponding spatial location and no color overlay will be applied.

• **background_class_id** *(int, optional)* – Class id to interpret as the background class. See `draw_background`.

• **background_threshold** *(None, optional)* – Deprecated. This parameter is ignored.

Returns: Rendered overlays as uint8 arrays. Always a list containing one RGB image per segmentation map array channel.

Return type: list of (H,W,3) ndarray

**get_arr**(self)

Return the seg.map array, with original dtype and shape ndim.

Here, “original” denotes the dtype and number of shape dimensions that was used when the `SegmentationMapsOnImage` instance was created, i.e. upon the call of `SegmentationMapsOnImage.__init__()`. Internally, this class may use a different dtype and shape to simplify computations.

---

Note: The height and width may have changed compared to the original input due to e.g. pooling operations.

Returns: Segmentation map array. Same dtype and number of dimensions as was originally used when the `SegmentationMapsOnImage` instance was created.

Return type: ndarray

**get_arr_int**(self, *args, **kwargs)

Deprecated. Use `SegmentationMapsOnImage.get_arr()` instead.

Return the seg.map array, with original dtype and shape ndim.

**pad**(self, top=0, right=0, bottom=0, left=0, mode='constant', cval=0)

Pad the segmentation maps at their top/right/bottom/left side.

Parameters:

• **top** *(int, optional)* – Amount of pixels to add at the top side of the segmentation map. Must be 0 or greater.

• **right** *(int, optional)* – Amount of pixels to add at the right side of the segmentation map. Must be 0 or greater.

• **bottom** *(int, optional)* – Amount of pixels to add at the bottom side of the segmentation map. Must be 0 or greater.

• **left** *(int, optional)* – Amount of pixels to add at the left side of the segmentation map. Must be 0 or greater.

• **mode** *(str, optional)* – Padding mode to use. See `pad()` for details.

• **cval** *(number, optional)* – Value to use for padding if `mode` is `constant`. See `pad()` for details.
Returns Padded segmentation map with height \( H' = H + \text{top} + \text{bottom} \) and width \( W' = W + \text{left} + \text{right} \).

Return type `imgaug.augmentables.segmaps.SegmentationMapsOnImage`

`pad_to_aspect_ratio` *(self, aspect_ratio, mode='constant', cval=0, return_pad_amounts=False)*

Pad the segmentation maps until they match a target aspect ratio.

Depending on which dimension is smaller (height or width), only the corresponding sides (left/right or top/bottom) will be padded. In each case, both of the sides will be padded equally.

Parameters

- `aspect_ratio` *(float)* – Target aspect ratio, given as width/height. E.g. 2.0 denotes the image having twice as much width as height.
- `mode` *(str, optional)* – Padding mode to use. See `pad()` for details.
- `cval` *(number, optional)* – Value to use for padding if `mode` is `constant`. See `pad()` for details.
- `return_pad_amounts` *(bool, optional)* – If `False`, then only the padded instance will be returned. If `True`, a tuple with two entries will be returned, where the first entry is the padded instance and the second entry are the amounts by which each array side was padded. These amounts are again a tuple of the form \((\text{top}, \text{right}, \text{bottom}, \text{left})\), with each value being an integer.

Returns

- `tuple of int` – Amounts by which the instance's array was padded on each side, given as a tuple \((\text{top}, \text{right}, \text{bottom}, \text{left})\). This tuple is only returned if `return_pad_amounts` was set to `True`.

`resize` *(self, sizes, interpolation='nearest')*

Resize the seg.map(s) array given a target size and interpolation.

Parameters

- `sizes` *(float or iterable of int or iterable of float)* – New size of the array in \((\text{height}, \text{width})\). See `imresize_single_image()` for details.
- `interpolation` *(None or str or int, optional)* – The interpolation to use during resize. Nearest neighbour interpolation ("nearest") is almost always the best choice. See `imresize_single_image()` for details.

Returns Resized segmentation map object.

Return type `imgaug.augmentables.segmaps.SegmentationMapsOnImage`

`scale` *(self, *args, **kwargs)*

Deprecated. Use `SegmentationMapsOnImage.resize()` instead. `resize()` has the exactly same interface.

Resize the seg.map(s) array given a target size and interpolation.

13.16 `imgaug.augmentables.utils`

Utility functions used in augmentable modules.
imgaug.augmentables.utils.convert_cbaois_to_kpsois(cbaois)
Convert coordinate-based augmentables to KeypointsOnImage instances.

Added in 0.4.0.

Parameters
cbaois (list of imgaug.augmentables.bbs.BoundingBoxesOnImage
or list of imgaug.augmentables.bbs.PolygonsOnImage or
list of imgaug.augmentables.bbs.LineStringsOnImage or im-
gaug.augmentables.bbs.BoundingBoxesOnImage or imgaug.augmentables.bbs.PolygonsOnImage
or imgaug.augmentables.bbs.LineStringsOnImage) – Coordinate-based augmentables to con-
vert, e.g. bounding boxes.

Returns KeypointsOnImage instances containing the coordinates of input cbaois.

Return type list of imgaug.augmentables.kps.KeypointsOnImage or im-
gaug.augmentables.kps.KeypointsOnImage

imgaug.augmentables.utils.copy_augmentables(augmentables)

imgaug.augmentables.utils.deepcopy_fast(obj)

imgaug.augmentables.utils.interpolate_point_pair(point_a, point_b, nb_steps)
Interpolate N points on a line segment.

Parameters

• point_a (iterable of number) – Start point of the line segment, given as (x, y) coordinates.
• point_b (iterable of number) – End point of the line segment, given as (x, y) coordinates.
• nb_steps (int) – Number of points to interpolate between point_a and point_b.

Returns The interpolated points. Does not include point_a.

Return type list of tuple of number

imgaug.augmentables.utils.interpolate_points(points, nb_steps, closed=True)
Interpolate N on each line segment in a line string.

Parameters

• points (iterable of iterable of number) – Points on the line segments, each one given as (x, y) coordinates. They are assumed to form one connected line string.
• nb_steps (int) – Number of points to interpolate on each individual line string.
• closed (bool, optional) – If True the output contains the last point in points. Otherwise it does not (but it will contain the interpolated points leading to the last point).

Returns Coordinates of points, with additional nb_steps new points interpolated between each point pair. If closed is False, the last point in points is not returned.

Return type list of tuple of number

imgaug.augmentables.utils.interpolate_points_by_max_distance(points, max_distance, closed=True)
Interpolate points with distance d on a line string.

For a list of points A, B, C, if the distance between A and B is greater than max_distance, it will place at least one point between A and B at A + max_distance * (B - A). Multiple points can be placed between the two points if they are far enough away from each other. The process is repeated for B and C.

Parameters
• **points** *(iterable of iterable of number)* – Points on the line segments, each one given as \((x, y)\) coordinates. They are assumed to form one connected line string.

• **max_distance** *(number)* – Maximum distance between any two points in the result.

• **closed** *(bool, optional)* – If **True** the output contains the last point in **points**. Otherwise it does not (but it will contain the interpolated points leading to the last point).

**Returns** Coordinates of **points**, with interpolated points added to the iterable. If **closed** is **False**, the last point in **points** is not returned.

**Return type** list of tuple of number

`imgaug.augmentables.utils.invert_convert_cbaois_to_kpsois_(cbaois, kpsois)`

Invert the output of `convert_to_cbaois_to_kpsois()` in-place.

This function writes in-place into **cbaois**.

Added in 0.4.0.

**Parameters**

• **cbaois** (list of `imgaug.augmentables.bbs.BoundingBoxesOnImage` or `imgaug.augmentables.bbs.PolygonsOnImage` or `list of imgaug.augmentables.bbs.LineStringsOnImage` or `imgaug.augmentables.bbs.BoundingBoxesOnImage` or `imgaug.augmentables.bbs.PolygonsOnImage` or `imgaug.augmentables.bbs.LineStringsOnImage`) – Original coordinate-based augmentables before they were converted, i.e. the same inputs as provided to `convert_to_kpsois()`.

• **kpsois** (list of `imgaug.augmentables.kps.KeypointsOnImages` or `imgaug.augmentables.kps.KeypointsOnImages`) – Keypoints to convert back to the types of **cbaois**, i.e. the outputs of `convert_cbaois_to_kpsois()`.

**Returns** Parameter **cbaois**, with updated coordinates and shapes derived from **kpsois**. **cbaois** is modified in-place.

**Return type** list of `imgaug.augmentables.bbs.BoundingBoxesOnImage` or `list of imgaug.augmentables.bbs.PolygonsOnImage` or `list of imgaug.augmentables.bbs.LineStringsOnImage` or `imgaug.augmentables.bbs.BoundingBoxesOnImage` or `imgaug.augmentables.bbs.PolygonsOnImage` or `imgaug.augmentables.bbs.LineStringsOnImage`

`imgaug.augmentables.utils.normalize_shape(shape)`

Normalize a shape tuple or array to a shape tuple.

**Parameters** **shape** *(tuple of int or ndarray)* – The input to normalize. May optionally be an array.

**Returns** Shape tuple.

**Return type** tuple of int

`imgaug.augmentables.utils.project_coords(coords, from_shape, to_shape)`

Project coordinates from one image shape to another.

This performs a relative projection, e.g. a point at 60% of the old image width will be at 60% of the new image width after projection.

**Parameters**

• **coords** *(ndarray or list of tuple of number)* – Coordinates to project. Either an \((N, 2)\) numpy array or a list containing \((x, y)\) coordinate tuples.

• **from_shape** *(tuple of int or ndarray)* – Old image shape.
- `to_shape` *(tuple of int or ndarray)* – New image shape.

**Returns**  Projected coordinates as *(N, 2)* float32 numpy array.

**Return type**  ndarray

```python
imgaug.augmentables.utils.project_coords_(coords, from_shape, to_shape)
```

Project coordinates from one image shape to another in-place.

This performs a relative projection, e.g. a point at 60% of the old image width will be at 60% of the new image width after projection.

Added in 0.4.0.

**Parameters**

- `coords` *(ndarray or list of tuple of number)* – Coordinates to project. Either an *(N, 2)* numpy array or a list containing *(x, y)* coordinate tuples.
- `from_shape` *(tuple of int or ndarray)* – Old image shape.
- `to_shape` *(tuple of int or ndarray)* – New image shape.

**Returns**  Projected coordinates as *(N, 2)* float32 numpy array. This function may change the input data in-place.

**Return type**  ndarray

### 13.17 imgaug.augmenters.arithmetic

Augmenters that perform simple arithmetic changes.

List of augmenters:

- *Add*
- *AddElementwise*
- *AdditiveGaussianNoise*
- *AdditiveLaplaceNoise*
- *AdditivePoissonNoise*
- *Multiply*
- *MultiplyElementwise*
- *Cutout*
- *Dropout*
- *CoarseDropout*
- *Dropout2d*
- *TotalDropout*
- *ReplaceElementwise*
- *ImpulseNoise*
- *SaltAndPepper*
- *CoarseSaltAndPepper*
- *Salt*
• CoarseSalt
• Pepper
• CoarsePepper
• Invert
• Solarize
• ContrastNormalization
• JpegCompression

class imgaug.augmenters.arithmetic.Add(value=(-20, 20), per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.meta.Augmenter

Add a value to all pixels in an image.

Supported dtypes:

See add_scalar().

Parameters

• **value** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Value to add to all pixels.
  - If a number, exactly that value will always be used.
  - If a tuple \((a, b)\), then a value from the discrete interval \([a..b]\) will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled per image from that parameter.

• **per_channel** (bool or float or imgaug.parameters.StochasticParameter, optional) – Whether to use (imagewise) the same sample(s) for all channels (False) or to sample value(s) for each channel (True). Setting this to True will therefore lead to different transformations per image and channel, otherwise only per image. If this value is a float \(p\), then for \(p\) percent of all images per_channel will be treated as True. If it is a StochasticParameter it is expected to produce samples with values between 0.0 and 1.0, where values >0.5 will lead to per-channel behaviour (i.e. same as True).

• **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

• **name** (None or str, optional) – See __init__().

• **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.
Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Add(10)
```

Always adds a value of 10 to all channels of all pixels of all input images.

```python
>>> aug = iaa.Add((-10, 10))
```

Adds a value from the discrete interval \([-10..10]\) to all pixels of input images. The exact value is sampled per image.

```python
>>> aug = iaa.Add((-10, 10), per_channel=True)
```

Adds a value from the discrete interval \([-10..10]\) to all pixels of input images. The exact value is sampled per image and channel, i.e. to a red-channel it might add 5 while subtracting 7 from the blue channel of the same image.

```python
>>> aug = iaa.Add((-10, 10), per_channel=0.5)
```

Identical to the previous example, but the `per_channel` feature is only active for 50 percent of all images.

Methods

```python
__call__ (self,*args,**kwargs)  Alias for `augment()`.
```

Augment a batch.

```python
augment_batch (self,[return_batch,hooks]) Deprecated.
```

Augment a single batch in-place.

```python
augment_bounding_boxes (self,...[,parents])
```

Augment a batch of bounding boxes.

```python
augment_heatmaps (self,...[,parents])
```

Augment a batch of heatmaps.

```python
augment_image (self,...[,parents])
```

Augment a single image.

```python
augment_keypoints (self,...[,parents])
```

Augment a batch of keypoints/landmarks.

```python
augment_line_strings (self,...[,parents])
```

Augment a batch of line strings.

```python
augment_polygons (self,...[,parents])
```

Augment a batch of polygons.

```python
augment_segmentation_maps (self,...[,parents])
```

Augment a batch of segmentation maps.

```python
copy (self)
```

Create a shallow copy of this Augmenter instance.

```python
copy_random_state (self,...[,source])
```

Copy the RNGs from a source augmenter sequence.

```python
copy_random_state_ (self,...[,source])
```

Copy the RNGs from a source augmenter sequence (in-place).

```python
dojeeopy (self)
```

Create a deep copy of this Augmenter instance.

```python
draw_grid (self,...)
```

Augment images and draw the results as a single grid-like image.

```python
find_augmenters (self,...)
```

Find augmenters that match a condition.

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<td><code>remove_augmenters_inplace(...)</code></td>
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<tr>
<td><code>seed_(...)</code></td>
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</tr>
<tr>
<td><code>show_grid(...)</code></td>
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</tr>
<tr>
<td><code>to_deterministic(...)</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**get_parameters**

See `get_parameters()`.  

**class imgaug.augmenters.arithmetic.AddElementwise**

```
value=(-20, 20),
per_channel=False,
seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.meta.Augmenter`

Add to the pixels of images values that are pixelwise randomly sampled.

While the **Add** Augmenter samples one value to add per image (and optionally per channel), this augmenter samples different values per image and per pixel (and optionally per channel), i.e. intensities of neighbouring pixels may be increased/decreased by different amounts.

**Supported dtypes:**

See `add_elementwise()`.  

**Parameters**

- **value** *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)*
  
  Value to add to the pixels.
  
  - If an int, exactly that value will always be used.
  
  - If a tuple \((a, b)\), then values from the discrete interval \([a..b]\) will be sampled per image and pixel.
  
  - If a list of integers, a random value will be sampled from the list per image and pixel.
- If a StochasticParameter, then values will be sampled per image and pixel from that parameter.

- **per_channel** *(bool or float or imgaug.parameters.StochasticParameter, optional)* – Whether to use (imagewise) the same sample(s) for all channels (False) or to sample value(s) for each channel (True). Setting this to True will therefore lead to different transformations per image and channel, otherwise only per image. If this value is a float $p$, then for $p$ percent of all images `per_channel` will be treated as True. If it is a StochasticParameter it is expected to produce samples with values between 0.0 and 1.0, where values >0.5 will lead to per-channel behaviour (i.e. same as True).

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.

- **name** *(None or str, optional)* – See `__init__()`.

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.AddElementwise(10)
```

Always adds a value of 10 to all channels of all pixels of all input images.

```python
>>> aug = iaa.AddElementwise((-10, 10))
```

Samples per image and pixel a value from the discrete interval $[-10..10]$ and adds that value to the respective pixel.

```python
>>> aug = iaa.AddElementwise((-10, 10), per_channel=True)
```

Samples per image, pixel and also channel a value from the discrete interval $[-10..10]$ and adds it to the respective pixel’s channel value. Therefore, added values may differ between channels of the same pixel.

```python
>>> aug = iaa.AddElementwise((-10, 10), per_channel=0.5)
```

Identical to the previous example, but the `per_channel` feature is only active for 50 percent of all images.

### Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
</table>
| `__call__()` | Alias for `augment()`.
| `augment(self[, return_batch, hooks])` | Augment a batch.
| `augment_batch(self[, batch[, parents, hooks]])` | Deprecated.
| `augment_batch_(self[, batch[, parents, hooks]])` | Augment a single batch in-place. |

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<table>
<thead>
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<td><code>augment_batches(self, batches[, hooks, ...])</code></td>
<td>Augment multiple batches.</td>
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<tr>
<td><code>augment_bounding_boxes(self, ...[, parents, ...])</code></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps(self, heatmaps[, parents, ...])</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(self, image[, hooks])</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images(self, images[, parents, hooks])</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints(self, keypoints_on_images)</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings(self, ...[, parents, hooks])</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons(self, polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
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<td><code>augment_segmentation_maps(self, segmaps[, ...])</code></td>
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<td><code>draw_grid(self, images, rows, cols)</code></td>
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<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
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<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
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<td><code>seed_(self[, entropy, deterministic_too])</code></td>
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<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>

`get_parameters(self)`

See `get_parameters()`.
class imgaug.augmenters.arithmetic.AdditiveGaussianNoise(loc=0, scale=(0, 15),
per_channel=False, seed=None, name=None, random_state=’deprecated’,
deterministic=’deprecated’)

Bases: imgaug.augmenters.arithmetic.AddElementwise

Add noise sampled from gaussian distributions elementwise to images.

This augmenter samples and adds noise elementwise, i.e. it can add different noise values to neighbouring pixels and is comparable to AddElementwise.

Supported dtypes:
See AddElementwise.

Parameters

- **loc** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Mean of the normal distribution from which the noise is sampled.
  - If a number, exactly that value will always be used.
  - If a tuple \((a, b)\), a random value from the interval \([a, b]\) will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, a value will be sampled from the parameter per image.

- **scale** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Standard deviation of the normal distribution that generates the noise. Must be \(>=0\). If 0 then loc will simply be added to all pixels.
  - If a number, exactly that value will always be used.
  - If a tuple \((a, b)\), a random value from the interval \([a, b]\) will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, a value will be sampled from the parameter per image.

- **per_channel** (bool or float or imgaug.parameters.StochasticParameter, optional) – Whether to use (imagewise) the same sample(s) for all channels (False) or to sample value(s) for each channel (True). Setting this to True will therefore lead to different transformations per image and channel, otherwise only per image. If this value is a float \(p\), then for \(p\) percent of all images per_channel will be treated as True. If it is a StochasticParameter it is expected to produce samples with values between 0.0 and 1.0, where values >0.5 will lead to per-channel behaviour (i.e. same as True).

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- **name** (None or str, optional) – See __init__().

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage
will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.AdditiveGaussianNoise(scale=0.1*255)
```

Adds gaussian noise from the distribution \(N(0, 0.1\times255)\) to images. The samples are drawn per image and pixel.

```python
>>> aug = iaa.AdditiveGaussianNoise(scale=(0, 0.1*255))
```

Adds gaussian noise from the distribution \(N(0, s)\) to images, where \(s\) is sampled per image from the interval \([0, 0.1\times255]\).

```python
>>> aug = iaa.AdditiveGaussianNoise(scale=0.1*255, per_channel=True)
```

Adds gaussian noise from the distribution \(N(0, 0.1\times255)\) to images, where the noise value is different per image and pixel and channel (e.g. a different one for red, green and blue channels of the same pixel). This leads to “colorful” noise.

```python
>>> aug = iaa.AdditiveGaussianNoise(scale=0.1*255, per_channel=0.5)
```

Identical to the previous example, but the per_channel feature is only active for 50 percent of all images.

**Methods**

- `_call_`(self, *args, **kwargs) Alias for `augment()`.
- `augment`(self, return_batch, hooks) Augment a batch.
- `augment_batch`(self, batch[, hooks]) Deprecated.
- `augment_batch_`(self, batch[, parents, hooks]) Augment a single batch in-place.
- `augment_batches`(self, batches[, hooks, ...]) Augment multiple batches.
- `augment_bounding_boxes`(self, ...[, parents, ...]) Augment a batch of bounding boxes.
- `augment_heatmaps`(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
- `augment_image`(self, image[, hooks]) Augment a single image.
- `augment_images`(self, images[, parents, hooks]) Augment a batch of images.
- `augment_keypoints`(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
- `augment_line_strings`(self, ...[, parents, hooks]) Augment a batch of line strings.
- `augment_polygons`(self, polygons_on_images[, ...]) Augment a batch of polygons.
- `augment_segmentation_maps`(self, segmaps[, ...]) Augment a batch of segmentation maps.
- `copy`(self) Create a shallow copy of this Augmenter instance.

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<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
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<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
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<td><code>to_deterministic(self[, n])</code></td>
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</table>

**class** `imgaug.augmenters.arithmetic.AdditiveLaplaceNoise(loc=0, scale=(0, 15), per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')`

**Bases:** `imgaug.augmenters.arithmetic.AddElementwise`

Add noise sampled from laplace distributions elementwise to images.

The laplace distribution is similar to the gaussian distribution, but puts more weight on the long tail. Hence, this noise will add more outliers (very high/low values). It is somewhere between gaussian noise and salt and pepper noise.

Values of around $255 \times 0.05$ for `scale` lead to visible noise (for `uint8`). Values of around $255 \times 0.10$ for `scale` lead to very visible noise (for `uint8`). It is recommended to usually set `per_channel` to True.

This augmenter samples and adds noise elementwise, i.e. it can add different noise values to neighbouring pixels and is comparable to `AddElementwise`.

**Supported dtypes:**
See \texttt{AddElementwise}.

Parameters

- **\texttt{loc}** (number or tuple of number or list of number or \texttt{imgaug.parameters.StochasticParameter}, optional) – Mean of the laplace distribution that generates the noise.
  - If a number, exactly that value will always be used.
  - If a tuple \((a, b)\), a random value from the interval \([a, b]\) will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a \texttt{StochasticParameter}, a value will be sampled from the parameter per image.

- **\texttt{scale}** (number or tuple of number or list of number or \texttt{imgaug.parameters.StochasticParameter}, optional) – Standard deviation of the laplace distribution that generates the noise. Must be \(\geq 0\). If \(0\) then only \texttt{loc} will be used. Recommended to be around \(255 \times 0.05\).
  - If a number, exactly that value will always be used.
  - If a tuple \((a, b)\), a random value from the interval \([a, b]\) will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a \texttt{StochasticParameter}, a value will be sampled from the parameter per image.

- **\texttt{per_channel}** (bool or float or \texttt{imgaug.parameters.StochasticParameter}, optional) – Whether to use (image-wise) the same sample(s) for all channels (\texttt{False}) or to sample value(s) for each channel (\texttt{True}). Setting this to \texttt{True} will therefore lead to different transformations per image and channel, otherwise only per image. If this value is a float \(p\), then for \(p\) percent of all images \texttt{per_channel} will be treated as \texttt{True}. If it is a \texttt{StochasticParameter} it is expected to produce samples with values between \(0.0\) and \(1.0\), where values \(>0.5\) will lead to per-channel behaviour (i.e. same as \texttt{True}).

- **\texttt{seed}** (None or int or \texttt{imgaug.random.RNG} or \texttt{numpy.random.Generator} or \texttt{numpy.random.BitGenerator} or \texttt{numpy.random.SeedSequence} or \texttt{numpy.random.RandomState}, optional) – See \texttt{\_\_init\_}().

- **\texttt{name}** (None or str, optional) – See \texttt{\_\_init\_}().

- **\texttt{random_state}** (None or int or \texttt{imgaug.random.RNG} or \texttt{numpy.random.Generator} or \texttt{numpy.random.BitGenerator} or \texttt{numpy.random.SeedSequence} or \texttt{numpy.random.RandomState}, optional) – Old name for parameter \texttt{seed}. Its usage will not yet cause a deprecation warning, but it is still recommended to use \texttt{seed} now. Outdated since 0.4.0.

- **\texttt{deterministic}** (bool, optional) – Deprecated since 0.4.0. See method \texttt{to\_\_deterministic()} for an alternative and for details about what the “deterministic mode” actually does.

Examples

```
>>> import imgaug.augmenters as iaa
>>> aug = iaa.AdditiveLaplaceNoise(scale=0.1*255)
```

Adds laplace noise from the distribution \texttt{Laplace(0, 0.1\times255)} to images. The samples are drawn per image and pixel.
>>> aug = iaa.AdditiveLaplaceNoise(scale=(0, 0.1*255))

Adds laplace noise from the distribution $Laplace(0, s)$ to images, where $s$ is sampled per image from the interval $[0, 0.1*255]$.

>>> aug = iaa.AdditiveLaplaceNoise(scale=0.1*255, per_channel=True)

Adds laplace noise from the distribution $Laplace(0, 0.1*255)$ to images, where the noise value is different per image and pixel and channel (e.g. a different one for the red, green and blue channels of the same pixel). This leads to “colorful” noise.

>>> aug = iaa.AdditiveLaplaceNoise(scale=0.1*255, per_channel=0.5)

Identical to the previous example, but the `per_channel` feature is only active for 50 percent of all images.

Methods

```python
__call__(self, *args, **kwargs) Alias for augment().
augment(self[, return_batch, hooks]) Augment a batch.
augment_batch(self[, batch[, hooks]]) Augment a single batch in-place.
augment_batches(self[, batches[, hooks]]) Augment multiple batches.
augment_bounding_boxes(self[, bboxes[, parents, hooks]]) Augment a batch of bounding boxes.
augment_heatmaps(self[, heatmaps[, parents, ...]]) Augment a batch of heatmaps.
augment_image(self[, image[, hooks]]) Augment a single image.
augment_images(self[, images[, parents, hooks]]) Augment a batch of images.
augment_keypoints(self[, keypoints_on_images]) Augment a batch of keypoints/landmarks.
augment_line_strings(self[, line_strings[, parents, hooks]]) Augment a batch of line strings.
augment_polygons(self[, polygons_on_images[, ...]]) Augment a batch of polygons.
augment_segmentation_maps(self[, segmaps[,...]]) Augment a batch of segmentation maps.
copy(self) Create a shallow copy of this Augmenter instance.
copy_random_state(self[, source[, recursive,...]]) Copy the RNGs from a source augmenter sequence.
copy_random_state_(self[, source[, ...]]) Copy the RNGs from a source augmenter sequence (in-place).
deepcopy(self) Create a deep copy of this Augmenter instance.
draw_grid(self[, images, rows, cols]) Augment images and draw the results as a single grid-like image.
find_augmenters(self[, func[, parents, flat]]) Find augmenters that match a condition.
find_augmenters_by_name(self[, name[, regex,...]]) Find augmenter(s) by name.
find_augmenters_by_names(self[, names[, ...]]) Find augmenter(s) by names.
get_all_children(self[, flat]) Get all children of this augmenter as a list.
get_children_lists(self) Get a list of lists of children of this augmenter.
```
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<td><code>remove_augmenters</code></td>
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<tr>
<td><code>seed_</code></td>
<td>Seed this augmenter and all of its children.</td>
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<tr>
<td><code>show_grid</code></td>
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</tr>
<tr>
<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>

**class** `imgaug.augmenters.arithmetic.AdditivePoissonNoise` *(lam=(0.0, 15.0), per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')*

**Bases:** `imgaug.augmenters.arithmetic.AddElementwise`

Add noise sampled from poisson distributions elementwise to images.

Poisson noise is comparable to gaussian noise, as e.g. generated via `AdditiveGaussianNoise`. As poisson distributions produce only positive numbers, the sign of the sampled values are here randomly flipped.

Values of around `10.0` for `lam` lead to visible noise (for `uint8`). Values of around `20.0` for `lam` lead to very visible noise (for `uint8`). It is recommended to usually set `per_channel` to `True`.

This augmenter samples and adds noise elementwise, i.e. it can add different noise values to neighbouring pixels and is comparable to `AddElementwise`.

**Supported dtypes:**

See `AddElementwise`.

**Parameters**

- **lam** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Lambda parameter of the poisson distribution. Must be `>=0`. Recommended values are around `0.0` to `10.0`.
  - If a number, exactly that value will always be used.
  - If a tuple `(a, b)`, a random value from the interval `[a, b]` will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a `StochasticParameter`, a value will be sampled from the parameter per image.

- **per_channel** *(bool or float or imgaug.parameters.StochasticParameter, optional)* – Whether to use (imagewise) the same sample(s) for all channels (`False`) or to sample
value(s) for each channel (True). Setting this to True will therefore lead to different transformations per image and channel, otherwise only per image. If this value is a float \( p \), then for \( p \) percent of all images per channel will be treated as True. If it is a StochasticParameter it is expected to produce samples with values between 0.0 and 1.0, where values >0.5 will lead to per-channel behaviour (i.e. same as True).

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- **name** (None or str, optional) – See __init__().

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.AdditivePoissonNoise(lam=5.0)
```

Adds poisson noise sampled from a poisson distribution with a lambda parameter of 5.0 to images. The samples are drawn per image and pixel.

```python
>>> aug = iaa.AdditivePoissonNoise(lam=(0.0, 15.0))
```

Adds poisson noise sampled from \( \text{Poisson}(x) \) to images, where \( x \) is randomly sampled per image from the interval \([0.0, \, 15.0]\).

```python
>>> aug = iaa.AdditivePoissonNoise(lam=5.0, per_channel=True)
```

Adds poisson noise sampled from \( \text{Poisson}(5.0) \) to images, where the values are different per image and pixel and channel (e.g. a different one for red, green and blue channels for the same pixel).

```python
>>> aug = iaa.AdditivePoissonNoise(lam=(0.0, 15.0), per_channel=True)
```

Adds poisson noise sampled from \( \text{Poisson}(x) \) to images, with \( x \) being sampled from \( \text{uniform}(0.0, \, 15.0) \) per image and channel. This is the recommended configuration.

```python
>>> aug = iaa.AdditivePoissonNoise(lam=(0.0, 15.0), per_channel=0.5)
```

Identical to the previous example, but the per_channel feature is only active for 50 percent of all images.

### Methods

<table>
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<tr>
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<th>Description</th>
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<td><strong>call</strong>(self, *args, **kwargs)</td>
<td>Alias for augment().</td>
</tr>
<tr>
<td>augment(self[, return_batch, hooks])</td>
<td>Augment a batch.</td>
</tr>
<tr>
<td>augment_batch(self[, batch[, hooks]])</td>
<td>Deprecated.</td>
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<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td><code>augment_batch_(self, batch[, parents, hooks])</code></td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><code>augment_batches(self, batches[, hooks, ...])</code></td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td><code>augment_bounding_boxes(self, ..., [parents, ...])</code></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps(self, heatmaps[, parents, ...])</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(self, image[, hooks])</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images(self, images[, parents, hooks])</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints(self, keypoints_on_images)</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings(self, ..., [parents, hooks])</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons(self, polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(self, segmaps[, ...])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(self, source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(self, source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
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<tr>
<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
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<tr>
<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
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<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
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<td><code>get_children_lists(self)</code></td>
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<tr>
<td><code>get_parameters(self)</code></td>
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</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
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<td><code>pool(self, processes, maxtasksperchild, seed)</code></td>
<td>Create a pool used for multicore augmentation.</td>
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<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self, random_state, deterministic_too)</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>
class imgaug.augmenters.arithmetic.CoarseDropout (p=(0.02, 0.1), size_px=None, size_percent=None, per_channel=False, min_size=3, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.arithmetic.MultiplyElementwise

Set rectangular areas within images to zero.

In contrast to Dropout, these areas can have larger sizes. (E.g. you might end up with three large black rectangles in an image.) Note that the current implementation leads to correlated sizes, so if e.g. there is any thin and high rectangle that is dropped, there is a high likelihood that all other dropped areas are also thin and high.

This method is implemented by generating the dropout mask at a lower resolution (than the image has) and then upsampling the mask before dropping the pixels.

This augmenter is similar to Cutout. Usually, cutout is defined as an operation that drops exactly one rectangle from an image, while here CoarseDropout can drop multiple rectangles (with some correlation between the sizes of these rectangles).

Supported dtypes:

See MultiplyElementwise.

Parameters

- **p** (float or tuple of float or imgaug.parameters.StochasticParameter, optional) – The probability of any pixel being dropped (i.e. set to zero) in the lower-resolution dropout mask.
  - If a float, then that value will be used for all pixels. A value of 1.0 would mean, that all pixels will be dropped. A value of 0.0 would lead to no pixels being dropped.
  - If a tuple (a, b), then a value p will be sampled from the interval [a, b] per image and be used as the dropout probability.
  - If a list, then a value will be sampled from that list per batch and used as the probability.
  - If a StochasticParameter, then this parameter will be used to determine per pixel whether it should be kept (sampled value of >0.5) or shouldn’t be kept (sampled value of <=0.5). If you instead want to provide the probability as a stochastic parameter, you can usually do imgaug.parameters.Binomial(1-p) to convert parameter p to a 0/1 representation.

- **size_px** (None or int or tuple of int or imgaug.parameters.StochasticParameter, optional) – The size of the lower resolution image from which to sample the dropout mask in absolute pixel dimensions. Note that this means that lower values of this parameter lead to larger areas being dropped (as any pixel in the lower resolution image will correspond to a larger area at the original resolution).
  - If None then size_percent must be set.
  - If an integer, then that size will always be used for both height and width. E.g. a value of 3 would lead to a 3x3 mask, which is then upsampled to HxW, where H is the image size and W the image width.
  - If a tuple (a, b), then two values M, N will be sampled from the discrete interval [a, ..b]. The dropout mask will then be generated at size MxN and upsampled to HxW.
  - If a StochasticParameter, then this parameter will be used to determine the sizes. It is expected to be discrete.
• **size_percent** *(None or float or tuple of float or imgaug.parameters.StochasticParameter, optional)* – The size of the lower resolution image from which to sample the dropout mask in percent of the input image. Note that this means that lower values of this parameter lead to larger areas being dropped (as any pixel in the lower resolution image will correspond to a larger area at the original resolution).

  - If None then `size_px` must be set.
  - If a float, then that value will always be used as the percentage of the height and width (relative to the original size). E.g. for value `p`, the mask will be sampled from \((p\times H)\times(p\times W)\) and later upsampled to \(H\times W\).
  - If a tuple \((a, b)\), then two values \(m, n\) will be sampled from the interval \((a, b)\) and used as the size fractions, i.e. the mask size will be \((m\times H)\times(n\times W)\).
  - If a StochasticParameter, then this parameter will be used to sample the percentage values. It is expected to be continuous.

• **per_channel** *(bool or float or imgaug.parameters.StochasticParameter, optional)* – Whether to use (imagewise) the same sample(s) for all channels (False) or to sample value(s) for each channel (True). Setting this to True will therefore lead to different transformations per image and channel, otherwise only per image. If this value is a float \(p\), then for \(p\) percent of all images per_channel will be treated as True. If it is a StochasticParameter it is expected to produce samples with values between 0.0 and 1.0, where values >0.5 will lead to per-channel behaviour (i.e. same as True).

• **min_size** *(int, optional)* – Minimum height and width of the low resolution mask. If `size_percent` or `size_px` leads to a lower value than this, `min_size` will be used instead. This should never have a value of less than 2, otherwise one may end up with a 1x1 low resolution mask, leading easily to the whole image being dropped.

• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.

• **name** *(None or str, optional)* – See `__init__()`.

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CoarseDropout(0.02, size_percent=0.5)
```

Drops 2 percent of all pixels on a lower-resolution image that has 50 percent of the original image’s size, leading to dropped areas that have roughly 2x2 pixels size.

```python
>>> aug = iaa.CoarseDropout((0.0, 0.05), size_percent=(0.05, 0.5))
```
Generates a dropout mask at 5 to 50 percent of each input image’s size. In that mask, 0 to 5 percent of all pixels are marked as being dropped. The mask is afterwards projected to the input image’s size to apply the actual dropout operation.

```python
>>> aug = iaa.CoarseDropout((0.0, 0.05), size_px=(2, 16))
```

Same as the previous example, but the lower resolution image has 2 to 16 pixels size. On images of e.g. `224x224` pixels in size this would lead to fairly large areas being dropped (height/width of `224/2 to 224/16`).

```python
>>> aug = iaa.CoarseDropout(0.02, size_percent=0.5, per_channel=True)
```

Drops 2 percent of all pixels at 50 percent resolution (2x2 sizes) in a channel-wise fashion, i.e. it is unlikely for any pixel to have all channels set to zero (black pixels).

```python
>>> aug = iaa.CoarseDropout(0.02, size_percent=0.5, per_channel=0.5)
```

Same as the previous example, but the `per_channel` feature is only active for 50 percent of all images.

**Methods**

- `__call__`(self, *args, **kwargs) Alias for `augment()`.
- `augment(self[, return_batch, hooks])` Augment a batch.
- `augment_batch(self[, batch[, hooks]])` Deprecated.
- `augment_batch_(self, batch[, parents, hooks])` Augment a single batch in-place.
- `augment_bounding_boxes(self[, ...[, parents, ...]])` Augment a batch of bounding boxes.
- `augment_heatmaps(self[, heatmaps[, parents, ...]])` Augment a batch of heatmaps.
- `augment_image(self[, image[, hooks]])` Augment a single image.
- `augment_images(self[, images[, parents, hooks]])` Augment a batch of images.
- `augment_keypoints(self[, keypoints_on_images])` Augment a batch of keypoints/landmarks.
- `augment_line_strings(self[, ...[, parents, hooks]])` Augment a batch of line strings.
- `augment_polygons(self[, polygons_on_images[, ...]])` Augment a batch of polygons.
- `augment_segmentation_maps(self[, segmaps[, ...]])` Augment a batch of segmentation maps.
- `copy(self)` Create a shallow copy of this Augmenter instance.
- `copy_random_state(self[, source[, recursive[, ...]])` Copy the RNGs from a source augmenter sequence.
- `copy_random_state_(self, source[, ...])` Copy the RNGs from a source augmenter sequence (in-place).
- `deepcopy(self)` Create a deep copy of this Augmenter instance.
- `draw_grid(self[, images, rows, cols])` Augment images and draw the results as a single grid-like image.
- `find_augmenters(self[, func[, parents, flat]])` Find augmenters that match a condition.
- `find_augmenters_by_name(self[, name[, regex[, ...]])` Find augmenter(s) by name.
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<td>find_augmenters_by_names(self, names...)</td>
<td>Find augmenter(s) by names.</td>
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<tr>
<td>get_all_children(self)</td>
<td>Get all children of this augmenter as a list.</td>
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<tr>
<td>get_children_lists(self)</td>
<td>Get a list of lists of children of this augmenter.</td>
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<tr>
<td>get_parameters(self)</td>
<td>See get_parameters().</td>
</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_tool])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>

**class** `imgaug.augmenters.arithmetic.CoarsePepper(p=(0.02, 0.1), size_px=None, size_percent=None, per_channel=False, min_size=3, seed=None, name=None, random_state='deprecated', deterministic='deprecated')`

Bases: `imgaug.augmenters.arithmetic.ReplaceElementwise`

Replace rectangular areas in images with black-ish pixel noise.

**Supported dtypes:**

See `ReplaceElementwise`.

**Parameters**

- **p** *(float or tuple of float or list of float or imgaug.parameters.StochasticParameter, optional)*

  Probability of changing a pixel to pepper noise.

  - If a float, then that value will always be used as the probability.
  - If a tuple \((a, b)\), then a probability will be sampled uniformly per image from the interval \([a, b]\).
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a lower-resolution mask will be sampled from that parameter per image. Any value \(>0.5\) in that mask will denote a spatial location that is to be replaced by pepper noise.

- **size_px** *(int or tuple of int or imgaug.parameters.StochasticParameter, optional)* – The size of the lower resolution image from which to sample the replacement mask in absolute pixel dimensions. Note that this means that lower values of this parameter lead to larger areas
being replaced (as any pixel in the lower resolution image will correspond to a larger area at the original resolution).
- If None then \(\text{size\_percent}\) must be set.
- If an integer, then that size will always be used for both height and width. E.g. a value of 3 would lead to a 3x3 mask, which is then upsampled to \(H \times W\), where \(H\) is the image size and \(W\) the image width.
- If a tuple \((a, b)\), then two values \(M, N\) will be sampled from the discrete interval \([a, b]\). The mask will then be generated at size \(M \times N\) and upsampled to \(H \times W\).
- If a \textit{StochasticParameter}, then this parameter will be used to determine the sizes. It is expected to be discrete.

- \textbf{size\_percent} (float or tuple of float or \textit{imgaug.parameters.StochasticParameter}, optional)
  - The size of the lower resolution image from which to sample the replacement mask in percent of the input image. Note that this means that lower values of this parameter lead to larger areas being replaced (as any pixel in the lower resolution image will correspond to a larger area at the original resolution).
  - If None then \(\text{size\_px}\) must be set.
  - If a float, then that value will always be used as the percentage of the height and width (relative to the original size). E.g. for value \(p\), the mask will be sampled from \((p \times H) \times (p \times W)\) and later upsampled to \(H \times W\).
  - If a tuple \((a, b)\), then two values \(m, n\) will be sampled from the interval \((a, b)\) and used as the size fractions, i.e. the mask size will be \((m \times H) \times (n \times W)\).
  - If a \textit{StochasticParameter}, then this parameter will be used to sample the percentage values. It is expected to be continuous.

- \textbf{per\_channel} (bool or float or \textit{imgaug.parameters.StochasticParameter}, optional) – Whether to use (imagewise) the same sample(s) for all channels (False) or to sample value(s) for each channel (True). Setting this to True will therefore lead to different transformations per image and channel, otherwise only per image. If this value is a float \(p\), then for \(p\) percent of all images \textit{per\_channel} will be treated as True. If it is a \textit{StochasticParameter} it is expected to produce samples with values between 0.0 and 1.0, where values >0.5 will lead to per-channel behaviour (i.e. same as True).

- \textbf{min\_size} (int, optional) – Minimum size of the low resolution mask, both width and height. If \textit{size\_percent} or \textit{size\_px} leads to a lower value than this, \textit{min\_size} will be used instead. This should never have a value of less than 2, otherwise one may end up with a 1x1 low resolution mask, leading easily to the whole image being replaced.

- \textbf{seed} (\textit{None} or int or \textit{imgaug.random.RNG} or \textit{numpy.random.Generator} or \textit{numpy.random.BitGenerator} or \textit{numpy.random.SeedSequence} or \textit{numpy.random.RandomState}, optional) – See \textit{\_\_init\_\_}().
- \textbf{name} (\textit{None} or str, optional) – See \textit{\_\_init\_\_}().

- \textbf{random\_state} (\textit{None} or int or \textit{imgaug.random.RNG} or \textit{numpy.random.Generator} or \textit{numpy.random.BitGenerator} or \textit{numpy.random.SeedSequence} or \textit{numpy.random.RandomState}, optional) – Old name for parameter \textit{seed}. Its usage will not yet cause a deprecation warning, but it is still recommended to use \textit{seed} now. Outdated since 0.4.0.

- \textbf{deterministic} (bool, optional) – Deprecated since 0.4.0. See method \textit{to\_deterministic()} for an alternative and for details about what the “deterministic mode” actually does.
Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CoarsePepper(0.05, size_percent=(0.01, 0.1))
```

Mark 5% of all pixels in a mask to be replaced by pepper noise. The mask has 1% to 10% the size of the input image. The mask is then upscaled to the input image size, leading to large rectangular areas being marked as to be replaced. These areas are then replaced in the input image by pepper noise.

Methods

```python
__call__(self, *args, **kwargs) Alias for augment().

augment(self, return_batch, hooks) Augment a batch.

augment_batch(self, batch[, hooks]) Deprecated.

augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.

augment_batches(self, batches[, hooks]) Deprecated.

augment_bounding_boxes(self, [parents, ...]) Augment a batch of bounding boxes.

augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.

augment_image(self, image[, hooks]) Augment a single image.

augment_images(self, images[, hooks]) Augment a batch of images.

augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.

augment_line_strings(self, [parents, hooks]) Augment a batch of line strings.

augment_polygons(self, polygons_on_images[, ...]) Augment a batch of polygons.

augment_segmentation_maps(self, segmaps[, ...]) Augment a batch of segmentation maps.

copy(self) Create a shallow copy of this Augmenter instance.

copy_random_state(self, source[, recursive, ...]) Copy the RNGs from a source augmenter sequence.

copy_random_state_(self[, recursive]) Copy the RNGs from a source augmenter sequence (in-place).

decopy(self) Create a deep copy of this Augmenter instance.

draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.

find_augmenters(self, func[, parents, flat]) Find augmenters that match a condition.

find_augmenters_by_name(self, name[, regex, ...]) Find augmenter(s) by name.

find_augmenters_by_names(self, names[, ...]) Find augmenter(s) by names.

get_all_children(self[, flat]) Get all children of this augmenter as a list.

get_children_lists(self) Get a list of lists of children of this augmenter.

get_parameters(self) See get_parameters().

localize_random_state(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.

localize_random_state_(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
```
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<table>
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<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**class** `imgaug.augmenters.arithmetic.CoarseSalt(p=(0.02, 0.1), size_px=None, size_percent=None, per_channel=False, min_size=3, seed=None, name=None, random_state='deprecated', deterministic='deprecated')`

Bases: `imgaug.augmenters.arithmetic.ReplaceElementwise`

Replace rectangular areas in images with white-ish pixel noise.

See also the similar `CoarseSaltAndPepper`.

**Supported dtypes:**

See `ReplaceElementwise`.

**Parameters**

- **p** *(float or tuple of float or list of float or imgaug.parameters.StochasticParameter, optional)*
  - Probability of changing a pixel to salt noise.
    - If a float, then that value will always be used as the probability.
    - If a tuple \((a, b)\), then a probability will be sampled uniformly per image from the interval \([a, b]\).
    - If a list, then a random value will be sampled from that list per image.
    - If a StochasticParameter, then a lower-resolution mask will be sampled from that parameter per image. Any value \(>0.5\) in that mask will denote a spatial location that is to be replaced by salt noise.

- **size_px** *(int or tuple of int or imgaug.parameters.StochasticParameter, optional)* – The size of the lower resolution image from which to sample the replacement mask in absolute pixel dimensions. Note that this means that lower values of this parameter lead to larger areas being replaced (as any pixel in the lower resolution image will correspond to a larger area at the original resolution).
  - If None then `size_percent` must be set.
  - If an integer, then that size will always be used for both height and width. E.g. a value of 3 would lead to a \(3 \times 3\) mask, which is then upsampled to \(H \times W\), where \(H\) is the image size and \(W\) the image width.
If a tuple \((a, b)\), then two values \(M, N\) will be sampled from the discrete interval \([a, b]\). The mask will then be generated at size \(M \times N\) and upsampled to \(H \times W\).

- If a \texttt{StochasticParameter}, then this parameter will be used to determine the sizes. It is expected to be discrete.

- **\texttt{size\_percent}** (float or tuple of float or \texttt{imgaug.parameters.StochasticParameter}, optional)
  - The size of the lower resolution image from which to sample the replacement mask in percent of the input image. Note that this means that lower values of this parameter lead to larger areas being replaced (as any pixel in the lower resolution image will correspond to a larger area at the original resolution).
  - If None then \texttt{size\_px} must be set.
  - If a float, then that value will always be used as the percentage of the height and width (relative to the original size). E.g. for value \(p\), the mask will be sampled from \((p \times H) \times (p \times W)\) and later upsampled to \(H \times W\).
  - If a tuple \((a, b)\), then two values \(m, n\) will be sampled from the interval \((a, b)\) and used as the size fractions, i.e. the mask size will be \((m \times H) \times (n \times W)\).
  - If a \texttt{StochasticParameter}, then this parameter will be used to sample the percentage values. It is expected to be continuous.

- **\texttt{per\_channel}** (bool or float or \texttt{imgaug.parameters.StochasticParameter}, optional)
  - Whether to use (imagewise) the same sample(s) for all channels (\texttt{False}) or to sample value(s) for each channel (\texttt{True}). Setting this to \texttt{True} will therefore lead to different transformations per image and channel, otherwise only per image. If this value is a float \(p\), then for \(p\) percent of all images \texttt{per\_channel} will be treated as \texttt{True}. If it is a \texttt{StochasticParameter} it is expected to produce samples with values between 0.0 and 1.0, where values > 0.5 will lead to per-channel behaviour (i.e. same as \texttt{True}).

- **\texttt{min\_size}** (int, optional) – Minimum height and width of the low resolution mask. If \texttt{size\_percent} or \texttt{size\_px} leads to a lower value than this, \texttt{min\_size} will be used instead. This should never have a value of less than 2, otherwise one may end up with a 1x1 low resolution mask, leading easily to the whole image being replaced.

- **\texttt{seed}** (None or \texttt{int} or \texttt{imgaug.random.RNG} or \texttt{numpy.random.Generator} or \texttt{numpy.random.BitGenerator} or \texttt{numpy.random.SeedSequence} or \texttt{numpy.random.RandomState}, optional) – See \texttt{\_\_init\_\_}().

- **\texttt{name}** (None or \texttt{str}, optional) – See \texttt{\_\_init\_\_}().

- **\texttt{random\_state}** (None or \texttt{int} or \texttt{imgaug.random.RNG} or \texttt{numpy.random.Generator} or \texttt{numpy.random.BitGenerator} or \texttt{numpy.random.SeedSequence} or \texttt{numpy.random.RandomState}, optional) – Old name for parameter \texttt{seed}. Its usage will not yet cause a deprecation warning, but it is still recommended to use \texttt{seed} now. Outdated since 0.4.0.

- **\texttt{deterministic}** (bool, optional) – Deprecated since 0.4.0. See method \texttt{to\_deterministic()} for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CoarseSalt(0.05, size_percent=(0.01, 0.1))
```
Mark 5% of all pixels in a mask to be replaced by salt noise. The mask has 1% to 10% the size of the input image. The mask is then upscaled to the input image size, leading to large rectangular areas being marked as to be replaced. These areas are then replaced in the input image by salt noise.

Methods

```
__call__(self, *args, **kwargs) Alias for `augment()`.
augment(self, return_batch, hooks) Augment a batch.
augment_batch(self, batch, hooks) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self, batches[, hooks, ...]) Augment multiple batches.
augment_bounding_boxes(self,[..., parents, ...]) Augment a batch of bounding boxes.
augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
augment_image(self, image[, hooks]) Augment a single image.
augment_images(self, images[, parents, hooks]) Augment a batch of images.
augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
augment_line_strings(self,...[, parents, hooks]) Augment a batch of line strings.
augment_polygons(self, polygons_on_images[, ...]) Augment a batch of polygons.
augment_segmentation_maps(self, segmaps[,...]) Augment a batch of segmentation maps.
copy(self) Create a shallow copy of this Augmenter instance.
copy_random_state(self, source[, recursive,...]) Copy the RNGs from a source augmenter sequence.
copy_random_state_(self[, recursive]) Copy the RNGs from a source augmenter sequence in-place.
deepcopy(self) Create a deep copy of this Augmenter instance.
draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.
find_augmenters(self, func[, parents, flat]) Find augmenters that match a condition.
find_augmenters_by_name(self, name[, regex,...]) Find augmenter(s) by name.
find_augmenters_by_names(self, names[, ...]) Find augmenter(s) by names.
get_all_children(self[, flat]) Get all children of this augmenter as a list.
get_children_lists(self) Get a list of lists of children of this augmenter.
get_parameters(self) See `get_parameters()`.
localize_random_state(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
localize_random_state_(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
pool(self, processes, maxtasksperchild, seed) Create a pool used for multicore augmentation.
remove_augmenters(self, func[, copy,...]) Remove this augmenter or children that match a condition.
remove_augmenters_(self, func[, parents]) Remove in-place children of this augmenter that match a condition.
```

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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>Deprecated</th>
</tr>
</thead>
<tbody>
<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Function to remove augmenters in place.</td>
<td></td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
<td></td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
<td></td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
<td></td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
<td></td>
</tr>
</tbody>
</table>

class `imgaug.augmenters.arithmetic.CoarseSaltAndPepper` *(p=(0.02, 0.1), size_px=None, size_percent=None, per_channel=False, min_size=3, seed=None, name=None, random_state='deprecated', deterministic='deprecated')*

Replace rectangular areas in images with white/black-ish pixel noise.

This adds salt and pepper noise (noisy white-ish and black-ish pixels) to rectangular areas within the image. Note that this means that within these rectangular areas the color varies instead of each rectangle having only one color.

See also the similar `CoarseDropout`.

TODO replace dtype support with uint8 only, because replacement is geared towards that value range

Supported dtypes:

See `ReplaceElementwise`.

Parameters

- **p** *(float or tuple of float or list of float or `imgaug.parameters.StochasticParameter`, optional)*
  - Probability of changing a pixel to salt/pepper noise.
    - If a float, then that value will always be used as the probability.
    - If a tuple `(a, b)`, then a probability will be sampled uniformly per image from the interval `[a, b]`.
    - If a list, then a random value will be sampled from that list per image.
    - If a `StochasticParameter`, then a lower-resolution mask will be sampled from that parameter per image. Any value >0.5 in that mask will denote a spatial location that is to be replaced by salt and pepper noise.

- **size_px** *(int or tuple of int or `imgaug.parameters.StochasticParameter`, optional)* – The size of the lower resolution image from which to sample the replacement mask in absolute pixel dimensions. Note that this means that lower values of this parameter lead to larger areas being replaced (as any pixel in the lower resolution image will correspond to a larger area at the original resolution).
  - If None then `size_percent` must be set.
- If an integer, then that size will always be used for both height and width. E.g. a value of 3 would lead to a 3x3 mask, which is then upsampled to HxW, where H is the image size and W the image width.

- If a tuple (a, b), then two values M, N will be sampled from the discrete interval [a..b]. The mask will then be generated at size MxN and upsampled to HxW.

- If a StochasticParameter, then this parameter will be used to determine the sizes. It is expected to be discrete.

  - size_percent (float or tuple of float or imgaug.parameters.StochasticParameter, optional)
    - The size of the lower resolution image from which to sample the replacement mask in percent of the input image. Note that this means that lower values of this parameter lead to larger areas being replaced (as any pixel in the lower resolution image will correspond to a larger area at the original resolution).
      - If None then size_px must be set.
      - If a float, then that value will always be used as the percentage of the height and width (relative to the original size). E.g. for value p, the mask will be sampled from \((p*H) \times (p*W)\) and later upsampled to HxW.
      - If a tuple (a, b), then two values m, n will be sampled from the interval (a, b) and used as the size fractions, i.e the mask size will be \((m*H) \times (n*W)\).
      - If a StochasticParameter, then this parameter will be used to sample the percentage values. It is expected to be continuous.

  - per_channel (bool or float or imgaug.parameters.StochasticParameter, optional)
    - Whether to use (imagewise) the same sample(s) for all channels (False) or to sample value(s) for each channel (True). Setting this to True will therefore lead to different transformations per image and channel, otherwise only per image. If this value is a float p, then for p percent of all images per_channel will be treated as True. If it is a StochasticParameter it is expected to produce samples with values between 0.0 and 1.0, where values >0.5 will lead to per-channel behaviour (i.e. same as True).

  - min_size (int, optional) – Minimum height and width of the low resolution mask. If size_percent or size_px leads to a lower value than this, min_size will be used instead. This should never have a value of less than 2, otherwise one may end up with a 1x1 low resolution mask, leading easily to the whole image being replaced.

  - seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

  - name (None or str, optional) – See __init__().

  - random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

  - deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.
Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CoarseSaltAndPepper(0.05, size_percent=(0.01, 0.1))
```

Marks 5% of all pixels in a mask to be replaced by salt/pepper noise. The mask has 1% to 10% the size of the input image. The mask is then upscaled to the input image size, leading to large rectangular areas being marked as to be replaced. These areas are then replaced in the input image by salt/pepper noise.

```python
>>> aug = iaa.CoarseSaltAndPepper(0.05, size_px=(4, 16))
```

Same as in the previous example, but the replacement mask before upsampling has a size between 4x4 and 16x16 pixels (the axis sizes are sampled independently, i.e. the mask may be rectangular).

```python
>>> aug = iaa.CoarseSaltAndPepper(
>>> 0.05, size_percent=(0.01, 0.1), per_channel=True)
```

Same as in the first example, but mask and replacement are each sampled independently per image channel.

Methods

- `__call__` (self, *args, **kwargs) Alias for `augment()`.
- `augment` (self, return_batch, hooks) Augment a batch.
- `augment_batch` (self, batch[, hooks]) Deprecated.
- `augment_batch_(self, batch[, parents, hooks])` Augment a single batch in-place.
- `augment_batches` (self, batches[, hooks, ...]) Augment multiple batches.
- `augment_bounding_boxes` (self, ..., [parents, ...]) Augment a batch of bounding boxes.
- `augment_heatmaps` (self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
- `augment_image` (self, image[, hooks]) Augment a single image.
- `augment_images` (self, images[, parents, hooks]) Augment a batch of images.
- `augment_keypoints` (self, keypoints_on_images) Augment a batch of keypoints/landmarks.
- `augment_line_strings` (self, ..., [parents, hooks]) Augment a batch of line strings.
- `augment_polygons` (self, polygons_on_images[, ...]) Augment a batch of polygons.
- `augment_segmentation_maps` (self, segmaps[, ...]) Augment a batch of segmentation maps.
- `copy` (self) Create a shallow copy of this Augmenter instance.
- `copy_random_state` (self, source[, recursive, ...]) Copy the RNGs from a source augmenter sequence.
- `copy_random_state_` (self, source[, ...]) Copy the RNGs from a source augmenter sequence (in-place).
- `deepcopy` (self) Create a deep copy of this Augmenter instance.
- `draw_grid` (self, images, rows, cols) Augment images and draw the results as a single grid-like image.
- `find_augmenters` (self, func[, parents, flat]) Find augmenters that match a condition.
- `find_augmenters_by_name` (self, name[, regex, ...]) Find augmenter(s) by name.

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<thead>
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</tr>
</thead>
<tbody>
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<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self, flat)</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
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<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</tbody>
</table>

**imgaug.augmenters.arithmetic.ContrastNormalization**

```python
imgaug.augmenters.arithmetic.ContrastNormalization(alpha=1.0, per_channel=False, seed=None, name=None, random_state=’deprecated’, deterministic=’deprecated’)
```

*Deprecated.* Use `imgaug.contrast.LinearContrast` instead.

Change the contrast of images.

dtype support:

See `imgaug.augmenters.contrast.LinearContrast`.

Deprecated since 0.3.0.

**Parameters**

- **alpha** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Strength of the contrast normalization. Higher values than 1.0 lead to higher contrast, lower values decrease the contrast.
  - If a number, then that value will be used for all images.
  - If a tuple \((a, b)\), then a value will be sampled per image uniformly from the interval \([a, b]\) and be used as the alpha value.
  - If a list, then a random value will be picked per image from that list.
  - If a `StochasticParameter`, then this parameter will be used to sample the alpha value per image.

- **per_channel** *(bool or float or imgaug.parameters.StochasticParameter, optional)* – Whether to use (imagewise) the same sample(s) for all channels (False) or to sample value(s) for each channel (True). Setting this to `True` will therefore lead to different transformations per image and channel, otherwise only per image. If this value is a float \(p\), then for \(p\) percent of all images `per_channel` will be treated as `True`. If it is a
StochasticParameter it is expected to produce samples with values between 0.0 and 1.0, where values > 0.5 will lead to per-channel behaviour (i.e. same as True).

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.

- **name** *(None or str, optional)* – See `__init__()`.

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> iaa.ContrastNormalization((0.5, 1.5))

Decreases oder improves contrast per image by a random factor between 0.5 and 1.5. The factor 0.5 means that any difference from the center value (i.e. 128) will be halved, leading to less contrast.

>>> iaa.ContrastNormalization((0.5, 1.5), per_channel=0.5)

Same as before, but for 50 percent of all images the normalization is done independently per channel (i.e. factors can vary per channel for the same image). In the other 50 percent of all images, the factor is the same for all channels.
```

class `imgaug.augmenters.arithmetic.Cutout` *(nb_iterations=1, position='uniform', size=0.2, squared=True, fill_mode='constant', cval=128, fill_per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')*

Bases: `imgaug.augmenters.meta.Augmenter`

Fill one or more rectangular areas in an image using a fill mode.

See paper “Improved Regularization of Convolutional Neural Networks with Cutout” by DeVries and Taylor.

In contrast to the paper, this implementation also supports replacing image sub-areas with gaussian noise, random intensities or random RGB colors. It also supports non-squared areas. While the paper uses absolute pixel values for the size and position, this implementation uses relative values, which seems more appropriate for mixed-size datasets. The position parameter furthermore allows more flexibility, e.g. gaussian distributions around the center.

**Note:** This augmenter affects only image data. Other datatypes (e.g. segmentation map pixels or keypoints within the filled areas) are not affected.

**Note:** Gaussian fill mode will assume that float input images contain values in the interval [0.0, 1.0] and hence sample values from a gaussian within that interval, i.e. from $N(0.5, \text{std}=0.5/3)$.
Added in 0.4.0.

**Supported dtypes:**

See `cutout_()`.  

**Parameters**

- **nb_iterations** *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)*:  
  How many rectangular areas to fill.  
  - If `int`: Exactly that many areas will be filled on all images.  
  - If `tuple (a, b)`: A value from the interval `[a, b]` will be sampled per image.  
  - If `list`: A random value will be sampled from that list per image.  
  - If `StochasticParameter`: That parameter will be used to sample `(B,)` values per batch of `B` images.  

- **position** *({'uniform', 'normal', 'center', 'left-top', 'left-center', 'left-bottom', 'center-top', 'center-center', 'center-bottom', 'right-top', 'right-center', 'right-bottom'} or tuple of float or StochasticParameter or tuple of StochasticParameter, optional)*: Defines the position of each area to fill. Analogous to the definition in e.g. `CropToFixedSize`. Usually, `uniform` (anywhere in the image) or `normal` (anywhere in the image with preference around the center) are sane values.  

- **size** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)*: The size of the rectangle to fill as a fraction of the corresponding image size, i.e. with value range `[0.0, 1.0]`. The size is sampled independently per image axis.  
  - If `number`: Exactly that size is always used.  
  - If `tuple (a, b)`: A value from the interval `[a, b]` will be sampled per area and axis.  
  - If `list`: A random value will be sampled from that list per area and axis.  
  - If `StochasticParameter`: That parameter will be used to sample `(N, 2)` values per batch, where `N` is the total number of areas to fill within the whole batch.  

- **squared** *(bool or float or imgaug.parameters.StochasticParameter, optional)*: Whether to generate only squared areas cutout areas or allow rectangular ones. If this evaluates to a true-like value, the first value from `size` will be converted to absolute pixels and used for both axes.  
  If this value is a float `p`, then for `p` percent of all areas to be filled `per_channel` will be treated as True. If it is a `StochasticParameter` it is expected to produce samples with values between 0.0 and 1.0, where values >0.5 will lead to per-channel behaviour (i.e. same as True).  

- **fill_mode** *(str or list of str or imgaug.parameters.StochasticParameter, optional)*: Mode to use in order to fill areas. Corresponds to `mode` parameter in some other augmenters. Valid strings for the mode are:  
  - `constant`: Fill each area with a single value.  
  - `gaussian`: Fill each area with gaussian noise.  
  Valid datatypes are:  
  - If `str`: Exactly that mode will always be used.
• list: A random value will be sampled from that list per area.
• StochasticParameter: That parameter will be used to sample \((N, )\) values per batch, where \(N\) is the total number of areas to fill within the whole batch.

• cval (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – The value to use (i.e. the color) to fill areas if fill_mode is `constant`.
  • number: Exactly that value is used for all areas and channels.
  • tuple \((a, b)\): A value from the interval \([a, b]\) will be sampled per area (and channel if per_channel=True).
  • list: A random value will be sampled from that list per area (and channel if per_channel=True).
  • StochasticParameter: That parameter will be used to sample \((N, Cmax)\) values per batch, where \(N\) is the total number of areas to fill within the whole batch and \(Cmax\) is the maximum number of channels in any image (usually 3). If per_channel=False, only the first value of the second axis is used.

• fill_per_channel (bool or float or imgaug.parameters.StochasticParameter, optional) – Whether to fill each area in a channelwise fashion (True) or not (False). The behaviour per fill mode is:
  • constant: Whether to fill all channels with the same value (i.e, grayscale) or different values (i.e. usually RGB color).
  • gaussian: Whether to sample once from a gaussian and use the values for all channels (i.e. grayscale) or to sample channelwise (i.e. RGB colors)

If this value is a float \(p\), then for \(p\) percent of all areas to be filled per_channel will be treated as True. If it is a StochasticParameter it is expected to produce samples with values between 0.0 and 1.0, where values >0.5 will lead to per-channel behaviour (i.e. same as True).

• name (None or str, optional) – See `__init__()`.
• deterministic (bool, optional) – See `__init__()`.
• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.random.bit_generator.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See `__init__()`.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Cutout(nb_iterations=2)
```

Fill per image two random areas, by default with grayish pixels.

```python
>>> aug = iaa.Cutout(nb_iterations=(1, 5), size=0.2, squared=False)
```

Fill per image between one and five areas, each having 20% of the corresponding size of the height and width (for non-square images this results in non-square areas to be filled).

```python
>>> aug = iaa.Cutout(fill_mode="constant", cval=255)
```

Fill all areas with white pixels.
Fill 50% of all areas with a random intensity value between 0 and 256. Fill the other 50% of all areas with random colors.

```python
>>> aug = iaa.Cutout(fill_mode="constant", cval=(0, 255),
                      fill_per_channel=0.5)
```

Fill areas with gaussian channelwise noise (i.e. usually RGB).

```python
>>> aug = iaa.Cutout(fill_mode="gaussian", fill_per_channel=True)
```

Methods

```python
__call__(self, *args, **kwargs) Alias for augment().

augment(self[, return_batch, hooks]) Augment a batch.

augment_batch(self[, batch[, hooks]]) Deprecated.

augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.

augment_batches(self, batches[, hooks, ...]) Augment multiple batches.

augment_bounding_boxes(self, ..., parents, ...) Augment a batch of bounding boxes.

augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.

augment_image(self, image[, hooks]) Augment a single image.

augment_images(self, images[, parents, hooks]) Augment a batch of images.

augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.

augment_line_strings(self, ..., parents, hooks) Augment a batch of line strings.

augment_polygons(self, polygons_on_images[, ...]) Augment a batch of polygons.

augment_segmentation_maps(self, segmaps[, ...]) Augment a batch of segmentation maps.

copy(self) Create a shallow copy of this Augmenter instance.

copy_random_state(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.

copy_random_state_(self[, ...]) Assign augmenter-specific RNGs to this augmenter and its children.

deepcopy(self) Create a deep copy of this Augmenter instance.

draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.

find_augmenters(self, func[, parents, flat]) Find augmenters that match a condition.

find_augmenters_by_name(self, name[, regex, ...]) Find augmenter(s) by name.

find_augmenters_by_names(self, names[, ...]) Find augmenter(s) by names.

get_all_children(self[, flat]) Get all children of this augmenter as a list.

get_children_lists(self) Get a list of lists of children of this augmenter.

get_parameters(self) See get_parameters().

localize_random_state(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.

localize_random_state_(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
```

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<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
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<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
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<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
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<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
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<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
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<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
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<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.arithmetic.Dropout(p=(0.0, 0.05), per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Set a fraction of pixels in images to zero.

**Supported dtypes:**

See `MultiplyElementwise`.

**Parameters**

- **p** *(float or tuple of float or imgaug.parameters.StochasticParameter, optional)* –
  The probability of any pixel being dropped (i.e. to set it to zero).
  - If a float, then that value will be used for all images. A value of 1.0 would mean that all pixels will be dropped and 0.0 that no pixels will be dropped. A value of 0.05 corresponds to 5 percent of all pixels being dropped.
  - If a tuple \((a, b)\), then a value \(p\) will be sampled from the interval \([a, b]\) per image and be used as the pixel’s dropout probability.
  - If a list, then a value will be sampled from that list per batch and used as the probability.
  - If a StochasticParameter, then this parameter will be used to determine per pixel whether it should be kept (sampled value of > 0.5) or shouldn’t be kept (sampled value of <= 0.5). If you instead want to provide the probability as a stochastic parameter, you can usually do `imgaug.parameters.Binomial(1-p)` to convert parameter \(p\) to a 0/1 representation.

- **per_channel** *(bool or float or imgaug.parameters.StochasticParameter, optional)* –
  Whether to use (image-wise) the same sample(s) for all channels (False) or to sample value(s) for each channel (True). Setting this to True will therefore lead to different transformations per image and channel, otherwise only per image. If this value is a float \(p\), then for \(p\) percent of all images per_channel will be treated as True. If it is a StochasticParameter it is expected to produce samples with values between 0.0 and 1.0, where values >0.5 will lead to per-channel behaviour (i.e. same as True).
• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.

• **name** *(None or str, optional)* – See `__init__()`.

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Dropout(0.02)
```

Drops 2 percent of all pixels.

```python
>>> aug = iaa.Dropout((0.0, 0.05))
```

Drops in each image a random fraction of all pixels, where the fraction is uniformly sampled from the interval [0.0, 0.05].

```python
>>> aug = iaa.Dropout(0.02, per_channel=True)
```

Drops 2 percent of all pixels in a channelwise fashion, i.e. it is unlikely for any pixel to have all channels set to zero (black pixels).

```python
>>> aug = iaa.Dropout(0.02, per_channel=0.5)
```

Identical to the previous example, but the `per_channel` feature is only active for 50 percent of all images.

### Methods

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<td><code>__call__</code>(self, *args, **kwargs)</td>
<td>Alias for <code>augment()</code>.</td>
</tr>
<tr>
<td><code>augment</code>(self[, return_batch, hooks])</td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><code>augment_batch</code>(self, batch[, hooks])</td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><code>augment_batch_(self, batch[, parents, hooks])</code></td>
<td>Augment multiple batches.</td>
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<tr>
<td><code>augment_bounding_boxes</code>(self, ...[, parents, ...])</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps</code>(self, heatmaps[, parents, ...])</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image</code>(self, image[, hooks])</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images</code>(self, images[, parents, hooks])</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints</code>(self, key_points_on_images)</td>
<td>Augment a batch of keypoints/landmarks.</td>
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<td><code>augment_line_strings</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
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<tr>
<td><code>find_augmenters</code></td>
<td>Find augmenters that match a condition.</td>
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<tr>
<td><code>find_augmenters_by_name</code></td>
<td>Find augmenter(s) by name.</td>
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<tr>
<td><code>find_augmenters_by_names</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
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<tr>
<td><code>remove_augmenters</code></td>
<td>Remove this augmenter or children that match a condition.</td>
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<tr>
<td><code>remove_augmenters_inplace</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>reseed</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
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```python
class imgaug.augmenters.arithmetic.Dropout2d(p=0.1, nb_keep_channels=1, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.meta.Augmenter`  
Drop random channels from images.  
For image data, dropped channels will be filled with zeros.  

**Note:** This augmenter may also set the arrays of heatmaps and segmentation maps to zero and remove all coordinate-based data (e.g. it removes all bounding boxes on images that were filled with zeros). It does so if and only if all channels of an image are dropped. If `nb_keep_channels >= 1` then that never happens.
Added in 0.4.0.

**Supported dtypes:**

- `uint8`: yes; fully tested
- `uint16`: yes; tested
- `uint32`: yes; tested
- `uint64`: yes; tested
- `int8`: yes; tested
- `int16`: yes; tested
- `int32`: yes; tested
- `int64`: yes; tested
- `float16`: yes; tested
- `float32`: yes; tested
- `float64`: yes; tested
- `float128`: yes; tested
- `bool`: yes; tested

**Parameters**

- `p` *(float or tuple of float or imgaug.parameters.StochasticParameter, optional)* –
  The probability of any channel to be dropped (i.e. set to zero).
  - If a float, then that value will be used for all channels. A value of 1.0 would mean, that all channels will be dropped. A value of 0.0 would lead to no channels being dropped.
  - If a tuple `(a, b)`, then a value `p` will be sampled from the interval `[a, b)` per batch and be used as the dropout probability.
  - If a list, then a value will be sampled from that list per batch and used as the probability.
  - If a StochasticParameter, then this parameter will be used to determine per channel whether it should be kept (sampled value of >= 0.5) or shouldn’t be kept (sampled value of < 0.5). If you instead want to provide the probability as a stochastic parameter, you can usually do `imgaug.parameters.Binomial(1-p)` to convert parameter `p` to a 0/1 representation.

- `nb_keep_channels` *(int)* – Minimum number of channels to keep unaltered in all images. E.g. a value of 1 means that at least one channel in every image will not be dropped, even if `p=1.0`. Set to 0 to allow dropping all channels.

- `seed` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.

- `name` *(None or str, optional)* – See `__init__()`.

- `random_state` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
• **deterministic** *(bool, optional)*  – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Dropout2d(p=0.5)
```

Create a dropout augmenter that drops on average half of all image channels. Dropped channels will be filled with zeros. At least one channel is kept unaltered in each image (default setting).

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Dropout2d(p=0.5, nb.keep_channels=0)
```

Create a dropout augmenter that drops on average half of all image channels and may drop all channels in an image (i.e. images may contain nothing but zeros).

**Methods**

```python
__call__ (self, *args, **kwargs)  
Augment a batch.

augment (self, return_batch, hooks)  
Augment a batch.

augment_batch (self, batch[, hooks])  
Augment a single batch in-place.

augment_batches (self, batches[, hooks,...])  
Augment multiple batches.

augment_bounding_boxes (self, ..., parents, ...)  
Augment a batch of bounding boxes.

augment_heatmaps (self, heatmaps[, parents, ...])  
Augment a batch of heatmaps.

augment_image (self, image[, hooks])  
Augment a single image.

augment_images (self, images[, parents, hooks])  
Augment a batch of images.

augment_keypoints (self, keypoints_on_images)  
Augment a batch of keypoints/landmarks.

augment_line_strings (self, ..., parents, hooks)  
Augment a batch of line strings.

augment_polygons (self, polygons_on_images[, ...])  
Augment a batch of polygons.

augment_segmentation_maps (self, segmaps[, ...])  
Augment a batch of segmentation maps.

copy (self)  
Create a shallow copy of this Augmenter instance.

copy_random_state (self, source[, recursive,...])  
Copy the RNGs from a source augmenter sequence.

copy_random_state (self, source[, ...,])  
Copy the RNGs from a source augmenter sequence (in-place).

decopy (self)  
Create a deep copy of this Augmenter instance.

draw_grid (self, images, rows, cols)  
Augment images and draw the results as a single grid-like image.

find_augmenters (self, func[, parents, flat])  
Find augmenters that match a condition.

find_augmenters_by_name (self, name[, regex,...])  
Find augmenter(s) by name.
```

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<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
<td><code>localize_random_state_</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace</code></td>
<td><strong>Deprecated.</strong></td>
</tr>
<tr>
<td><code>reseed</code></td>
<td><strong>Deprecated.</strong></td>
</tr>
<tr>
<td><code>seed_</code></td>
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</tr>
<tr>
<td><code>show_grid</code></td>
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</tr>
<tr>
<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

#### get_parameters

See `get_parameters()`.

```python
class imgaug.augmenters.arithmetic.ImpulseNoise(p=(0.0, 0.03), seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.arithmetic.SaltAndPepper`

Add impulse noise to images.

This is identical to `SaltAndPepper`, except that `per_channel` is always set to `True`.

**Supported dtypes:**

See `SaltAndPepper`.

**Parameters**

- **p** *(float or tuple of float or list of float or imgaug.parameters.StochasticParameter, optional)*
  - Probability of replacing a pixel to impulse noise.
    - If a float, then that value will always be used as the probability.
    - If a tuple `(a, b)`, then a probability will be sampled uniformly per image from the interval `[a, b]`.
    - If a list, then a random value will be sampled from that list per image.
    - If a StochasticParameter, then a image-sized mask will be sampled from that parameter per image. Any value >0.5 in that mask will be replaced with impulse noise noise.
• **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

• **name** (None or str, optional) – See __init__().

• **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
generate = import imgaug.augmenters as iaa
>>> aug = iaa.ImpulseNoise(0.1)
```

Replace 10% of all pixels with impulse noise.

### Methods

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<tr>
<td><strong>call</strong> (self, *args, **kwargs)</td>
<td>Alias for augment().</td>
</tr>
<tr>
<td>augment(self[, return_batch, hooks])</td>
<td>Augment a batch.</td>
</tr>
<tr>
<td>augment_batch(self[, batch[, hooks]])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>augment_batch (self, batch[, parents, hooks])</td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td>augment_batches (self, batches[, hooks, ...])</td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td>augment_bounding_boxes (self, [...[, parents, ...]])</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td>augment_heatmaps (self[, heatmaps[, parents, ...]])</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td>augment_image (self, image[, hooks])</td>
<td>Augment a single image.</td>
</tr>
<tr>
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</tr>
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<td>augment_line_strings (self, [...[, parents, hooks]])</td>
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</tr>
<tr>
<td>augment_polygons (self, polygons_on_images[, ...])</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation (self, segmaps[, ...])</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
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<td>Copy the RNGs from a source augmenter sequence.</td>
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<td>(in-place).</td>
<td></td>
</tr>
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<tr>
<td>draw_grid (self, images, rows, cols)</td>
<td>Augment images and draw the results as a single</td>
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<td>grid-like image.</td>
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<table>
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<td>Find augmenters that match a condition.</td>
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**class** `imgaug.augmenters.arithmetic.Invert` *(p=1, per_channel=False, min_value=None, max_value=None, threshold=None, invert_above_threshold=0.5, seed=None, name=None, random_state='deprecated', deterministic='deprecated')*

**Bases:** `imgaug.augmenters.meta.Augmenter`

Invert all values in images, e.g. turn 5 into 255-5=250.

For the standard value range of 0-255 it converts 0 to 255, 255 to 0 and 10 to (255-10)=245. Let M be the maximum value possible, m the minimum value possible, v a value. Then the distance of v to m is d=abs(v-m) and the new value is given by v'=M-d.

**Supported dtypes:**

See `invert()`.

**Parameters**

- `p` *(float or imgaug.parameters.StochasticParameter, optional)*

  The probability of an image to be inverted.

  - If a float, then that probability will be used for all images, i.e. p percent of all images will be inverted.
  
  - If a StochasticParameter, then that parameter will be queried per image and is expected to return values in the interval [0.0, 1.0], where values >0.5 mean that the image is supposed to be inverted. Recommended to be some form of `imgaug.parameters.Binomial`. 

13.17. `imgaug.augmenters.arithmetic`
• **per_channel** *(bool or float or imgaug.parameters.StochasticParameter, optional)* — Whether to use (image-wise) the same sample(s) for all channels *(False)* or to sample value(s) for each channel *(True)*. Setting this to *True* will therefore lead to different transformations per image and channel, otherwise only per image. If this value is a float $p$, then for $p$ percent of all images *per_channel* will be treated as *True*. If it is a *StochasticParameter* it is expected to produce samples with values between $0.0$ and $1.0$, where values $>0.5$ will lead to per-channel behaviour (i.e. same as *True*).

• **min_value** *(None or number, optional)* — Minimum of the value range of input images, e.g. 0 for *uint8* images. If set to *None*, the value will be automatically derived from the image’s dtype.

• **max_value** *(None or number, optional)* — Maximum of the value range of input images, e.g. 255 for *uint8* images. If set to *None*, the value will be automatically derived from the image’s dtype.

• **threshold** *(None or number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* — A threshold to use in order to invert only numbers above or below the threshold. If *None* no thresholding will be used.
  - If *None*: No thresholding will be used.
  - If *number*: The value will be used for all images.
  - If *tuple* $(a, b)$: A value will be uniformly sampled per image from the interval $[a, b)$.
  - If *list*: A random value will be picked from the list per image.
  - If *StochasticParameter*: Per batch of size $N$, the parameter will be queried once to return $(N,)$ samples.

• **invert_above_threshold** *(bool or float or imgaug.parameters.StochasticParameter, optional)* — If *True*, only values $\geq$ *threshold* will be inverted. Otherwise, only values $<\text{threshold}$ will be inverted. If a number, then expected to be in the interval $[0.0, 1.0]$ and denoting an image-wise probability. If a *StochasticParameter* then $(N,)$ values will be sampled from the parameter per batch of size $N$ and interpreted as *True* if $>0.5$. If *threshold* is *None* this parameter has no effect.

• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* — See *__init__()*.

• **name** *(None or str, optional)* — See *__init__()*.

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* — Old name for parameter *seed*. Its usage will not yet cause a deprecation warning, but it is still recommended to use *seed* now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* — Deprecated since 0.4.0. See method *to_deterministic()* for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Invert(0.1)
```
Inverts the colors in 10 percent of all images.

```python
>>> aug = iaa.Invert(0.1, per_channel=True)
```

Inverts the colors in 10 percent of all image channels. This may or may not lead to multiple channels in an image being inverted.

```python
>>> aug = iaa.Invert(0.1, per_channel=0.5)
```

Identical to the previous example, but the `per_channel` feature is only active for 50 percent of all images.

**Methods**

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<td><code>augment(self[, return_batch, hooks])</code></td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><code>augment_batch(self, batch[, hooks])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>augment_batch_(self, batch[, parents, hooks])</code></td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><code>augment_batches(self, batches[, hooks, ...])</code></td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td><code>augment_bounding_boxes(self, [...], parents, ...)</code></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps(self, heatmaps[, ...])</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(self, image[, hooks])</code></td>
<td>Augment a single image.</td>
</tr>
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<td><code>augment_images(self, images[, parents, hooks])</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints(self, keypoints_on_images)</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings(self, [...], parents, hooks)</code></td>
<td>Augment a batch of line strings.</td>
</tr>
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<td><code>augment_polygons(self, polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(self, segmaps[, ...])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
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<tr>
<td><code>copy_random_state(self[, source[, recursive[, ...]])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(self, source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
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<tr>
<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
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<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
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<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
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<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
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<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
<td>pool(self[, processes, maxtasksperchild, seed])</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters(self, func[, copy, ...])</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

ALLOW_DTYPES_CUSTOM_MINMAX = [dtypes('uint8'), dtypes('uint16'), dtypes('uint32'), dtypes('int8'), dtypes('int16'), dtypes('int32'), dtypes('float16'), dtypes('float32')]

get_parameters(self)
See get_parameters().

class imgaug.augmenters.arithmetic.JpegCompression(compression=(0, 100), seed=None, name=None, random_state='deprecated', deterministic='deprecated')
Bases: imgaug.augmenters.meta.Augmenter

Degrade the quality of images by JPEG-compressing them.

During JPEG compression, high frequency components (e.g. edges) are removed. With low compression (strength) only the highest frequency components are removed, while very high compression (strength) will lead to only the lowest frequency components “surviving”. This lowers the image quality. For more details, see https://en.wikipedia.org/wiki/Compression_artifact.

Note that this augmenter still returns images as numpy arrays (i.e. saves the images with JPEG compression and then reloads them into arrays). It does not return the raw JPEG file content.

Supported dtypes:
See compress_jpeg().

Parameters

- **compression** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Degree of compression used during JPEG compression within value range [0, 100]. Higher values denote stronger compression and will cause low-frequency components to disappear. Note that JPEG’s compression strength is also often set as a quality, which is the inverse of this parameter. Common choices for the quality setting are around 80 to 95, depending on the image. This translates here to a compression parameter of around 20 to 5.
  - If a single number, then that value always will be used as the compression.
  - If a tuple (a, b), then the compression will be a value sampled uniformly from the interval [a, b].
  - If a list, then a random value will be sampled from that list per image and used as the compression.
- If a StochasticParameter, then $N$ samples will be drawn from that parameter per
  $N$ input images, each representing the compression for the $n$-th image.
  
- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator
  or numpy.random.BitGenerator or numpy.random.SeedSequence or
  numpy.random.RandomState, optional)* – See **init**(.)

- **name** *(None or str, optional)* – See **init**(.)

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator
  or numpy.random.BitGenerator or numpy.random.SeedSequence or
  numpy.random.RandomState, optional)* – Old name for parameter seed. Its usage
  will not yet cause a deprecation warning, but it is still recommended to use
  seed now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method
  to_deterministic() for an alternative and for details about what the “deterministic
  mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.JpegCompression(compression=(70, 99))
```

Remove high frequency components in images via JPEG compression with a compression strength
between 70 and 99 (randomly and uniformly sampled per image). This corresponds to a (very low) quality setting of 1 to 30.

**Methods**

- **__call__**(self, *args, **kwargs) – Alias for **augment**(.)

- **augment**(self, return_batch, hooks) – Augment a batch.

- **augment_batch**(self, batch[, hooks]) – Deprecated.

- **augment_batch**(self, batch[, parents, hooks]) – Augment a single batch in-place.

- **augment_batches**(self, batches[, hooks, ...]) – Augment multiple batches.

- **augment_bounding_boxes**(self, ..., [parents, ...
  ...]) – Augment a batch of bounding boxes.

- **augment_heatmaps**(self, heatmaps[, parents,
  ...]) – Augment a batch of heatmaps.

- **augment_image**(self, image[, hooks]) – Augment a single image.

- **augment_images**(self, images[, parents, hooks]) – Augment a batch of images.

- **augment_keypoints**(self,
  keypoints_on_images) – Augment a batch of keypoints/landmarks.

- **augment_line_strings**(self, ..., [parents,
  hooks]) – Augment a batch of line strings.

- **augment_polygons**(self, polygons_on_images[, ...
  ...]) – Augment a batch of polygons.

- **augment_segmentation_maps**(self,
  segmaps[, ...]) – Augment a batch of segmentation maps.

- **copy**(self) – Create a shallow copy of this Augmenter instance.

- **copy_random_state**(self, source[, recursive,
  ...]) – Copy the RNGs from a source augmenter sequence.

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<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
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<tr>
<td><code>reseed_(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
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<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
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<tr>
<td><code>to_deterministic_(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>

```
get_parameters_(self)
    See `get_parameters()`.
```

```
class imgaug.augmenters.arithmetic.Multiply (mul=(0.8, 1.2), per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.meta.Augmenter`

Multiply all pixels in an image with a random value sampled once per image.

This augmenter can be used to make images lighter or darker.

**Supported dtypes:**

See `multiply_scalar()`.

**Parameters**

- `mul` *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – 
  
  The value with which to multiply the pixel values in each image.
  
  - If a number, then that value will always be used.
- If a tuple \((a, b)\), then a value from the interval \([a, b]\) will be sampled per image and used for all pixels.
- If a list, then a random value will be sampled from that list per image.
- If a \(\text{StochasticParameter}\), then that parameter will be used to sample a new value per image.

- **per_channel** (\(\text{bool or float or imgaug.parameters.StochasticParameter, optional}\)) – Whether to use (image-wise) the same sample(s) for all channels (\(\text{False}\)) or to sample value(s) for each channel (\(\text{True}\)). Setting this to \(\text{True}\) will therefore lead to different transformations per image and channel, otherwise only per image. If this value is a float \(p\), then for \(p\) percent of all images \(\text{per_channel}\) will be treated as \(\text{True}\). If it is a \(\text{StochasticParameter}\) it is expected to produce samples with values between 0.0 and 1.0, where values >0.5 will lead to per-channel behaviour (i.e. same as \(\text{True}\)).

- **seed** (\(\text{None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional}\)) – See \(\text{__init__()}\).

- **name** (\(\text{None or str, optional}\)) – See \(\text{__init__()}\).

- **random_state** (\(\text{None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional}\)) – Old name for parameter \(\text{seed}\). Its usage will not yet cause a deprecation warning, but it is still recommended to use \(\text{seed}\) now. Outdated since 0.4.0.

- **deterministic** (\(\text{bool, optional}\)) – Deprecated since 0.4.0. See method \(\text{to_deterministic()}\) for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Multiply(2.0)
```

Multiplies all images by a factor of 2, making the images significantly brighter.

```python
>>> aug = iaa.Multiply((0.5, 1.5))
```

Multiplies images by a random value sampled uniformly from the interval \([0.5, 1.5]\), making some images darker and others brighter.

```python
>>> aug = iaa.Multiply((0.5, 1.5), per_channel=True)
```

Identical to the previous example, but the sampled multipliers differ by image and channel, instead of only by image.

```python
>>> aug = iaa.Multiply((0.5, 1.5), per_channel=0.5)
```

Identical to the previous example, but the \(\text{per_channel}\) feature is only active for 50 percent of all images.

### Methods
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<td>Alias for augment().</td>
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<td>augment(self, return_batch, hooks)</td>
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<tr>
<td>get_parameters(self)</td>
<td>See get_parameters().</td>
</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td>Remove in-place children of this augmenter that match a condition.</td>
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<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
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<tr>
<td>show_grid(images, rows, cols)</td>
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<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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**get_parameters** *(self)*  
See `get_parameters()`.

class `imgaug.augmenters.arithmetic.MultiplyElementwise` *(mul=(0.8, 1.2), per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')*  

Bases: `imgaug.augmenters.meta.Augmenter`  
Multiply image pixels with values that are pixelwise randomly sampled.

While the `Multiply` Augmenter uses a constant multiplier *per image* (and optionally channel), this augmenter samples the multipliers to use per image and *per pixel* (and optionally per channel).

**Supported dtypes:**  
See `multiply_elementwise()`.

**Parameters**

- **mul** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)*  
The value with which to multiply pixel values in the image.
  - If a number, then that value will always be used.
  - If a tuple \((a, b)\), then a value from the interval \([a, b]\) will be sampled per image and pixel.
  - If a list, then a random value will be sampled from that list per image and pixel.
  - If a `StochasticParameter`, then that parameter will be used to sample a new value per image and pixel.

- **per_channel** *(bool or float or imgaug.parameters.StochasticParameter, optional)*  
Whether to use (imagewise) the same sample(s) for all channels *(False)* or to sample value(s) for each channel *(True)*. Setting this to `True` will therefore lead to different transformations per image and channel, otherwise only per image. If this value is a float \(p\), then for \(p\) percent of all images *per_channel* will be treated as `True`. If it is a `StochasticParameter` it is expected to produce samples with values between 0.0 and 1.0, where values >0.5 will lead to per-channel behaviour (i.e. same as `True`).

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)*  
See `__init__()`.

- **name** *(None or str, optional)*  
See `__init__()`.

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)*  
Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.MultiplyElementwise(2.0)
```

Multiply all images by a factor of 2.0, making them significantly brighter.

```python
>>> aug = iaa.MultiplyElementwise((0.5, 1.5))
```

Samples per image and pixel uniformly a value from the interval [0.5, 1.5] and multiplies the pixel with that value.

```python
>>> aug = iaa.MultiplyElementwise((0.5, 1.5), per_channel=True)
```

Samples per image and pixel *and channel* uniformly a value from the interval [0.5, 1.5] and multiplies the pixel with that value. Therefore, used multipliers may differ between channels of the same pixel.

```python
>>> aug = iaa.MultiplyElementwise((0.5, 1.5), per_channel=0.5)
```

Identical to the previous example, but the `per_channel` feature is only active for 50 percent of all images.

### Methods

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| `augment(self[, return_batch, hooks])` | Augment a batch. |
| `augment_batch(self[, batch[, hooks]])` | Deprecated. |
| `augment_batch_(self, batch[, parents, hooks])` | Augment a single batch in-place. |
| `augment_batches(self, batches[, hooks, ...])` | Augment multiple batches. |
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| `augment_segmentation_maps(self[, segmaps[, ...]])` | Augment a batch of segmentation maps. |
| `copy(self)` | Create a shallow copy of this Augmenter instance. |
| `copy_random_state(self[, source[, recursive, ...]])` | Copy the RNGs from a source augmenter sequence. |
| `copy_random_state_(self, source[, ...])` | Copy the RNGs from a source augmenter sequence (in-place). |

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```python
get_parameters(self)

See get_parameters().
```

**class** `imgaug.augmenters.arithmetic.Peper (p=(0.0, 0.05), per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')`

**Bases:** `imgaug.augmenters.arithmetic.ReplaceElementwise`

Replace pixels in images with pepper noise, i.e. black-ish pixels.

This augmenter is similar to SaltAndPepper, but adds no salt noise to images.

This augmenter is similar to Dropout, but slower and the black pixels are not uniformly black.

**Supported dtypes:**

See `ReplaceElementwise`.

**Parameters**

- **p** *(float or tuple of float or list of float or imgaug.parameters.StochasticParameter, optional)*
  - Probability of replacing a pixel with pepper noise.
  - If a float, then that value will always be used as the probability.
  - If a tuple `(a, b)`, then a probability will be sampled uniformly per image from the interval `[a, b]`. 
If a list, then a random value will be sampled from that list per image.

- If a StochasticParameter, then a image-sized mask will be sampled from that parameter per image. Any value >0.5 in that mask will be replaced with pepper noise.

**per_channel** *(bool or float or imgaug.parameters.StochasticParameter, optional)* – Whether to use (imagewise) the same sample(s) for all channels (False) or to sample value(s) for each channel (True). Setting this to True will therefore lead to different transformations per image and channel, otherwise only per image. If this value is a float $p$, then for $p$ percent of all images per_channel will be treated as True. If it is a StochasticParameter it is expected to produce samples with values between 0.0 and 1.0, where values >0.5 will lead to per-channel behaviour (i.e. same as True).

**seed** *(None or int or imgaug.random.RNG or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See __init__().

**name** *(None or str, optional)* – See __init__().

**random_state** *(None or int or imgaug.random.RNG or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

**deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Pepper(0.05)
```

Replace 5% of all pixels with pepper noise (black-ish colors).

### Methods

- `__call__()` *(self, *args, **kwargs)* – Alias for `augment()`.
- `augment(self, return_batch, hooks)` – Augment a batch.
- `augment_batch(self, batch[, hooks])` – Deprecated.
- `augment_batch(self, batch[, parents, hooks])` – Augment a single batch in-place.
- `augment_batches(self, batches[, parents, hooks])` – Augment multiple batches.
- `augment_bounding_boxes(self, ...[, parents, hooks, ...])` – Augment a batch of bounding boxes.
- `augment_heatmaps(self, heatmaps[, parents, ...])` – Augment a batch of heatmaps.
- `augment_image(self, image[, hooks])` – Augment a single image.
- `augment_images(self, images[, parents, hooks])` – Augment a batch of images.
- `augment_keypoints(self, keypoints_on_images)` – Augment a batch of keypoints/landmarks.
- `augment_line_strings(self, ...[, parents, hooks])` – Augment a batch of line strings.

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### `class imgaug.augmenters.arithmetic.ReplaceElementwise(mask, replacement, per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')`

**Bases:** `imgaug.augmenters.meta.Augmenter`

Replace pixels in an image with new values.

**Supported dtypes:**

See `replace_elementwise()`.

**Parameters**

- **mask** *(float or tuple of float or list of float or imgaug.parameters.StochasticParameter)* – Mask that indicates the pixels that are supposed to be replaced. The mask will be binarized
using a threshold of 0.5. A value of 1 then indicates a pixel that is supposed to be replaced.

- If this is a float, then that value will be used as the probability of being a 1 in the mask (sampled per image and pixel) and hence being replaced.
- If a tuple \((a, b)\), then the probability will be uniformly sampled per image from the interval \([a, b]\).
- If a list, then a random value will be sampled from that list per image and pixel.
- If a \texttt{StochasticParameter}, then this parameter will be used to sample a mask per image.

- **replacement** (\textit{number or tuple of number or list of number or \texttt{imgaug.parameters.StochasticParameter}}) – The replacement to use at all locations that are marked as 1 in the mask.
  - If this is a number, then that value will always be used as the replacement.
  - If a tuple \((a, b)\), then the replacement will be sampled uniformly per image and pixel from the interval \([a, b]\).
  - If a list, then a random value will be sampled from that list per image and pixel.
  - If a \texttt{StochasticParameter}, then this parameter will be used to sample replacement values per image and pixel.

- **per_channel** (\textit{bool or float or \texttt{imgaug.parameters.StochasticParameter}, optional}) – Whether to use (imagewise) the same sample(s) for all channels (\texttt{False}) or to sample value(s) for each channel (\texttt{True}). Setting this to \texttt{True} will therefore lead to different transformations per image \textit{and} channel, otherwise only per image. If this value is a float \(p\), then for \(p\) percent of all images \textit{per_channel} will be treated as \texttt{True}. If it is a \texttt{StochasticParameter} it is expected to produce samples with values between 0.0 and 1.0, where values >0.5 will lead to per-channel behaviour (i.e. same as \texttt{True}).

- **seed** (\textit{None or int or \texttt{imgaug.random.RNG} or \texttt{numpy.random.Generator} or \texttt{numpy.random.BitGenerator} or \texttt{numpy.random.SeedSequence} or \texttt{numpy.random.RandomState}, optional) – See \texttt{__init__}().

- **name** (\textit{None or str}, optional) – See \texttt{__init__}().

- **random_state** (\textit{None or int or \texttt{imgaug.random.RNG} or \texttt{numpy.random.Generator} or \texttt{numpy.random.BitGenerator} or \texttt{numpy.random.SeedSequence} or \texttt{numpy.random.RandomState}, optional) – Old name for parameter \texttt{seed}. Its usage will not yet cause a deprecation warning, but it is still recommended to use \texttt{seed} now. Outdated since 0.4.0.

- **deterministic** (\textit{bool}, optional) – Deprecated since 0.4.0. See method \texttt{to_deterministic()} for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = ReplaceElementwise(0.05, [0, 255])
```

Replaces 5 percent of all pixels in each image by either 0 or 255.

```python
>>> import imgaug.augmenters as iaa
>>> aug = ReplaceElementwise(0.1, [0, 255], per_channel=0.5)
```
For 50% of all images, replace 10% of all pixels with either the value 0 or the value 255 (same as in the previous example). For the other 50% of all images, replace channelwise 10% of all pixels with either the value 0 or the value 255. So, it will be very rare for each pixel to have all channels replaced by 255 or 0.

```python
>>> import imgaug.augmenters as iaa
>>> import imgaug.parameters as iap

>>> aug = ReplaceElementwise(0.1, iap.Normal(128, 0.4*128), per_channel=0.5)
```

Replace 10% of all pixels by gaussian noise centered around 128. Both the replacement mask and the gaussian noise are sampled channelwise for 50% of all images.

```python
>>> import imgaug.augmenters as iaa
>>> import imgaug.parameters as iap

>>> aug = ReplaceElementwise(iap.FromLowerResolution(iap.Binomial(0.1), size_px=8), iap.Normal(128, 0.4*128), per_channel=0.5)
```

Replace 10% of all pixels by gaussian noise centered around 128. Sample the replacement mask at a lower resolution (8x8 pixels) and upscale it to the image size, resulting in coarse areas being replaced by gaussian noise.

### Methods

- `_call__` *(self, *args, **kwargs)*: Alias for `augment()`.
- `augment(self[, return_batch, hooks])`: Augment a batch.
- `augment_batch(self[, batch[, hooks]])`: Deprecated.
- `augment_batch_(self, batch[, parents, hooks])`: Augment a single batch in-place.
- `augment_batches(self, batches[, hooks, ...])`: Augment multiple batches.
- `augment_bounding_boxes(self[, ...[, parents, ...]])`: Augment a batch of bounding boxes.
- `augment_heatmaps(self, heatmaps[, parents, ...])`: Augment a batch of heatmaps.
- `augment_image(self, image[, hooks])`: Augment a single image.
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- `augment_line_strings(self[, ...[, parents, hooks]])`: Augment a batch of line strings.
- `augment_polygons(self, polygons_on_images[, ...])`: Augment a batch of polygons.
- `augment_segmentation_maps(self, segmaps[, ...])`: Augment a batch of segmentation maps.
- `copy(self)`: Create a shallow copy of this Augmenter instance.
- `copy_random_state(self[, source[, recursive, ...]])`: Copy the RNGs from a source augmenter sequence.
- `copy_random_state_(self[, source[, ...]])`: Copy the RNGs from a source augmenter sequence (in-place).
- `deepcopy(self)`: Create a deep copy of this Augmenter instance.
- `draw_grid(self, images, rows, cols)`: Augment images and draw the results as a single grid-like image.
- `find_augmenters(self, func[, parents, flat])`: Find augmenters that match a condition.
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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
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<tbody>
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<td><code>find_augmenters_by_name</code></td>
<td>Find augmenter(s) by name.</td>
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<td><code>get_all_children</code></td>
<td>Get all children of this augmenter as a list.</td>
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<td>Get a list of lists of children of this augmenter.</td>
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<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters</code></td>
<td>Remove this augmenter or children that match a condition.</td>
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<tr>
<td><code>remove_augmenters_</code></td>
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<td><code>reseed</code></td>
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<td><code>seed_</code></td>
<td>Seed this augmenter and all of its children.</td>
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<td><code>show_grid</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>

**get_parameters** (`self`)

See `get_parameters()`.

**class** `imgaug.augmenters.arithmetic.Salt` (`p=(0.0, 0.03), per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')`

Bases: `imgaug.augmenters.arithmetic.ReplaceElementwise`

Replace pixels in images with salt noise, i.e. white-ish pixels.

This augmenter is similar to `SaltAndPepper`, but adds no pepper noise to images.

**Supported dtypes:**

See `ReplaceElementwise`.

**Parameters**

- `p` (`float`, `tuple` of `float` or `list` of `float` or `imgaug.parameters.StochasticParameter`, `optional`)
  
  Probability of replacing a pixel with salt noise.

  - If a float, then that value will always be used as the probability.
  - If a tuple `(a, b)`, then a probability will be sampled uniformly per image from the interval `[a, b]`.
  - If a list, then a random value will be sampled from that list per image.
  - If a `StochasticParameter`, then an image-sized mask will be sampled from that parameter per image. Any value >0.5 in that mask will be replaced with salt noise.
• **per_channel** *(bool or float or imgaug.parameters.StochasticParameter, optional)* – Whether to use (imagewise) the same sample(s) for all channels *(False)* or to sample value(s) for each channel *(True)*. Setting this to True will therefore lead to different transformations per image and channel, otherwise only per image. If this value is a float p, then for p percent of all images **per_channel** will be treated as True. If it is a StochasticParameter it is expected to produce samples with values between 0.0 and 1.0, where values >0.5 will lead to per-channel behaviour (i.e. same as True).

• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See **__init__()**.

• **name** *(None or str, optional)* – See **__init__()**.

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter **seed**. Its usage will not yet cause a deprecation warning, but it is still recommended to use **seed** now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method **to_deterministic()** for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Salt(0.05)
```

Replace 5% of all pixels with salt noise (white-ish colors).

Methods

```python
__call__(self, *args, **kwargs) Alias for augment().
augment(self, return_batch, hooks) Augment a batch.
augment_batch(self, batch, hooks) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_bounding_boxes(self, ...[, parents, ...) Augment a batch of bounding boxes.
augment_heatmaps(self, heatmaps[, parents, ...) Augment a batch of heatmaps.
augment_image(self, image[, hooks]) Augment a single image.
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augment_line_strings(self, ...[, parents, hooks]) Augment a batch of line strings.
augment_polygons(self, polygons_on_images[, ...) Augment a batch of polygons.
augment_segmentation_maps(self, segmaps[, ...]) Augment a batch of segmentation maps.
```

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<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
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<tr>
<td>copy_random_state(self, source[, recursive, ...])</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
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<tr>
<td>copy_random_state_(self, source[...])</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy(self)</td>
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</tr>
<tr>
<td>draw_grid(self, images, rows, cols)</td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td>find_augmenters(self, func[, parents, flat])</td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td>find_augmenters_by_name(self, name[, regex, ...])</td>
<td>Find augmenter(s) by name.</td>
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<td>find_augmenters_by_names(self, names[, ...])</td>
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<tr>
<td>get_all_children(self[, flat])</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
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<td>get_children_lists(self)</td>
<td>Get a list of lists of children of this augmenter.</td>
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<tr>
<td>get_parameters(self)</td>
<td>See get_parameters().</td>
</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td>localize_random_state_(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td>pool(self[, processes, maxtasksperchild, seed])</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters(self, func[, copy, ...])</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td><strong>Deprecated.</strong></td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td><strong>Deprecated.</strong></td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**class** `imgaug.augmenters.arithmetic.SaltAndPepper` *(p=(0.0, 0.03), per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')*

Bases: `imgaug.augmenters.arithmetic.ReplaceElementwise`

Replace pixels in images with salt/pepper noise (white/black-ish colors).

**Supported dtypes:**

See `ReplaceElementwise`.

**Parameters**

- **p** *(float or tuple of float or list of float or `imgaug.parameters.StochasticParameter`, optional)*
  - Probability of replacing a pixel to salt/pepper noise.
  - If a float, then that value will always be used as the probability.
- If a tuple \((a, b)\), then a probability will be sampled uniformly per image from the interval \([a, b]\).
- If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, then a image-sized mask will be sampled from that parameter per image. Any value \(>0.5\) in that mask will be replaced with salt and pepper noise.

- **per_channel** (bool or float or imgaug.parameters.StochasticParameter, optional) – Whether to use (imagewise) the same sample(s) for all channels (False) or to sample value(s) for each channel (True). Setting this to True will therefore lead to different transformations per image and channel, otherwise only per image. If this value is a float \(p\), then for \(p\) percent of all images per_channel will be treated as True. If it is a StochasticParameter it is expected to produce samples with values between 0.0 and 1.0, where values \(>0.5\) will lead to per-channel behaviour (i.e. same as True).

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- **name** (None or str, optional) – See __init__().

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.SaltAndPepper(0.05)
```

Replace 5% of all pixels with salt and pepper noise.

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.SaltAndPepper(0.05, per_channel=True)
```

Replace channelwise 5% of all pixels with salt and pepper noise.

**Methods**

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<tr>
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<tbody>
<tr>
<td><strong>call</strong>(self, *args, **kwargs)</td>
<td>Alias for augment().</td>
</tr>
<tr>
<td>augment(self[, return_batch, hooks])</td>
<td>Augment a batch.</td>
</tr>
<tr>
<td>augment_batch(self[, batch[, hooks]])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>augment_batch_(self, batch[, parents, hooks])</td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td>augment_batches(self, batches[, hooks, ...])</td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td>augment_bounding_boxes(self, ..., [], parents, ...)</td>
<td>Augment a batch of bounding boxes.</td>
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<td>Augment a batch of heatmaps.</td>
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<tr>
<td>augment_image(self, image[, hooks])</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td>augment_images(self, images[, parents, hooks])</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td>augment_keypoints(self, keypoints_on_images)</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings(self, ...[, parents, hooks])</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td>augment_polygons(self, polygons_on_images[, ...])</td>
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</tr>
<tr>
<td>augment_segmentation_maps(self, segmaps[, ...])</td>
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<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
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<td>Copy the RNGs from a source Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state_(self, source[, ...])</td>
<td>Copy the RNGs from a source Augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy(self)</td>
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<td>draw_grid(self, images, rows, cols)</td>
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<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td>reseed(self[, random_state, deterministic_too])</td>
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<td>seed_(self[, entropy, deterministic_too])</td>
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<tr>
<td>show_grid(self, images, rows, cols)</td>
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<td>to_deterministic(self, n)</td>
<td>Convert this augmenter from a stochastic to a deterministc one.</td>
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</table>

**Class**: `imgaug.augmenters.arithmetic.Solarize` (p=1, per_channel=False, min_value=None, max_value=None, threshold=(64, 192), invert_above_threshold=True, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

**Bases**: `imgaug.augmenters.arithmetic.Invert`
Invert all pixel values above a threshold.

This is the same as \texttt{Invert}, but sets a default threshold around 128 (+/- 64, decided per image) and default \texttt{invert\_above\_threshold} to True (i.e. only values above the threshold will be inverted).

See \texttt{Invert} for more details.

Added in 0.4.0.

\textbf{Supported dtypes:}

See \texttt{Invert}.

\textbf{Parameters}

\begin{itemize}
  \item \texttt{p} (float or \texttt{imgaug.parameters.StochasticParameter}) – See \texttt{Invert}.
  \item \texttt{per\_channel} (bool or float or \texttt{imgaug.parameters.StochasticParameter}, optional) – See \texttt{Invert}.
  \item \texttt{min\_value} (None or number, optional) – See \texttt{Invert}.
  \item \texttt{max\_value} (None or number, optional) – See \texttt{Invert}.
  \item \texttt{threshold} (None or number or tuple of number or list of number or \texttt{imgaug.parameters.StochasticParameter}, optional) – See \texttt{Invert}.
  \item \texttt{invert\_above\_threshold} (bool or float or \texttt{imgaug.parameters.StochasticParameter}, optional) – See \texttt{Invert}.
  \item \texttt{seed} (None or int or \texttt{imgaug.random.RNG} or \texttt{numpy.random.Generator} or \texttt{numpy.random.BitGenerator} or \texttt{numpy.random.SeedSequence} or \texttt{numpy.random.RandomState}, optional) – \texttt{__init__}.
  \item \texttt{name} (None or str, optional) – \texttt{__init__}.
  \item \texttt{random\_state} (None or int or \texttt{imgaug.random.RNG} or \texttt{numpy.random.Generator} or \texttt{numpy.random.BitGenerator} or \texttt{numpy.random.SeedSequence} or \texttt{numpy.random.RandomState}, optional) – Old name for parameter \texttt{seed}. Its usage will not yet cause a deprecation warning, but it is still recommended to use \texttt{seed} now. Outdated since 0.4.0.
  \item \texttt{deterministic} (bool, optional) – Deprecated since 0.4.0. See method \texttt{to\_deterministic()} for an alternative and for details about what the “deterministic mode” actually does.
\end{itemize}

\textbf{Examples}

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Solarize(0.5, threshold=(32, 128))
```

Invert the colors in 50 percent of all images for pixels with a value between 32 and 128 or more. The threshold is sampled once per image. The thresholding operation happens per channel.

\textbf{Methods}

\begin{tabular}{ll}
\texttt{__call__}(self, *args, **kwargs) & Alias for \texttt{augment()}. \\
\texttt{augment}(self[, return\_batch, hooks]) & Augment a batch. \\
\texttt{augment\_batch}(self, batch[, hooks]) & \texttt{Depreciated}.
\end{tabular}

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<tr>
<td><code>augment_batches</code></td>
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<td><code>augment_bounding_boxes</code></td>
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<td><code>augment_heatmaps</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image</code></td>
<td>Augment a single image.</td>
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<tr>
<td><code>copy</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(in-place)</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
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<td><code>draw_grid</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
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<td><code>find_augmenters</code></td>
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<td>Find augmenter(s) by names.</td>
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<td><code>get_all_children</code></td>
<td>Get all children of this augmenter as a list.</td>
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<td><code>get_children_lists</code></td>
<td>Get a list of lists of children of this augmenter.</td>
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<td><code>get_parameters</code></td>
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<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
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<tr>
<td><code>remove_augmenters</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
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<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>resseed</code></td>
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<tr>
<td><code>seed_(in-place)</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>show_grid</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>
class imgaug.augmenters.arithmetic.TotalDropout (p=1, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.meta.Augmenter

Drop all channels of a defined fraction of all images.
For image data, all components of dropped images will be filled with zeros.

Note: This augmenter also sets the arrays of heatmaps and segmentation maps to zero and removes all coordinate-based data (e.g. it removes all bounding boxes on images that were filled with zeros).

Added in 0.4.0.

Supported dtypes:
- uint8: yes; fully tested
- uint16: yes; tested
- uint32: yes; tested
- uint64: yes; tested
- int8: yes; tested
- int16: yes; tested
- int32: yes; tested
- int64: yes; tested
- float16: yes; tested
- float32: yes; tested
- float64: yes; tested
- float128: yes; tested
- bool: yes; tested

Parameters
- p (float or tuple of float or imgaug.parameters.StochasticParameter, optional) –
  The probability of an image to be filled with zeros.
  - If float: The value will be used for all images. A value of 1.0 would mean that all
    images will be set to zero. A value of 0.0 would lead to no images being set to zero.
  - If tuple (a, b): A value p will be sampled from the interval [a, b) per batch and
    be used as the dropout probability.
  - If a list, then a value will be sampled from that list per batch and used as the probability.
  - If StochasticParameter: The parameter will be used to determine per image
    whether it should be kept (sampled value of >=0.5) or shouldn’t be kept (sampled value
    of <0.5). If you instead want to provide the probability as a stochastic parameter, you
    can usually do imgaug.parameters.Binomial(1-p) to convert parameter p to a
    0/1 representation.
- seed (None or int or imgaug.random.RNG or numpy.random.Generator
  or numpy.random.BitGenerator or numpy.random.SeedSequence or
  numpy.random.RandomState, optional) – See __init__().
• **name** *(None or str, optional)* – See `__init__()`.  
• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator  
  or numpy.random.BitGenerator or numpy.random.SeedSequence or  
  numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage  
 will not yet cause a deprecation warning, but it is still recommended to use `seed` now.  
 Outdated since 0.4.0.  
• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method  
  `to_deterministic()` for an alternative and for details about what the “deterministic  
  mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.TotalDropout(1.0)
Create an augmenter that sets all components of all images to zero.

>>> aug = iaa.TotalDropout(0.5)
Create an augmenter that sets all components of 50% of all images to zero.
```

### Methods

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<td><code>__call__</code></td>
<td>Alias for <code>augment()</code></td>
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<td><code>augment(self, return_batch, hooks)</code></td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><code>augment_batch(self, batch[, hooks])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>augment_batch_(self, batch[, parents, hooks])</code></td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><code>augment_batches(self, batches[, hooks, ...])</code></td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td><code>augment_bounding_boxes(self, ..., [parents, ...])</code></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps(self, heatmaps[, parents, ...])</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(self, image[, hooks])</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images(self, images[, parents, hooks])</code></td>
<td>Augment a batch of images.</td>
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<tr>
<td><code>augment_keypoints(self, keypoints_on_images)</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings(self, ..., [parents, hooks])</code></td>
<td>Augment a batch of line strings.</td>
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<tr>
<td><code>augment_polygons(self, polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(self, segmaps[, ...])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(self, source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(self, source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
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<th>Description</th>
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<tbody>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[, regex,...])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy,...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
get_parameters(self)
```

See `get_parameters()`.  

```python
imgaug.augmenters.arithmetic.add_elementwise(image, values)
```

Add an array of values to an image.

This method ensures that `uint8` does not overflow during the addition.

**Supported dtypes:**

- `uint8`: yes; fully tested
- `uint16`: limited; tested (1)
- `uint32`: no
- `uint64`: no
- `int8`: limited; tested (1)
- `int16`: limited; tested (1)
- `int32`: no
- `int64`: no
- `float16`: limited; tested (1)
- `float32`: limited; tested (1)
- `float64`: no
• float128: no
• bool: limited; tested (1)

• (1) Non-uint8 dtypes can overflow. For floats, this can result in +/-inf.

Parameters
• image (ndarray) – Image array of shape \((H, W, [C])\).
• values (ndarray) – The values to add to the image. Expected to have the same height and width as image and either no channels or one channel or the same number of channels as image.

Returns Image with values added to it.
Return type ndarray

imgaug.augmenters.arithmetic.add_scalar(image, value)
Add a single scalar value or one scalar value per channel to an image.
This method ensures that uint8 does not overflow during the addition.

Supported dtypes:
• uint8: yes; fully tested
• uint16: limited; tested (1)
• uint32: no
• uint64: no
• int8: limited; tested (1)
• int16: limited; tested (1)
• int32: no
• int64: no
• float16: limited; tested (1)
• float32: limited; tested (1)
• float64: no
• float128: no
• bool: limited; tested (1)

• (1) Non-uint8 dtypes can overflow. For floats, this can result in +/-inf.

Parameters
• image (ndarray) – Image array of shape \((H, W, [C])\). If value contains more than one value, the shape of the image is expected to be \((H, W, C)\).
• value (number or ndarray) – The value to add to the image. Either a single value or an array containing exactly one component per channel, i.e. \(C\) components.

Returns Image with value added to it.
Return type ndarray
Compress an image using jpeg compression.

**Supported dtypes:**
- uint8: yes; fully tested
- uint16: ?
- uint32: ?
- uint64: ?
- int8: ?
- int16: ?
- int32: ?
- int64: ?
- float16: ?
- float32: ?
- float64: ?
- float128: ?
- bool: ?

**Parameters**
- **image** (*ndarray*) – Image of dtype `uint8` and shape `(H, W, [C])`. If `C` is provided, it must be 1 or 3.
- **compression** (*int*) – Strength of the compression in the interval `[0, 100]`.

**Returns**
Input image after applying jpeg compression to it and reloading the result into a new array. Same shape and dtype as the input.

**Return type** *ndarray*

This cutout method uses the top-left and bottom-right corner coordinates of the cutout region given as absolute pixel values.

**Note:** Gaussian fill mode will assume that float input images contain values in the interval `[0.0, 1.0]` and hence sample values from a gaussian within that interval, i.e. from `N(0.5, std=0.5/3)`.

**Supported dtypes:**
See `cutout_()`.

**Parameters**
- **image** (*ndarray*) – Image to modify.
- **x1** (*number*) – See `cutout_()`.
- **y1** (*number*) – See `cutout_()`.
• \(x2\) (number) – See cutout().
• \(y2\) (number) – See cutout().
• fill_mode (\{‘constant’, ‘gaussian’\}, optional) – See cutout().
• cval (number or tuple of number, optional) – See cutout().
• fill_per_channel (number or bool, optional) – See cutout().
• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See cutout().

Returns Image with area filled in.

Return type ndarray

**Fill a single area within an image using a fill mode (in-place).**

This cutout method uses the top-left and bottom-right corner coordinates of the cutout region given as absolute pixel values.

**Note:** Gaussian fill mode will assume that float input images contain values in the interval \([0.0, 1.0]\) and hence sample values from a gaussian within that interval, i.e. from \(\mathcal{N}(0.5, \text{std}=0.5/3)\).

Added in 0.4.0.

**Supported dtypes:**

minimum of (_fill_rectangle_gaussian_, _fill_rectangle_constant_)

**Parameters**

• image (ndarray) – Image to modify. Might be modified in-place.
• \(x1\) (number) – X-coordinate of the top-left corner of the cutout region.
• \(y1\) (number) – Y-coordinate of the top-left corner of the cutout region.
• \(x2\) (number) – X-coordinate of the bottom-right corner of the cutout region.
• \(y2\) (number) – Y-coordinate of the bottom-right corner of the cutout region.
• fill_mode (\{‘constant’, ‘gaussian’\}, optional) – Fill mode to use.
• cval (number or tuple of number, optional) – The constant value to use when filling with mode\ constant.\ May be an intensity value or color tuple.
• fill_per_channel (number or bool, optional) – Whether to fill in a channelwise fashion. If number then a value \(\geq 0.5\) will be interpreted as True.
• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – A random number generator to sample random values from. Usually an integer seed value or an RNG instance. See imgaug.random.RNG for details.

Returns Image with area filled in. The input image might have been modified in-place.

Return type ndarray
Invert an array.

**Supported dtypes:**

See `invert_()`.

**Parameters**

- `image` *(ndarray)* – See `invert_()`.
- `min_value` *(None or number, optional)* – See `invert_()`.
- `max_value` *(None or number, optional)* – See `invert_()`.
- `threshold` *(None or number, optional)* – See `invert_()`.
- `invert_above_threshold` *(bool, optional)* – See `invert_()`.

**Returns**

Inverted image.

**Return type**

`ndarray`

Invert an array in-place.

Added in 0.4.0.

**Supported dtypes:**

if (min_value=None and max_value=None):

- `uint8`: yes; fully tested
- `uint16`: yes; tested
- `uint32`: yes; tested
- `uint64`: yes; tested
- `int8`: yes; tested
- `int16`: yes; tested
- `int32`: yes; tested
- `int64`: yes; tested
- `float16`: yes; tested
- `float32`: yes; tested
- `float64`: yes; tested
- `float128`: yes; tested
- `bool`: yes; tested

if (min_value!=None or max_value!=None):

- `uint8`: yes; fully tested
- `uint16`: yes; tested
- `uint32`: yes; tested
- `uint64`: no (1)
- `int8`: yes; tested
Parameters

- **image** (*ndarray*) – Image array of shape \((H, W, [C])\). The array *might* be modified in-place.
- **min_value** (*None or number, optional*) – Minimum of the value range of input images, e.g. 0 for uint8 images. If set to None, the value will be automatically derived from the image’s dtype.
- **max_value** (*None or number, optional*) – Maximum of the value range of input images, e.g. 255 for uint8 images. If set to None, the value will be automatically derived from the image’s dtype.
- **threshold** (*None or number, optional*) – A threshold to use in order to invert only numbers above or below the threshold. If None no thresholding will be used.
- **invert_above_threshold** (*bool, optional*) – If True, only values \(\geq\)threshold will be inverted. Otherwise, only values \(<\)threshold will be inverted. If threshold is None this parameter has no effect.

Returns Inverted image. This *can* be the same array as input in image, modified in-place.

Return type *ndarray*

```python
imgaug.augmenters.arithmetic.multiply_elementwise(image, multipliers)
```

Multiply an image with an array of values.

This method ensures that uint8 does not overflow during the addition.

Supported dtypes:

- uint8: yes; fully tested
- uint16: limited; tested (1)
- uint32: no
- uint64: no
- int8: limited; tested (1)
- int16: limited; tested (1)
• int32: no
• int64: no
• float16: limited; tested (1)
• float32: limited; tested (1)
• float64: no
• float128: no
• bool: limited; tested (1)

• (1) Non-uint8 dtypes can overflow. For floats, this can result in +/-inf.

note:

Tests were only conducted for rather small multipliers, around `~10.0` to `+10.0`.

In general, the multipliers sampled from `multipliers` must be in a value range that corresponds to the input image's dtype. E.g. if the input image has dtype `uint16` and the samples generated from `multipliers` are `float64`, this function will still force all samples to be within the value range of `float16`, as it has the same number of bytes (two) as `uint16`. This is done to make overflows less likely to occur.

Parameters

• image (ndarray) – Image array of shape (H, W, [C]).
• multipliers (ndarray) – The multipliers with which to multiply the image. Expected to have the same height and width as image and either no channels or one channel or the same number of channels as image.

Returns Image, multiplied by multipliers.

Return type ndarray

imgaug.augmenters.arithmetic.multiply_scalar(image, multiplier)

Multiply an image by a single scalar or one scalar per channel.

This method ensures that uint8 does not overflow during the multiplication.

Supported dtypes:

• uint8: yes; fully tested
• uint16: limited; tested (1)
• uint32: no
• uint64: no
• int8: limited; tested (1)
• int16: limited; tested (1)
• int32: no
• int64: no
• float16: limited; tested (1)
• float32: limited; tested (1)
• float64: no
• float128: no
• bool: limited; tested (1)

• (1) Non-uint8 dtypes can overflow. For floats, this can result in +/-inf.

note:

Tests were only conducted for rather small multipliers, around `-10.0` to `+10.0`.

In general, the multipliers sampled from `multiplier` must be in a value range that corresponds to the input image's dtype. E.g. if the input image has dtype `uint16` and the samples generated from `multiplier` are `float64`, this function will still force all samples to be within the value range of `float16`, as it has the same number of bytes (two) as `uint16`. This is done to make overflows less likely to occur.

Parameters

• image (ndarray) – Image array of shape `(H, W, [C])`. If `value` contains more than one value, the shape of the image is expected to be `(H, W, C)`.

• multiplier (number or ndarray) – The multiplier to use. Either a single value or an array containing exactly one component per channel, i.e. C components.

Returns Image, multiplied by multiplier.

Return type ndarray

`imgaug.augmenters.arithmetic.replace_elementwise_`(image, mask, replacements)

Replace components in an image array with new values.

Supported dtypes:

• uint8: yes; fully tested
• uint16: yes; tested
• uint32: yes; tested
• uint64: no (1)
• int8: yes; tested
• int16: yes; tested
• int32: yes; tested
• int64: no (2)
• float16: yes; tested
• float32: yes; tested
• float64: yes; tested
• float128: no
• bool: yes; tested
• (1) \texttt{uint64} is currently not supported, because \texttt{clip\_to\_dtype\_value\_range()} does not support it, which again is because \texttt{numpy.clip()} seems to not support it.

• (2) \texttt{int64} is disallowed due to being converted to \texttt{float64} by \texttt{numpy.clip()} since 1.17 (possibly also before?).

**Parameters**

- \texttt{image (ndarray)} – Image array of shape \((H, W, [C])\).
- \texttt{mask (ndarray)} – Mask of shape \((H, W, [C])\) denoting which components to replace. If \(C\) is provided, it must be 1 or match the \(C\) of \texttt{image}. May contain floats in the interval \([0.0, 1.0]\).
- \texttt{replacements (iterable)} – Replacements to place in \texttt{image} at the locations defined by \texttt{mask}. This 1-dimensional iterable must contain exactly as many values as there are replaced components in \texttt{image}.

**Returns** Image with replaced components.

**Return type** \texttt{ndarray}

\begin{verbatim}
imgaug.augmenters.arithmetic.solarize(image, threshold=128)
Invert pixel values above a threshold.
Added in 0.4.0.

Supported dtypes:
See \texttt{solarize\_()}.

Parameters

- \texttt{image (ndarray)} – See \texttt{solarize\_()}.  
- \texttt{threshold (None or number, optional)} – See \texttt{solarize\_()}.  

Returns Inverted image.

Return type \texttt{ndarray}
\end{verbatim}

\begin{verbatim}
imgaug.augmenters.arithmetic.solarize_(image, threshold=128)
Invert pixel values above a threshold in-place.
This function is a wrapper around \texttt{invert()}.
This function performs the same transformation as \texttt{PIL.ImageOps.solarize()}.  
Added in 0.4.0.

Supported dtypes:
See \texttt{~imgaug.augmenters.arithmetic.invert\_()}.

Parameters

- \texttt{image (ndarray)} – See \texttt{invert\_()}.  
- \texttt{threshold (None or number, optional)} – See \texttt{invert\_()}. Note: The default threshold is optimized for \texttt{uint8} images.

Returns Inverted image. This \texttt{can} be the same array as input in \texttt{image}, modified in-place.

Return type \texttt{ndarray}
\end{verbatim}
13.18 imgaug.augmenters.artistic

Augmenters that apply artistic image filters.

List of augmenters:

- Cartoon

Added in 0.4.0.

class imgaug.augmenters.artistic.Cartoon(blur_ksize=(1, 5), segmentation_size=(0.8, 1.2), saturation=(1.5, 2.5), edge_prevalence=(0.9, 1.1), from_colorspace='RGB', seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.meta.Augmenter

Convert the style of images to a more cartoonish one.

This augmenter was primarily designed for images with a size of 200 to 800 pixels. Smaller or larger images may cause issues.

Note that the quality of the results can currently not compete with learned style transfer, let alone human-made images. A lack of detected edges or also too many detected edges are probably the most significant drawbacks.

Added in 0.4.0.

Supported dtypes:

See stylize_cartoon().

Parameters

- **blur_ksize** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Median filter kernel size. See stylize_cartoon() for details.
  
  - If number: That value will be used for all images.
  
  - If tuple (a, b) of number: A random value will be uniformly sampled per image from the interval [a, b).
  
  - If list: A random value will be picked per image from the list.
  
  - If StochasticParameter: The parameter will be queried once per batch for (N,) values, where N is the number of images.

- **segmentation_size** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Mean-Shift segmentation size multiplier. See stylize_cartoon() for details.
  
  - If number: That value will be used for all images.
  
  - If tuple (a, b) of number: A random value will be uniformly sampled per image from the interval [a, b).
  
  - If list: A random value will be picked per image from the list.
  
  - If StochasticParameter: The parameter will be queried once per batch for (N,) values, where N is the number of images.

- **saturation** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Saturation multiplier. See stylize_cartoon() for details.
- If `number`: That value will be used for all images.
- If `tuple (a, b) of number`: A random value will be uniformly sampled per image from the interval \([a, b)\).
- If `list`: A random value will be picked per image from the list.
- If `StochasticParameter`: The parameter will be queried once per batch for \((N,)\) values, where \(N\) is the number of images.

• **edge_prevalence** (`number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional`) – Multiplier for the prevalence of edges. See `stylize_cartoon()` for details.
  - If `number`: That value will be used for all images.
  - If `tuple (a, b) of number`: A random value will be uniformly sampled per image from the interval \([a, b)\).
  - If `list`: A random value will be picked per image from the list.
  - If `StochasticParameter`: The parameter will be queried once per batch for \((N,)\) values, where \(N\) is the number of images.

• **from_colorspace** (`str, optional`) – The source colorspace. Use one of `imgaug.augmenters.color.CSPACE_*`. Defaults to RGB.

• **seed** (`None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional`) – See `__init__()`.

• **name** (`None or str, optional`) – See `__init__()`.

• **random_state** (`None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional`) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

• **deterministic** (`bool, optional`) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Cartoon()
```
Create an example image, then apply a cartoon filter to it.

```python
>>> aug = iaa.Cartoon(blur_ksize=3, segmentation_size=1.0,
>>>                  saturation=2.0, edge_prevalence=1.0)
```
Create a non-stochastic cartoon augmenter that produces decent-looking images.

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<td>augment_segmentation_maps</td>
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<td>copy</td>
<td>Create a shallow copy of this Augmenter instance.</td>
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</tr>
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<tr>
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</tr>
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<td>to_deterministic</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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<tr>
<td>get_parameters()</td>
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**imgaug.augmenters.artistic.stylize_cartoon**

```python
imgaug.augmenters.artistic.stylize_cartoon(image, blur_ksize=3, segmentation_size=1.0, saturation=2.0, edge_prevalence=1.0, suppress_edges=True, from_colorspace='RGB')
```

Convert the style of an image to a more cartoonish one.

This function was primarily designed for images with a size of 200 to 800 pixels. Smaller or larger images may cause issues.

Note that the quality of the results can currently not compete with learned style transfer, let alone human-made images. A lack of detected edges or also too many detected edges are probably the most significant drawbacks.

This method is loosely based on the one proposed in [https://stackoverflow.com/a/11614479/3760780](https://stackoverflow.com/a/11614479/3760780)

Added in 0.4.0.

**Supported dtypes:**

- uint8: yes; fully tested
- uint16: no
- uint32: no
- uint64: no
- int8: no
- int16: no
- int32: no
- int64: no
- float16: no
- float32: no
- float64: no
- float128: no
- bool: no

**Parameters**

- **image** *(ndarray)* – A \((H, W, 3)\) uint8 image array.
- **blur_ksize** *(int, optional)* – Kernel size of the median blur filter applied initially to the input image. Expected to be an odd value and \(>=0\). If an even value, then automatically increased to an odd one. If <=1, no blur will be applied.
- **segmentation_size** *(float, optional)* – Size multiplier to decrease/increase the base size of the initial mean-shift segmentation of the image. Expected to be >=0. Note that the base size is increased by roughly a factor of two for images with height and/or width >=400.
- **edge_prevalence** *(float, optional)* – Multiplier for the prevalence of edges. Higher values lead to more edges. Note that the default value of 1.0 is already fairly conservative, so there is limit effect from lowerin it further.
- **saturation** *(float, optional)* – Multiplier for the saturation. Set to 1.0 to not change the image’s saturation.

- **suppress_edges** *(bool, optional)* – Whether to run edge suppression to remove blobs containing too many or too few edge pixels.

- **from_colorspace** *(str, optional)* – The source colorspace. Use one of `imgaug.augmenters.color.CSPACE_*.` Defaults to RGB.

  **Returns** Image in cartoonish style.

  **Return type** ndarray

### 13.19 imgaug.augmenters.base

Base classes and functions used by all/most augmenters.

This module is planned to contain `imgaug.augmenters.meta.Augmenter` in the future.

Added in 0.4.0.

**exception** `imgaug.augmenters.base.SuspiciousMultiImageShapeWarning`

**Bases:** UserWarning

Warning multi-image inputs that look like a single image.

**exception** `imgaug.augmenters.base.SuspiciousSingleImageShapeWarning`

**Bases:** UserWarning

Warning for single-image inputs that look like multiple images.

### 13.20 imgaug.augmenters.blend

Augmenters that blend two images with each other.

List of augmenters:

- `BlendAlpha`
- `BlendAlphaMask`
- `BlendAlphaElementwise`
- `BlendAlphaSimplexNoise`
- `BlendAlphaFrequencyNoise`
- `BlendAlphaSomeColors`
- `BlendAlphaHorizontalLinearGradient`
- `BlendAlphaVerticalLinearGradient`
- `BlendAlphaSegMapClassIds`
- `BlendAlphaBoundingBoxes`
- `BlendAlphaRegularGrid`
- `BlendAlphaCheckerboard`
imgaug.augmenters.blend.Alpha (factor=0, first=None, second=None, per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Deprecated. Use Alpha instead. Alpha is deprecated. Use BlendAlpha instead. The order of parameters is the same. Parameter ‘first’ was renamed to ‘foreground’. Parameter ‘second’ was renamed to ‘background’.

See BlendAlpha.

Deprecated since 0.4.0.

imgaug.augmenters.blend.AlphaElementwise (factor=0, first=None, second=None, per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Deprecated. Use AlphaElementwise instead. AlphaElementwise is deprecated. Use BlendAlphaElementwise instead. The order of parameters is the same. Parameter ‘first’ was renamed to ‘foreground’. Parameter ‘second’ was renamed to ‘background’.

See BlendAlphaElementwise.

Deprecated since 0.4.0.

class imgaug.augmenters.blend.BlendAlpha (factor=(0.0, 1.0), foreground=None, background=None, per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.meta.Augmenter

Alpha-blend two image sources using an alpha/opacity value.

The two image sources can be imagined as branches. If a source is not given, it is automatically the same as the input. Let \( FG \) be the foreground branch and \( BG \) be the background branch. Then the result images are defined as \( \text{factor} \times FG + (1-\text{factor}) \times BG \), where \( \text{factor} \) is an overlay factor.

**Note:** It is not recommended to use BlendAlpha with augmenters that change the geometry of images (e.g. horizontal flips, affine transformations) if you also want to augment coordinates (e.g. keypoints, polygons, …), as it is unclear which of the two coordinate results (foreground or background branch) should be used as the coordinates after augmentation.

Currently, if \( \text{factor} \geq 0.5 \) (per image), the results of the foreground branch are used as the new coordinates, otherwise the results of the background branch.

Added in 0.4.0. (Before that named Alpha.)

**Supported dtypes:**

See `blend_alpha()`.

**Parameters**

- **factor** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Opacity of the results of the foreground branch. Values close to 0.0 mean that the results from the background branch (see parameter `background`) make up most of the final image.
  - If float, then that value will be used for all images.
  - If tuple \((a, b)\), then a random value from the interval \([a, b]\) will be sampled per image.
  - If a list, then a random value will be picked from that list per image.
- If `StochasticParameter`, then that parameter will be used to sample a value per image.

- **foreground** *(None or `imgaug.augmenters.meta.Augmenter` or iterable of `imgaug.augmenters.meta.Augmenter`, optional)* – Augmenter(s) that make up the foreground branch. High alpha values will show this branch’s results.

  - If `None`, then the input images will be reused as the output of the foreground branch.

  - If `Augmenter`, then that augmenter will be used as the branch.

  - If iterable of `Augmenter`, then that iterable will be converted into a `Sequential` and used as the augmenter.

- **background** *(None or `imgaug.augmenters.meta.Augmenter` or iterable of `imgaug.augmenters.meta.Augmenter`, optional)* – Augmenter(s) that make up the background branch. Low alpha values will show this branch’s results.

  - If `None`, then the input images will be reused as the output of the background branch.

  - If `Augmenter`, then that augmenter will be used as the branch.

  - If iterable of `Augmenter`, then that iterable will be converted into a `Sequential` and used as the augmenter.

- **per_channel** *(bool or float or `imgaug.parameters.StochasticParameter`, optional)* – Whether to use the same factor for all channels (False) or to sample a new value for each channel (True). If this value is a float \( p \), then for \( p \) percent of all images per channel will be treated as True, otherwise as False.

- **seed** *(None or int or `imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or `numpy.random.RandomState`, optional)* – See `__init__()`.

- **name** *(None or str, optional)* – See `__init__()`.

- **random_state** *(None or int or `imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or `numpy.random.RandomState`, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.BlendAlpha(0.5, iaa.Grayscale(1.0))
```  
Convert each image to pure grayscale and alpha-blend the result with the original image using an alpha of 50%, thereby removing about 50% of all color. This is equivalent to `iaa.Grayscale(0.5)`.

```python
>>> aug = iaa.BlendAlpha((0.0, 1.0), iaa.Grayscale(1.0))
```  
Same as in the previous example, but the alpha factor is sampled uniformly from the interval \([0.0, 1.0]\) once per image, thereby removing a random fraction of all colors. This is equivalent to `iaa.Grayscale((0.0, 1.0))`.  

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First, rotate each image by a random degree sampled uniformly from the interval \([-20, 20]\). Then, alpha-blend that new image with the original one using a random factor sampled uniformly from the interval \([0.0, 1.0]\). For 50% of all images, the blending happens channel-wise and the factor is sampled independently per channel (per_channel=0.5). As a result, e.g. the red channel may look visibly rotated (factor near 1.0), while the green and blue channels may not look rotated (factors near 0.0).

Apply two branches of augmenters – A and B – independently to input images and alpha-blend the results of these branches using a factor \(f\). Branch A increases image pixel intensities by 100 and B multiplies the pixel intensities by 0.2. \(f\) is sampled uniformly from the interval \([0.0, 1.0]\) per image. The resulting images contain a bit of A and a bit of B.

Apply median blur to each image and alpha-blend the result with the original image using an alpha factor of either exactly 0.25 or exactly 0.75 (sampled once per image).

**Methods**

- `__call__`(self, *args, **kwargs) Alias for `augment()`.
- `augment`(self[, return_batch, hooks]) Augment a batch.
- `augment_batch`(self[, batch[, hooks]]) Deprecated.
- `augment_batch_`(self, batch[, parents, hooks]) Augment a single batch in-place.
- `augment_bounding_boxes`(self[, ...[, parents, ...]]) Augment a batch of bounding boxes.
- `augment_heatmaps`(self[, heatmaps[, parents, ...]]) Augment a batch of heatmaps.
- `augment_image`(self[, image[, hooks]]) Augment a single image.
- `augment_images`(self[, images[, parents, hooks]]) Augment a batch of images.
- `augment_keypoints`(self[, keypoints_on_images]) Augment a batch of keypoints/landmarks.
- `augment_line_strings`(self[, ...[, parents, hooks]]) Augment a batch of line strings.
- `augment_polygons`(self[, polygons_on_images[, ...]]) Augment a batch of polygons.
- `augment_segmentation_maps`(self[, segmaps[, ...]]) Augment a batch of segmentation maps.
- `copy`(self) Create a shallow copy of this Augmenter instance.
- `copy_random_state`(self[, source[, recursive[, ...]]]) Copy the RNGs from a source augmenter sequence.
- `copy_random_state_`(self[, source[, ...]]) Copy the RNGs from a source augmenter sequence (in-place).

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<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[, regex,...])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
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<tr>
<td><code>get_children_lists(self)</code></td>
<td>See <code>get_children_lists()</code></td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
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<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
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<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
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</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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#### `get_children_lists(self)`
See `get_children_lists()`.

#### `get_parameters(self)`
See `get_parameters()`.

### Class `imgaug.augmenters.blend.BlendAlphaBoundingBoxes`

```python
class imgaug.augmenters.blend.BlendAlphaBoundingBoxes(
    labels, foreground=None, background=None, nb_sample_labels=None, seed=None, name=None, random_state='deprecated', deterministic='deprecated'
)
```

**Bases:** `imgaug.augmenters.blend.BlendAlphaMask`

Blend images from two branches based on areas enclosed in bounding boxes.

This class generates masks that are 1.0 within bounding boxes of given labels. A mask pixel will be set to 1.0 if at least one bounding box covers the area and has one of the requested labels.

This class is a thin wrapper around `BlendAlphaMask` together with `BoundingBoxesMaskGen`.

**Note:** Avoid using augmenters as children that affect pixel locations (e.g. horizontal flips). See `BlendAlphaMask` for details.
Note: This class will produce an AssertionError if there are no bounding boxes in a batch.

Added in 0.4.0.

Supported dtypes:
See BlendAlphaMask.

Parameters

- **labels** (None or str or list of str or imgaug.parameters.StochasticParameter) – See BoundingBoxesMaskGen.

- **foreground** (None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional) – Augmenter(s) that make up the foreground branch. High alpha values will show this branch’s results.
  - If None, then the input images will be reused as the output of the foreground branch.
  - If Augmenter, then that augmenter will be used as the branch.
  - If iterable of Augmenter, then that iterable will be converted into a Sequential and used as the augmenter.

- **background** (None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional) – Augmenter(s) that make up the background branch. Low alpha values will show this branch’s results.
  - If None, then the input images will be reused as the output of the background branch.
  - If Augmenter, then that augmenter will be used as the branch.
  - If iterable of Augmenter, then that iterable will be converted into a Sequential and used as the augmenter.

- **nb_sample_labels** (None or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional) – See BoundingBoxesMaskGen.

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- **name** (None or str, optional) – See __init__().

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.BlendAlphaBoundingBoxes("person",
                                          foreground=iaa.Grayscale(1.0))
```
Create an augmenter that removes color within bounding boxes having the label `person`.

```python
>>> aug = iaa.BlendAlphaBoundingBoxes(["person", "car"],
                                        foreground=iaa.AddToHue((-255, 255)))
```

Create an augmenter that randomizes the hue within bounding boxes that have the label `person` or `car`.

```python
>>> aug = iaa.BlendAlphaBoundingBoxes(["person", "car"],
                                        foreground=iaa.AddToHue((-255, 255)),
                                        nb_sample_labels=1)
```

Create an augmenter that randomizes the hue within bounding boxes that have either the label `person` or `car`. Only one label is picked per image. Note that the sampling happens with replacement, so if `nb_sample_classes` would be \(>1\), it could still lead to only one `unique` label being sampled.

```python
>>> aug = iaa.BlendAlphaBoundingBoxes(None,
                                        background=iaa.Multiply(0.0))
```

Create an augmenter that zeros all pixels (`Multiply(0.0)`) that are not (`background` branch) within bounding boxes of \(\text{any} \) (None) label. In other words, all pixels outside of bounding boxes become black. Note that we don’t use `TotalDropout` here, because by default it will also remove all coordinate-based augmentables, which will break the blending of such inputs.

### Methods

- `__call__` (self, *args, **kwargs) | Alias for `augment()`.
- `augment` (self, return_batch, hooks) | Augment a batch.
- `augment_batch` (self, batch[, hooks]) | Deprecated.
- `augment_batch_` (self, batch[, parents, hooks]) | Augment a single batch in-place.
- `augment_batches` (self, batches[, hooks, ...]) | Augment multiple batches.
- `augment_bounding_boxes` (self, ...[, parents, ...]) | Augment a batch of bounding boxes.
- `augment_heatmaps` (self, heatmaps[, parents, ...]) | Augment a batch of heatmaps.
- `augment_image` (self, image[, hooks]) | Augment a single image.
- `augment_images` (self, images[, parents, hooks]) | Augment a batch of images.
- `augment_keypoints` (self, keypoints_on_images) | Augment a batch of keypoints/landmarks.
- `augment_line_strings` (self, ...[, parents, hooks]) | Augment a batch of line strings.
- `augment_polygons` (self, polygons_on_images[, ...]) | Augment a batch of polygons.
- `augment_segmentation_maps` (self, segmaps[, ...]) | Augment a batch of segmentation maps.
- `copy` (self) | Create a shallow copy of this Augmenter instance.
- `copy_random_state` (self, source[, recursive, ...]) | Copy the RNGs from a source augmenter sequence.
- `copy_random_state_` (self, source[, ...]) | Copy the RNGs from a source augmenter sequence (in-place).
- `deepcopy` (self) | Create a deep copy of this Augmenter instance.
- `draw_grid` (self, images, rows, cols) | Augment images and draw the results as a single grid-like image.

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Table 76 – continued from previous page
 find_augmenters(self, func[, parents, flat]) Find augmenters that match a condition.
 find_augmenters_by_name(self, name[, regex, ...]) Find augmenter(s) by name.
 find_augmenters_by_names(self, names[, ...]) Find augmenter(s) by names.
 get_all_children(self[, flat]) Get all children of this augmenter as a list.
 get_children_lists(self) See get_children_lists().
 get_parameters(self) See get_parameters().
 localize_random_state(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
 localize_random_state_(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
 pool(self[, processes, maxtasksperchild, seed]) Create a pool used for multicore augmentation.
 remove_augmenters(self, func[, copy, ...]) Remove this augmenter or children that match a condition.
 remove_augmenters_(self, func[, copy, ...]) Remove in-place children of this augmenter that match a condition.
 remove_augmenters_inplace(self, func[, parents]) Deprecated.
 reseed(self[, random_state, deterministic_too]) Deprecated.
 seed_(self[, entropy, deterministic_too]) Seed this augmenter and all of its children.
 show_grid(self, images, rows, cols) Augment images and plot the results as a single grid-like image.
 to_deterministic(self[, n]) Convert this augmenter from a stochastic to a deterministic one.

class imgaug.augmenters.blend.BlendAlphaCheckerboard

Bases: imgaug.augmenters.blend.BlendAlphaMask

Blend images from two branches according to a checkerboard pattern.

This class generates for each image a mask following a checkboard layout of \( H \) rows and \( W \) columns. Each cell is then filled with either 1.0 or 0.0. The cell at the top-left is always 1.0. Its right and bottom neighbour cells are 0.0. The 4-neighbours of any cell always have a value opposite to the cell’s value (0.0 vs. 1.0).

This class is a thin wrapper around BlendAlphaMask together with CheckerboardMaskGen.

Notes: Avoid using augmenters as children that affect pixel locations (e.g. horizontal flips). See BlendAlphaMask for details.

Added in 0.4.0.

Supported dtypes:
See BlendAlphaMask.

Parameters
- \textbf{nb_rows} (int or tuple of int or list of int or imgaug.parameters.StochasticParameter) – Number of rows of the checkerboard. See CheckerboardMaskGen for details.
• **nb_cols** *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter)*
  – Number of columns of the checkerboard. Analogous to `nb_rows`. See `CheckerboardMaskGen` for details.

• **foreground** *(None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional)* – Augmenter(s) that make up the foreground branch. High alpha values will show this branch’s results.
  – If `None`, then the input images will be reused as the output of the foreground branch.
  – If `Augmenter`, then that augmenter will be used as the branch.
  – If iterable of `Augmenter`, then that iterable will be converted into a `Sequential` and used as the augmenter.

• **background** *(None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional)* – Augmenter(s) that make up the background branch. Low alpha values will show this branch’s results.
  – If `None`, then the input images will be reused as the output of the background branch.
  – If `Augmenter`, then that augmenter will be used as the branch.
  – If iterable of `Augmenter`, then that iterable will be converted into a `Sequential` and used as the augmenter.

• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__`.

• **name** *(None or str, optional)* – See `__init__`.

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.BlendAlphaCheckerboard(nb_rows=2, nb_cols=(1, 4),
>>> foreground=iaa.AddToHue((-100, 100)))
```

Create an augmenter that places a $H \times W$ grid on each image, where $H$ (rows) is always 2 and $W$ is randomly and uniformly sampled from the interval $[1, 4]$. For half of the cells in the grid the hue is randomly modified, the other half of the cells is unaltered.

### Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
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</table>
| `__call__` | Alias for `augment()`.
| `augment(self, return_batch, hooks)` | Augment a batch. |
| `augment_batch(self, batch[, hooks])` | Deprecated. |

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<table>
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<td>augment_batch_(self, batch[, parents, hooks])</td>
<td>Augment a single batch in-place.</td>
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<tr>
<td>augment_batches(self, batches[, hooks, ...])</td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td>augment_bounding_boxes(self, ...[, parents, ...])</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td>augment_heatmaps(self, heatmaps[, parents, ...])</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td>augment_image(self, image[, hooks])</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td>augment_images(self, images[, parents, hooks])</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td>augment_keypoints(self, keypoints_on_images)</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings(self, ...[, parents, hooks])</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td>augment_polygons(self, polygons_on_images[, ...])</td>
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</tr>
<tr>
<td>augment_segmentation_maps(self, segmaps[, ...])</td>
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</tr>
<tr>
<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state(self, source[, recursive, ...])</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td>copy_random_state_(self, source[, ...])</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy(self)</td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td>draw_grid(self, images, rows, cols)</td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td>find_augmenters(self, func[, parents, flat])</td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td>find_augmenters_by_name(self, name[, regex, ...])</td>
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<td>find_augmenters_by_names(self, names[, ...])</td>
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</tr>
<tr>
<td>get_all_children(self[, flat])</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td>get_children_lists(self)</td>
<td>See get_children_lists().</td>
</tr>
<tr>
<td>get_parameters(self)</td>
<td>See get_parameters().</td>
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<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
<td>pool(self[, processes, maxtaskspervchild, seed])</td>
<td>Create a pool used for multicore augmentation.</td>
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<td>remove_augmenters(self, func[, copy, ...])</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace_deprecated(self, func[, parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>
class imgaug.augmenters.blend.BlendAlphaElementwise(factor=(0.0, 1.0), foreground=None, background=None, per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.blend.BlendAlphaMask

Alpha-blend two image sources using alpha/opacity values sampled per pixel.

This is the same as BlendAlpha, except that the opacity factor is sampled once per pixel instead of once per image (or a few times per image, if BlendAlpha.per_channel is set to True).

See BlendAlpha for more details.

This class is a wrapper around BlendAlphaMask.

Note: Avoid using augmenters as children that affect pixel locations (e.g. horizontal flips). See BlendAlphaMask for details.

Added in 0.4.0. (Before that named AlphaElementwise.)

Supported dtypes:

See BlendAlphaMask.

Parameters

- **factor** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Opacity of the results of the foreground branch. Values close to 0.0 mean that the results from the background branch (see parameter background) make up most of the final image.
  - If float, then that value will be used for all images.
  - If tuple (a, b), then a random value from the interval [a, b] will be sampled per image.
  - If a list, then a random value will be picked from that list per image.
  - If StochasticParameter, then that parameter will be used to sample a value per image.

- **foreground** (None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional) – Augmenter(s) that make up the foreground branch. High alpha values will show this branch’s results.
  - If None, then the input images will be reused as the output of the foreground branch.
  - If Augmenter, then that augmenter will be used as the branch.
  - If iterable of Augmenter, then that iterable will be converted into a Sequential and used as the augmenter.

- **background** (None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional) – Augmenter(s) that make up the background branch. Low alpha values will show this branch’s results.
  - If None, then the input images will be reused as the output of the background branch.
  - If Augmenter, then that augmenter will be used as the branch.
– If iterable of Augmenter, then that iterable will be converted into a Sequential and used as the augmenter.

• **per_channel** (bool or float, optional) – Whether to use the same factor for all channels (False) or to sample a new value for each channel (True). If this value is a float p, then for p percent of all images per_channel will be treated as True, otherwise as False.

• **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See `__init__()`.

• **name** (None or str, optional) – See `__init__()`.

• **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• **deterministic** (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.BlendAlphaElementwise(0.5, iaa.Grayscale(1.0))
```

Convert each image to pure grayscale and alpha-blend the result with the original image using an alpha of 50% for all pixels, thereby removing about 50% of all color. This is equivalent to `iaa.Grayscale(0.5)`. This is also equivalent to `iaa.BlendAlpha(0.5, iaa.Grayscale(1.0))`, as the opacity has a fixed value of 0.5 and is hence identical for all pixels.

```python
>>> aug = iaa.BlendAlphaElementwise((0.0, 1.0), iaa.AddToHue(100))
```

Same as in the previous example, but here with hue-shift instead of grayscaling and additionally the alpha factor is sampled uniformly from the interval [0.0, 1.0] once per pixel, thereby shifting the hue by a random fraction for each pixel.

```python
>>> aug = iaa.BlendAlphaElementwise((0.0, 1.0),
>>>                                  (0.0, 1.0),
>>>                                  iaa.Affine(rotate=(-20, 20)),
>>>                                  per_channel=0.5)
```

First, rotate each image by a random degree sampled uniformly from the interval [-20, 20]. Then, alpha-blend that new image with the original one using a random factor sampled uniformly from the interval [0.0, 1.0] per pixel. For 50% of all images, the blending happens channel-wise and the factor is sampled independently per pixel and channel (per_channel=0.5). As a result, e.g. the red channel may look visibly rotated (factor near 1.0), while the green and blue channels may not look rotated (factors near 0.0).

```python
>>> aug = iaa.BlendAlphaElementwise((0.0, 1.0),
>>>                                  foreground=iaa.Add(100),
>>>                                  background=iaa.Multiply(0.2))
```

Apply two branches of augmenters – A and B – independently to input images and alpha-blend the results of these branches using a factor f. Branch A increases image pixel intensities by 100 and B multiplies the pixel
intensities by 0.2. \( f \) is sampled uniformly from the interval \([0.0, 1.0]\) per pixel. The resulting images contain a bit of A and a bit of B.

```python
>>> aug = iaa.BlendAlphaElementwise([0.25, 0.75], iaa.MedianBlur(13))
```

Apply median blur to each image and alpha-blend the result with the original image using an alpha factor of either exactly 0.25 or exactly 0.75 (sampled once per pixel).

**Attributes**

factor

**Methods**

__call__ (self, *args, **kwargs) Alias for augment().

augment(self[, return_batch, hooks]) Augment a batch.

augment_batch(self, batch[, hooks]) Deprecated.

augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.

augment_bounding_boxes(self, ...[, parents, ...]) Augment a batch of bounding boxes.

augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.

augment_image(self, image[, hooks]) Augment a single image.

augment_images(self, images[, parents, hooks]) Augment a batch of images.

augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.

augment_line_strings(self, ...[, parents, hooks]) Augment a batch of line strings.

augment_polygons(self, polygons_on_images[, ...]) Augment a batch of polygons.

augment_segmentation_maps(self, segmaps[, ...]) Augment a batch of segmentation maps.

copy(self) Create a shallow copy of this Augmenter instance.

copy_random_state(self[, recursive]) Copy the RNGs from a source augmenter sequence.

copy_random_state_(self, source[, ...]) Copy the RNGs from a source augmenter sequence (in-place).

deepcopy(self) Create a deep copy of this Augmenter instance.

draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.

find_augmenters(self, func[, parents, flat]) Find augmenters that match a condition.

find_augmenters_by_name(self, name[, regex, ...]) Find augmenter(s) by name.

find_augmenters_by_names(self, names[, ...]) Find augmenter(s) by names.

get_all_children(self[, flat]) Get all children of this augmenter as a list.

get_children_lists(self) See get_children_lists().

get_parameters(self) See get_parameters().

localize_random_state(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
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</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td><strong>Deprecated.</strong></td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**factor**

**class** imgaug.augmenters.blend.BlendAlphaFrequencyNoise

```python
class imgaug.augmenters.blend.BlendAlphaFrequencyNoise
```

- `exponent=(-4, 4)`
- `foreground=None`
- `background=None`
- `per_channel=False`
- `size_px_max=(4, 16)`
- `upscale_method=None`
- `iterations=(1, 3)`
- `aggregation_method=['avg', 'max']`
- `sigmoid=0.5`
- `sigmoid_thresh=None`
- `seed=None`
- `name=None`
- `random_state='deprecated'`
- `deterministic='deprecated'`

Bases: `imgaug.augmenters.blend.BlendAlphaElementwise`

Alpha-blend two image sources using frequency noise masks.

The alpha masks are sampled using frequency noise of varying scales, which can sometimes create large connected blobs of 1s surrounded by 0s and other times results in smaller patterns. If nearest neighbour upsampling is used, these blobs can be rectangular with sharp edges.

Added in 0.4.0. (Before that named FrequencyNoiseAlpha.)

**Supported dtypes:**

See `BlendAlphaElementwise`.

**Parameters**

- `exponent` *(number or tuple of number of list of number or imgaug.parameters.StochasticParameter, optional)* – Exponent to use when scaling in the frequency domain. Sane values are in the range \(-4\) (large blobs) to \(4\) (small patterns). To generate cloud-like structures, use roughly \(-2\).
  - If number, then that number will be used as the exponent for all iterations.
  - If tuple of two numbers \((a, b)\), then a value will be sampled per iteration from the interval \([a, b]\).
- If a list of numbers, then a value will be picked per iteration at random from that list.
- If a StochasticParameter, then a value will be sampled from that parameter per iteration.

• **foreground** *(None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional)* – Augmenter(s) that make up the foreground branch. High alpha values will show this branch’s results.
  - If None, then the input images will be reused as the output of the foreground branch.
  - If Augmenter, then that augmenter will be used as the branch.
  - If iterable of Augmenter, then that iterable will be converted into a Sequential and used as the augmenter.

• **background** *(None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional)* – Augmenter(s) that make up the background branch. Low alpha values will show this branch’s results.
  - If None, then the input images will be reused as the output of the background branch.
  - If Augmenter, then that augmenter will be used as the branch.
  - If iterable of Augmenter, then that iterable will be converted into a Sequential and used as the augmenter.

• **per_channel** *(bool or float, optional)* – Whether to use the same factor for all channels (False) or to sample a new value for each channel (True). If this value is a float p, then for p percent of all images per_channel will be treated as True, otherwise as False.

• **size_px_max** *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)* – The noise is generated in a low resolution environment. This parameter defines the maximum size of that environment (in pixels). The environment is initialized at the same size as the input image and then downscaled, so that no side exceeds size_px_max (aspect ratio is kept).
  - If int, then that number will be used as the size for all iterations.
  - If tuple of two ints (a, b), then a value will be sampled per iteration from the discrete interval [a..b].
  - If a list of ints, then a value will be picked per iteration at random from that list.
  - If a StochasticParameter, then a value will be sampled from that parameter per iteration.

• **upscale_method** *(None or imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional)* – After generating the noise maps in low resolution environments, they have to be upscaled to the input image size. This parameter controls the upscaling method.
  - If None, then either nearest or linear or cubic is picked. Most weight is put on linear, followed by cubic.
  - If imgaug.ALL, then either nearest or linear or area or cubic is picked per iteration (all same probability).
  - If string, then that value will be used as the method (must be nearest or linear or area or cubic).
  - If list of string, then a random value will be picked from that list per iteration.
- If \texttt{StochasticParameter}, then a random value will be sampled from that parameter per iteration.

- **iterations** (\texttt{int} or tuple of \texttt{int} or list of \texttt{int} or \texttt{imgaug.parameters.StochasticParameter}, \texttt{optional}) – How often to repeat the simplex noise generation process per image.
  - If \texttt{int}, then that number will be used as the iterations for all images.
  - If tuple of two \texttt{int} \((a, b)\), then a value will be sampled per image from the discrete interval \([a..b]\).
  - If a list of \texttt{int} \(s\), then a value will be picked per image at random from that list.
  - If a \texttt{StochasticParameter}, then a value will be sampled from that parameter per image.

- **aggregation\_method** (\texttt{imgaug.ALL} or \texttt{str} or list of \texttt{str} or \texttt{imgaug.parameters.StochasticParameter}, \texttt{optional}) – The noise maps (from each iteration) are combined to one noise map using an aggregation process. This parameter defines the method used for that process. Valid methods are \texttt{min}, \texttt{max} or \texttt{avg}, where ‘min’ combines the noise maps by taking the (elementwise) minimum over all iteration’s results, \texttt{max} the (elementwise) maximum and \texttt{avg} the (elementwise) average.
  - If \texttt{imgaug.ALL}, then a random value will be picked per image from the valid ones.
  - If a string, then that value will always be used as the method.
  - If a list of string, then a random value will be picked from that list per image.
  - If a \texttt{StochasticParameter}, then a random value will be sampled from that parameter per image.

- **sigmoid** (\texttt{bool} or \texttt{number}, \texttt{optional}) – Whether to apply a sigmoid function to the final noise maps, resulting in maps that have more extreme values (close to 0.0 or 1.0).
  - If \texttt{bool}, then a sigmoid will always (\texttt{True}) or never (\texttt{False}) be applied.
  - If a number \(p\) with 0<=\(p\)\leq 1, then a sigmoid will be applied to \(p\) percent of all final noise maps.

- **sigmoid\_thresh** (\texttt{None} or \texttt{number} or tuple of \texttt{number} or \texttt{imgaug.parameters.StochasticParameter}, \texttt{optional}) – Threshold of the sigmoid, when applied. Thresholds above zero (e.g. \(5.0\)) will move the saddle point towards the right, leading to more values close to 0.0.
  - If \texttt{None}, then \texttt{Normal(0, 5.0)} will be used.
  - If number, then that threshold will be used for all images.
  - If tuple of two numbers \((a, b)\), then a random value will be sampled per image from the range \([a, b]\).
  - If \texttt{StochasticParameter}, then a random value will be sampled from that parameter per image.

- **seed** (\texttt{None} or \texttt{int} or \texttt{imgaug.random.RNG} or \texttt{numpy.random.Generator} or \texttt{numpy.random.BitGenerator} or \texttt{numpy.random.SeedSequence} or \texttt{numpy.random.RandomState}, \texttt{optional}) – See \texttt{__init__}().

- **name** (\texttt{None} or \texttt{str}, \texttt{optional}) – See \texttt{__init__}().

- **random\_state** (\texttt{None} or \texttt{int} or \texttt{imgaug.random.RNG} or \texttt{numpy.random.Generator} or \texttt{numpy.random.BitGenerator} or \texttt{numpy.random.SeedSequence} or \texttt{numpy.random.RandomState}, \texttt{optional}) – Old name for parameter \texttt{seed}. Its usage
will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method \texttt{to\_deterministic()} for an alternative and for details about what the “deterministic mode” actually does.

\section*{Examples}

```python
>>> import imgaug.augmenters as iaa

>>> aug = iaa.BlendAlphaFrequencyNoise(foreground=iaa.EdgeDetect(1.0))
```

Detect per image all edges, mark them in a black and white image and then alpha-blend the result with the original image using frequency noise masks.

```python
>>> aug = iaa.BlendAlphaFrequencyNoise(
>>>     foreground=iaa.EdgeDetect(1.0),
>>>     upscale_method="nearest")
```

Same as the first example, but using only linear upscaling to scale the frequency noise masks to the final image sizes, i.e. no nearest neighbour upsampling is used. This results in smooth edges.

```python
>>> aug = iaa.BlendAlphaFrequencyNoise(
>>>     foreground=iaa.EdgeDetect(1.0),
>>>     upscale_method="linear")
```

Same as the first example, but using only linear upscaling to scale the frequency noise masks to the final image sizes, i.e. no nearest neighbour upsampling is used. This results in smooth edges.

```python
>>> aug = iaa.BlendAlphaFrequencyNoise(
>>>     foreground=iaa.EdgeDetect(1.0),
>>>     upscale_method="linear",
>>>     exponent=-2,
>>>     sigmoid=False)
```

Same as in the previous example, but with the exponent set to a constant $-2$ and the sigmoid deactivated, resulting in cloud-like patterns without sharp edges.

```python
>>> aug = iaa.BlendAlphaFrequencyNoise(
>>>     foreground=iaa.EdgeDetect(1.0),
>>>     sigmoid_thresh=iap.Normal(10.0, 5.0))
```

Same as the first example, but using a threshold for the sigmoid function that is further to the right. This is more conservative, i.e. the generated noise masks will be mostly black (values around 0.0), which means that most of the original images (parameter/branch background) will be kept, rather than using the results of the augmentation (parameter/branch foreground).

\section*{Attributes}

- \texttt{factor}

\section*{Methods}

\begin{tabular}{ll}
\texttt{__call__}(self, *args, **kwargs) & Alias for \texttt{augment()}.
\end{tabular}

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**class** `imgaug.augmenters.blend.BlendAlphaHorizontalLinearGradient` *(foreground=None, background=None, min_value=(0.0, 0.2), max_value=(0.8, 1.0), start_at=(0.0, 0.2), end_at=(0.8, 1.0), seed=None, name=None, random_state='deprecated', deterministic='deprecated')*

**Bases:** `imgaug.augmenters.blend.BlendAlphaMask`

Blend images from two branches along a horizontal linear gradient.

This class generates a horizontal linear gradient mask (i.e. usually a mask with low values on the left and high values on the right) and alphas-blends between foreground and background branch using that mask.

This class is a thin wrapper around `BlendAlphaMask` together with `HorizontalLinearGradientMaskGen`.

**Note:** Avoid using augmenters as children that affect pixel locations (e.g. horizontal flips). See `BlendAlphaMask` for details.

Added in 0.4.0.

**Supported dtypes:**

See `BlendAlphaMask`.

**Parameters**

- **foreground** *(None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional)* – Augmenter(s) that make up the foreground branch. High alpha values will show this branch’s results.
  - If `None`, then the input images will be reused as the output of the foreground branch.
  - If `Augmenter`, then that augmenter will be used as the branch.
  - If iterable of `Augmenter`, then that iterable will be converted into a `Sequential` and used as the augmenter.

- **background** *(None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional)* – Augmenter(s) that make up the background branch. Low alpha values will show this branch’s results.
  - If `None`, then the input images will be reused as the output of the background branch.
  - If `Augmenter`, then that augmenter will be used as the branch.
  - If iterable of `Augmenter`, then that iterable will be converted into a `Sequential` and used as the augmenter.
- **min_value** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See HorizontalLinearGradientMaskGen.
- **max_value** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See HorizontalLinearGradientMaskGen.
- **start_at** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See HorizontalLinearGradientMaskGen.
- **end_at** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See HorizontalLinearGradientMaskGen.
- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().
- **name** (None or str, optional) – See __init__().
- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.BlendAlphaHorizontalLinearGradient(iaa.AddToHue((-100, 100)))
```
Create an augmenter that randomizes the hue towards the right of the image.

```python
>>> aug = iaa.BlendAlphaHorizontalLinearGradient(iaa.TotalDropout(1.0),
>>>                                              min_value=0.2, max_value=0.8)
```
Create an augmenter that replaces pixels towards the right with darker and darker values. However it always keeps at least 20% (1.0 - max_value) of the original pixel value on the far right and always replaces at least 20% on the far left (min_value=0.2).

```python
>>> aug = iaa.BlendAlphaHorizontalLinearGradient(iaa.AveragePooling(11),
>>>                                              start_at=(0.0, 1.0), end_at=(0.0, 1.0))
```
Create an augmenter that blends with an average-pooled image according to a horizontal gradient that starts at a random x-coordinate and reaches its maximum at another random x-coordinate. Due to that randomness, the gradient may increase towards the left or right.
### Methods

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<td><code>show_grid(self, images, rows, cols)</code></td>
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**class** `imgaug.augmenters.blend.BlendAlphaMask`  
(mask_generator, foreground=None, background=None, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: `imgaug.augmenters.meta.Augmenter`

Alpha-blend two image sources using non-binary masks generated per image.

This augmenter queries for each image a mask generator to generate a \((H, W)\) or \((H, W, C)\) channelwise mask \([0.0, 1.0]\), where \(H\) is the image height and \(W\) the width. The mask will then be used to alpha-blend pixel- and possibly channel-wise between a foreground branch of augmenters and a background branch. (Both branches default to the identity operation if not provided.)

See also `BlendAlpha`.

**Note:** It is not recommended to use `BlendAlphaMask` with augmenters that change the geometry of images (e.g. horizontal flips, affine transformations) if you also want to augment coordinates (e.g. keypoints, polygons, …), as it is unclear which of the two coordinate results (foreground or background branch) should be used as the final output coordinates after augmentation.

Currently, for keypoints the results of the foreground and background branch will be mixed. That means that for each coordinate the augmented result will be picked from the foreground or background branch based on the average alpha mask value at the corresponding spatial location.

For bounding boxes, line strings and polygons, either all objects (on an image) of the foreground or all of the background branch will be used, based on the average over the whole alpha mask.

Added in 0.4.0.

**Supported dtypes:**

See `blend_alpha()`.

**Parameters**

- **mask_generator** (*IBatchwiseMaskGenerator*) – A generator that will be queried per image to generate a mask.

- **foreground** (*None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional*) – Augmenter(s) that make up the foreground branch. High alpha values will show this branch’s results.
  - If `None`, then the input images will be reused as the output of the foreground branch (i.e. identity function).
  - If `Augmenter`, then that augmenter will be used as the branch.
  - If iterable of `Augmenter`, then that iterable will be converted into a `Sequential` and used as the augmenter.

- **background** (*None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional*) – Augmenter(s) that make up the background branch. Low alpha values will show this branch’s results.
• If None, then the input images will be reused as the output of the background branch (i.e. identity function).
• If Augmenter, then that augmenter will be used as the branch.
• If iterable of Augmenter, then that iterable will be converted into a Sequential and used as the augmenter.

**seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See __init__().

**name** *(None or str, optional)* – See __init__().

**random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

**deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.BlendAlphaMask(
>>>     iaa.InvertMaskGen(0.5, iaa.VerticalLinearGradientMaskGen()),
>>>     iaa.Sequential([
>>>         iaa.Clouds(),
>>>         iaa.WithChannels([1, 2], iaa.Multiply(0.5))
>>>     ])
>>> )
```

Create an augmenter that sometimes adds clouds at the bottom and sometimes at the top of the image.

### Methods

- `__call__(self, *args, **kwargs)` Alias for `augment()`.
- `augment(self[, return_batch, hooks])` Augment a batch.
- `augment_batch(self[, batch[, hooks]])` Deprecated.
- `augment_batch_(self[, batch[, parents, hooks]])` Augment a single batch in-place.
- `augment_batches(self[, batch[, parents, hooks]])` Augment multiple batches.
- `augment_bounding_boxes(self[, parents, ...])` Augment a batch of bounding boxes.
- `augment_heatmaps(self[, heatmaps[, parents, ...]])` Augment a batch of heatmaps.
- `augment_image(self[, image[, hooks]])` Augment a single image.
- `augment_images(self[, images[, parents, hooks]])` Augment a batch of images.
- `augment_keypoints(self[, keypoints_on_images])` Augment a batch of keypoints/landmarks.
- `augment_line_strings(self[, parents, ...])` Augment a batch of line strings.

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####igau.augmenters.blend.BlendAlphaRegularGrid

```python
class imgaug.augmenters.blend.BlendAlphaRegularGrid(nb_rows, nb_cols, foreground=None, background=None, alpha=[0.0, 1.0], seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases:** `imgaug.augmenters.blend.BlendAlphaMask`

Blend images from two branches according to a regular grid.
This class generates for each image a mask that splits the image into a grid-like pattern of \(H\) rows and \(W\) columns. Each cell is then filled with an alpha value, sampled randomly per cell.

The difference to `AlphaBlendCheckerboard` is that this class samples random alpha values per grid cell, while in the checkerboard the alpha values follow a fixed pattern.

This class is a thin wrapper around `BlendAlphaMask` together with `RegularGridMaskGen`.

**Note:** Avoid using augmenters as children that affect pixel locations (e.g. horizontal flips). See `BlendAlphaMask` for details.

Added in 0.4.0.

**Supported dtypes:**

See `BlendAlphaMask`.

**Parameters**

- `nb_rows` *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter)* – Number of rows of the checkerboard. See `CheckerboardMaskGen` for details.

- `nb_cols` *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter)* – Number of columns of the checkerboard. Analogous to `nb_rows`. See `CheckerboardMaskGen` for details.

- `foreground` *(None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional)* – Augmenter(s) that make up the foreground branch. High alpha values will show this branch’s results.
  - If `None`, then the input images will be reused as the output of the foreground branch.
  - If `Augmenter`, then that augmenter will be used as the branch.
  - If iterable of `Augmenter`, then that iterable will be converted into a `Sequential` and used as the augmenter.

- `background` *(None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional)* – Augmenter(s) that make up the background branch. Low alpha values will show this branch’s results.
  - If `None`, then the input images will be reused as the output of the background branch.
  - If `Augmenter`, then that augmenter will be used as the branch.
  - If iterable of `Augmenter`, then that iterable will be converted into a `Sequential` and used as the augmenter.

- `alpha` *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Alpha value of each cell.
  - If `number`: Exactly that value will be used for all images.
  - If `tuple (a, b)`: A random value will be uniformly sampled per image from the interval \([a, b]\).
  - If `list`: A random value will be picked per image from that list.
  - If `StochasticParameter`: That parameter will be queried once per batch for \((N,)\) values – one per image.
• **seed** (None or int or imgaug.random.RNG or numpy.random_generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See `__init__()`.  
• **name** (None or str, optional) – See `__init__()`.  
• **random_state** (None or int or imgaug.random.RNG or numpy.random_generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.  
• **deterministic** (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.BlendAlphaRegularGrid(nb_rows=(4, 6), nb_cols=(1, 4),
    foreground=iaa.Multiply(0.0))
```

Create an augmenter that places a HxW grid on each image, where H (rows) is randomly and uniformly sampled from the interval [4, 6] and W is analogously sampled from the interval [1, 4]. Roughly half of the cells in the grid are filled with 0.0, the remaining ones are unaltered. Which cells exactly are “dropped” is randomly decided per image. The resulting effect is similar to `CoarseDropout`.

```python
>>> aug = iaa.BlendAlphaRegularGrid(nb_rows=2, nb_cols=2,
    foreground=iaa.Multiply(0.0),
    background=iaa.AveragePooling(8),
    alpha=[0.0, 0.0, 1.0])
```

Create an augmenter that always placed 2x2 cells on each image and sets about 1/3 of them to zero (foreground branch) and the remaining 2/3 to a pixelated version (background branch).

**Methods**

```python
__call__(self, *args, **kwargs) Alias for `augment()`.
augment(self, return_batch, hooks) Augment a batch.
augment_batch(self, batch[, hooks]) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self, batches[, parents,...]) Augment multiple batches.
augment_bounding_boxes(self, ...[parents,...]) Augment a batch of bounding boxes.
augment_heatmaps(self, heatmaps[, parents,...]) Augment a batch of heatmaps.
augment_image(self, image[, hooks]) Augment a single image.
augment_images(self, images[, parents, hooks]) Augment a batch of images.
augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
augment_line_strings(self, ...[parents,...]) Augment a batch of line strings.
```

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<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(self, segmaps[, ...])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(self, source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(self, source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
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<td><code>get_all_children(self[, flat])</code></td>
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<td><code>get_parameters(self)</code></td>
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<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td><code>localize_random_state_(self[, recursive])</code></td>
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<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
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<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
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<td><code>remove_augmenters_(_self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self, n)</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.blend.BlendAlphaSegMapClassIds(class_ids, foreground=None, background=None, nb_sample_classes=None, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases:** `imgaug.augmenters.blend.BlendAlphaMask`

Blend images from two branches based on segmentation map ids.

This class generates masks that are 1.0 at pixel locations covered by specific classes in segmentation maps.

This class is a thin wrapper around `BlendAlphaMask` together with `SegMapClassIdsMaskGen`. 
Note: Avoid using augmenters as children that affect pixel locations (e.g. horizontal flips). See BlendAlphaMask for details.

Note: Segmentation maps can have multiple channels. If that is the case then for each position \((x, y)\) it is sufficient that any class id in any channel matches one of the desired class ids.

Note: This class will produce an AssertionError if there are no segmentation maps in a batch.

Added in 0.4.0.

Supported dtypes:
See BlendAlphaMask.

Parameters

- **class_ids** (int or tuple of int or list of int or imgaug.parameters.StochasticParameter) – See SegMapClassIdsMaskGen.

- **foreground** (None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional) – Augmenter(s) that make up the foreground branch. High alpha values will show this branch’s results.
  - If None, then the input images will be reused as the output of the foreground branch.
  - If Augmenter, then that augmenter will be used as the branch.
  - If iterable of Augmenter, then that iterable will be converted into a Sequential and used as the augmenter.

- **background** (None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional) – Augmenter(s) that make up the background branch. Low alpha values will show this branch’s results.
  - If None, then the input images will be reused as the output of the background branch.
  - If Augmenter, then that augmenter will be used as the branch.
  - If iterable of Augmenter, then that iterable will be converted into a Sequential and used as the augmenter.

- **nb_sample_classes** (None or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional) – See SegMapClassIdsMaskGen.

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- **name** (None or str, optional) – See __init__().

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.BlendAlphaSegMapClassIds(
    [1, 3],
    foreground=iaa.AddToHue((-100, 100)))
```

Create an augmenter that randomizes the hue wherever the segmentation maps contain the classes 1 or 3.

```python
>>> aug = iaa.BlendAlphaSegMapClassIds(
    [1, 2, 3, 4],
    nb_sample_classes=2,
    foreground=iaa.GaussianBlur(3.0))
```

Create an augmenter that randomly picks 2 classes from the list [1, 2, 3, 4] and blurs the image content wherever these classes appear in the segmentation map. Note that as the sampling of class ids happens with replacement, it is not guaranteed to sample two unique class ids.

```python
>>> aug = iaa.Sometimes(0.2,
    iaa.BlendAlphaSegMapClassIds(2,
    background=iaa.TotalDropout(1.0)))
```

Create an augmenter that zeros for roughly every fifth image all image pixels that do not belong to class id 2 (note that the background branch was used, not the foreground branch). Example use case: Human body landmark detection where both the landmarks/ keypoints and the body segmentation map are known. Train the model to detect landmarks and sometimes remove all non-body information to force the model to become more independent of the background.

### Methods

```python
__call__(self, *args, **kwargs) Alias for augment().
```  
```python
augment(self, return_batch, hooks) Augment a batch.
augment_batch(self, batch[, hooks]) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self, batches[, hooks]) Augment multiple batches.
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augment_image(self, image[, hooks]) Augment a single image.
augment_images(self, images[, parents, hooks]) Augment a batch of images.
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augment_line_strings(self, line_strings[, parents, hooks]) Augment a batch of line strings.
augment_polygons(self, polygons_on_images[, ...]) Augment a batch of polygons.
```
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<td>to_deterministic(self, n)</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</tbody>
</table>

```python
class imgaug.augmenters.blend.BlendAlphaSimplexNoise (foreground=None,
background=None,
per_channel=False,
scale_px_max=(2, 16), upscale_method=None, iterations=(1, 3),
aggregation_method='max', sigmoid=True,
sigmoid_thresh=None,
seed=None, name=None, random_state='deprecated',
deterministic='deprecated')
```

Bases: `imgaug.augmenters.blend.BlendAlphaElementwise`

Alpha-blend two image sources using simplex noise alpha masks.

The alpha masks are sampled using a simplex noise method, roughly creating connected blobs of 1s surrounded
by 0s. If nearest neighbour upsampling is used, these blobs can be rectangular with sharp edges.

Added in 0.4.0. (Before that named SimplexNoiseAlpha.)

Supported dtypes:

See BlendAlphaElementwise.

Parameters

- **foreground** *(None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional)* – Augmenter(s) that make up the foreground branch. High alpha values will show this branch's results.
  - If None, then the input images will be reused as the output of the foreground branch.
  - If Augmenter, then that augmenter will be used as the branch.
  - If iterable of Augmenter, then that iterable will be converted into a Sequential and used as the augmenter.

- **background** *(None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional)* – Augmenter(s) that make up the background branch. Low alpha values will show this branch's results.
  - If None, then the input images will be reused as the output of the background branch.
  - If Augmenter, then that augmenter will be used as the branch.
  - If iterable of Augmenter, then that iterable will be converted into a Sequential and used as the augmenter.

- **per_channel** *(bool or float, optional)* – Whether to use the same factor for all channels (False) or to sample a new value for each channel (True). If this value is a float p, then for p percent of all images per_channel will be treated as True, otherwise as False.

- **size_px_max** *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)* – The simplex noise is always generated in a low resolution environment. This parameter defines the maximum size of that environment (in pixels). The environment is initialized at the same size as the input image and then downscaled, so that no side exceeds size_px_max (aspect ratio is kept).
  - If int, then that number will be used as the size for all iterations.
  - If tuple of two ints (a, b), then a value will be sampled per iteration from the discrete interval [a..b].
  - If a list of ints, then a value will be picked per iteration at random from that list.
  - If a StochasticParameter, then a value will be sampled from that parameter per iteration.

- **upscale_method** *(None or imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional)* – After generating the noise maps in low resolution environments, they have to be upsampled to the input image size. This parameter controls the upscaling method.
  - If None, then either nearest or linear or cubic is picked. Most weight is put on linear, followed by cubic.
  - If imgaug.ALL, then either nearest or linear or area or cubic is picked per iteration (all same probability).
  - If a string, then that value will be used as the method (must be nearest or linear or area or cubic).
- If list of string, then a random value will be picked from that list per iteration.
- If StochasticParameter, then a random value will be sampled from that parameter per iteration.

**iterations** *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)* –

How often to repeat the simplex noise generation process per image.

- If int, then that number will be used as the iterations for all images.
- If tuple of two int s \((a, b)\), then a value will be sampled per image from the discrete interval \([a..b]\).
- If a list of int s, then a value will be picked per image at random from that list.
- If a StochasticParameter, then a value will be sampled from that parameter per image.

**aggregation_method** *(imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional)* – The noise maps (from each iteration) are combined to one noise map using an aggregation process. This parameter defines the method used for that process. Valid methods are min, max or avg, where min combines the noise maps by taking the (elementwise) minimum over all iteration’s results, max the (elementwise) maximum and avg the (elementwise) average.

- If imgaug.ALL, then a random value will be picked per image from the valid ones.
- If a string, then that value will always be used as the method.
- If a list of string, then a random value will be picked from that list per image.
- If a StochasticParameter, then a random value will be sampled from that parameter per image.

**sigmoid** *(bool or number, optional)* – Whether to apply a sigmoid function to the final noise maps, resulting in maps that have more extreme values (close to 0.0 or 1.0).

- If bool, then a sigmoid will always (True) or never (False) be applied.
- If a number \(p\) with \(0<=p<=1\), then a sigmoid will be applied to \(p\) percent of all final noise maps.

**sigmoid_thresh** *(None or number or tuple of number or imgaug.parameters.StochasticParameter, optional)* – Threshold of the sigmoid, when applied. Thresholds above zero (e.g. 5.0) will move the saddle point towards the right, leading to more values close to 0.0.

- If None, then Normal(0, 5.0) will be used.
- If number, then that threshold will be used for all images.
- If tuple of two numbers \((a, b)\), then a random value will be sampled per image from the interval \([a, b]\).
- If StochasticParameter, then a random value will be sampled from that parameter per image.

**seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See __init__().

**name** *(None or str, optional)* – See __init__().
• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter *seed*. Its usage will not yet cause a deprecation warning, but it is still recommended to use *seed* now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.BlendAlphaSimplexNoise(iaa.EdgeDetect(1.0))
```

Detect per image all edges, mark them in a black and white image and then alpha-blend the result with the original image using simplex noise masks.

```python
>>> aug = iaa.BlendAlphaSimplexNoise(
    iaa.EdgeDetect(1.0),
    upscale_method="nearest")
```

Same as in the previous example, but using only nearest neighbour upscaling to scale the simplex noise masks to the final image sizes, i.e. no nearest linear upsampling is used. This leads to rectangles with sharp edges.

```python
>>> aug = iaa.BlendAlphaSimplexNoise(
    iaa.EdgeDetect(1.0),
    upscale_method="linear")
```

Same as in the previous example, but using only linear upscaling to scale the simplex noise masks to the final image sizes, i.e. no nearest neighbour upsampling is used. This leads to rectangles with smooth edges.

```python
>>> aug = iaa.BlendAlphaSimplexNoise(
    iaa.EdgeDetect(1.0),
    sigmoid_thresh=iaa.Normal(10.0, 5.0))
```

Same as in the first example, but using a threshold for the sigmoid function that is further to the right. This is more conservative, i.e. the generated noise masks will be mostly black (values around 0.0), which means that most of the original images (parameter/branch background) will be kept, rather than using the results of the augmentation (parameter/branch foreground).

### Attributes

- **factor**

### Methods

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</table>
| `__call__` | Alias for `augment()`.
| `augment(self[, return_batch, hooks])` | Augment a batch. |
| `augment_batch(self[, batch[, parents, hooks]])` | Deprecated. |
| `augment_batch_(self, batch[, parents, hooks])` | Augment a single batch in-place. |
| `augment_batches(self, batches[, hooks, ...])` | Augment multiple batches. |

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</tr>
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<td>Augment a single image.</td>
</tr>
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</table>
class imgaug.augmenters.blend.BlendAlphaSomeColors

Bases: imgaug.augmenters.blend.BlendAlphaMask

Blend images from two branches using colorwise masks.

This class generates masks that “mark” a few colors and replace the pixels within these colors with the results of the foreground branch. The remaining pixels are replaced with the results of the background branch (usually the identity function). That allows to e.g. selectively grayscale a few colors, while keeping other colors unchanged.

This class is a thin wrapper around BlendAlphaMask together with SomeColorsMaskGen.

Note: The underlying mask generator will produce an AssertionError for batches that contain no images.

Note: Avoid using augmenters as children that affect pixel locations (e.g. horizontal flips). See BlendAlphaMask for details.

Added in 0.4.0.

Supported dtypes:
See change_colorspaces_().

Parameters

- **foreground** (None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional) – Augmenter(s) that make up the foreground branch. High alpha values will show this branch’s results.
  - If None, then the input images will be reused as the output of the foreground branch.
  - If Augmenter, then that augmenter will be used as the branch.
  - If iterable of Augmenter, then that iterable will be converted into a Sequential and used as the augmenter.

- **background** (None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional) – Augmenter(s) that make up the background branch. Low alpha values will show this branch’s results.
  - If None, then the input images will be reused as the output of the background branch.
  - If Augmenter, then that augmenter will be used as the branch.
  - If iterable of Augmenter, then that iterable will be converted into a Sequential and used as the augmenter.

- **nb_bins** (int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional) – See SomeColorsMaskGen.

- **smoothness** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See SomeColorsMaskGen.
• **alpha** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See SomeColorsMaskGen.

• **rotation_deg** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See SomeColorsMaskGen.

• **from_colorspace** (str, optional) – See SomeColorsMaskGen.

• **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

• **name** (None or str, optional) – See __init__().

• **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.BlendAlphaSomeColors(iaa.Grayscale(1.0))

Create an augmenter that turns randomly removes some colors in images by grayscaling them.

>>> aug = iaa.BlendAlphaSomeColors(iaa.TotalDropout(1.0))

Create an augmenter that removes some colors in images by replacing them with black pixels.

>>> aug = iaa.BlendAlphaSomeColors(iaa.MultiplySaturation(0.5), iaa.MultiplySaturation(1.5))

Create an augmenter that desaturates some colors and increases the saturation of the remaining ones.

>>> aug = iaa.BlendAlphaSomeColors(iaa.AveragePooling(7), alpha=[0.0, 1.0], smoothness=0.0)

Create an augmenter that applies average pooling to some colors. Each color tune is either selected (alpha of 1.0) or not selected (0.0). There is no gradual change between similar colors.

>>> aug = iaa.BlendAlphaSomeColors(iaa.AveragePooling(7), nb_bins=2, smoothness=0.0)

Create an augmenter that applies average pooling to some colors. Choose on average half of all colors in images for the blending operation.

>>> aug = iaa.BlendAlphaSomeColors(iaa.AveragePooling(7), from_colorspace="BGR")

Create an augmenter that applies average pooling to some colors with input images being in BGR colorspace.
## Methods

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<th>Description</th>
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</tr>
<tr>
<td><code>augment(self, return_batch, hooks)</code></td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><code>augment_batch(self, batch, hooks)</code></td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><code>augment_batch_(self, batch, parents, hooks)</code></td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td><code>augment_bounding_boxes(self, ..., parent, ...)</code></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps(self, heatmaps, parent, ...)</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(self, image, hooks)</code></td>
<td>Augment a single image.</td>
</tr>
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<td><code>augment_images(self, images, parents, hooks)</code></td>
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<td><code>augment_polygons(self, polygons_on_images, parent, ...)</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(self, segmaps, parent, ...)</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
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<td><code>copy_random_state(self, source, recursive)</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
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<td><code>copy_random_state_(self, source)</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
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<td><code>deepcopy(self)</code></td>
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<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
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<td><code>find_augmenters(self, func, parents, flat)</code></td>
<td>Find augmenters that match a condition.</td>
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<td><code>find_augmenters_by_name(self, name, regex, ...)</code></td>
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<td><code>pool(self, processes, maxtasksperchild, seed)</code></td>
<td>Create a pool used for multicore augmentation.</td>
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<td><code>remove_augmenters(self, func, copy, ...)</code></td>
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<td>Remove in-place children of this augmenter that match a condition.</td>
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<td><code>reseed(self, random_state, deterministic_too)</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self, entropy, deterministic_too)</code></td>
<td>Seed this augmenter and all of its children.</td>
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</table>

Continued on next page
show_grid\(\text{self, images, rows, cols}\) Augment images and plot the results as a single grid-like image.

to_deterministic\(\text{self[, n]}\) Convert this augmenter from a stochastic to a deterministic one.

class imgaug.augmenters.blend.BlendAlphaVerticalLinearGradient (foreground=None, background=None, min_value=(0.0, 0.2), max_value=(0.8, 1.0), start_at=(0.0, 0.2), end_at=(0.8, 1.0), seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.blend.BlendAlphaMask

Blend images from two branches along a vertical linear gradient.

This class generates a vertical linear gradient mask (i.e. usually a mask with low values on the left and high values on the right) and alphas-blends between foreground and background branch using that mask.

This class is a thin wrapper around BlendAlphaMask together with VerticalLinearGradientMaskGen.

Note: Avoid using augmenters as children that affect pixel locations (e.g. horizontal flips). See BlendAlphaMask for details.

Added in 0.4.0.

Supported dtypes:

See BlendAlphaMask.

Parameters

- foreground (None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional) – Augmenter(s) that make up the foreground branch. High alpha values will show this branch’s results.
  - If None, then the input images will be reused as the output of the foreground branch.
  - If Augmenter, then that augmenter will be used as the branch.
  - If iterable of Augmenter, then that iterable will be converted into a Sequential and used as the augmenter.

- background (None or imgaug.augmenters.meta.Augmenter or iterable of imgaug.augmenters.meta.Augmenter, optional) – Augmenter(s) that make up the background branch. Low alpha values will show this branch’s results.
- If None, then the input images will be reused as the output of the background branch.
- If Augmenter, then that augmenter will be used as the branch.
- If iterable of Augmenter, then that iterable will be converted into a Sequential and used as the augmenter.

- `min_value` (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See VerticalLinearGradientMaskGen.
- `max_value` (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See VerticalLinearGradientMaskGen.
- `start_at` (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See VerticalLinearGradientMaskGen.
- `end_at` (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See VerticalLinearGradientMaskGen.
- `seed` (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().
- `name` (None or str; optional) – See __init__().
- `random_state` (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
- `deterministic` (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.BlendAlphaVerticalLinearGradient(iaa.AddToHue((-100, 100)))
```

Create an augmenter that randomizes the hue towards the bottom of the image.

```python
>>> aug = iaa.BlendAlphaVerticalLinearGradient(
    iaa.TotalDropout(1.0),
    min_value=0.2, max_value=0.8)
```

Create an augmenter that replaces pixels towards the bottom with darker and darker values. However it always keeps at least 20% (1.0 - max_value) of the original pixel value on the far bottom and always replaces at least 20% on the far top (min_value=0.2).

```python
>>> aug = iaa.BlendAlphaVerticalLinearGradient(
    iaa.AveragePooling(11),
    start_at=(0.0, 1.0), end_at=(0.0, 1.0))
```
Create an augmenter that blends with an average-pooled image according to a vertical gradient that starts at a random y-coordinate and reaches its maximum at another random y-coordinate. Due to that randomness, the gradient may increase towards the bottom or top.

```python
>>> aug = iaa.BlendAlphaVerticalLinearGradient( 
>>>     iaa.Clouds(), 
>>>     start_at=(0.15, 0.35), end_at=0.0)
```

Create an augmenter that draws clouds in roughly the top quarter of the image.

**Methods**

<table>
<thead>
<tr>
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</tr>
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</table>
| `__call__` | Alias for `augment()`.
| `augment(self[, return_batch, hooks])` | Augment a batch. |
| `augment_batch(self[, batch[, hooks]])` | Deprecated. |
| `augment_batch_(self[, batch[, parents, hooks]])` | Augment a single batch in-place. |
| `augment_batches(self[, batches[, hooks]])` | Augment multiple batches. |
| `augment_bounding_boxes(self[, ...[, parents, ...]])` | Augment a batch of bounding boxes. |
| `augment_heatmaps(self[, heatmaps[, parents, ...]])` | Augment a batch of heatmaps. |
| `augment_image(self[, image[, hooks]])` | Augment a single image. |
| `augment_images(self[, image[, parents, hooks]])` | Augment a batch of images. |
| `augment_keypoints(self[, keypoints_on_images])` | Augment a batch of keypoints/landmarks. |
| `augment_line_strings(self[, ...[, parents, hooks]])` | Augment a batch of line strings. |
| `augment_polygons(self[, polygons_on_images[, ...]])` | Augment a batch of polygons. |
| `augment_segmentation_maps(self[, segmaps[, ...]])` | Augment a batch of segmentation maps. |
| `copy(self)` | Create a shallow copy of this Augmenter instance. |
| `copy_random_state(self[, source[, recursive,...]])` | Copy the RNGs from a source augmenter sequence. |
| `copy_random_state_(self[, source[, ...]])` | Copy the RNGs from a source augmenter sequence (in-place). |
| `deepcopy(self)` | Create a deep copy of this Augmenter instance. |
| `draw_grid(self[, images, rows, cols])` | Augment images and draw the results as a single grid-like image. |
| `find_augmenters(self, func[, parents, flat])` | Find augmenters that match a condition. |
| `find_augmenters_by_name(self[, name[, regex, ...]])` | Find augmenter(s) by name. |
| `find_augmenters_by_names(self[, names[, ...]])` | Find augmenter(s) by names. |
| `get_all_children(self[, flat])` | Get all children of this augmenter as a list. |
| `get_children_lists(self)` | See `get_children_lists()`. |
| `get_parameters(self)` | See `get_parameters()`. |
| `localize_random_state(self[, recursive])` | Assign augmenter-specific RNGs to this augmenter and its children. |
| `localize_random_state_(self[, recursive])` | Assign augmenter-specific RNGs to this augmenter and its children. |
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<table>
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<td>Remove in-place children of this augmenter that match a condition.</td>
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<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
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<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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**class** `imgaug.augmenters.blend.BoundingBoxesMaskGen` *(labels=None, nb_sample_labels=None)*

**Bases:** `imgaug.augmenters.blend(IBatchwiseMaskGenerator)`

Generator that produces masks highlighting bounding boxes.

This class produces for each row (i.e. image + bounding boxes) in a batch a mask in which the inner areas of bounding box rectangles with given labels are marked (i.e. set to 1.0). The labels may be provided as a fixed list of strings or a stochastic parameter from which labels will be sampled. If no labels are provided, all bounding boxes will be marked.

A pixel will be set to 1.0 if at least one bounding box at that location has one of the requested labels, even if there is also one bounding box at that location with a not requested label.

**Note:** This class will produce an `AssertionError` if there are no bounding boxes in a batch.

Added in 0.4.0.

**Parameters**

- **labels** *(None or str or list of str or imgaug.parameters.StochasticParameter)* – Labels of bounding boxes to select for.

  If `nb_sample_labels` is `None` then this is expected to be either also `None` (select all BBs) or a single `str` (select BBs with this one label) or a list of `strs` (always select BBs with these labels).

  If `nb_sample_labels` is set, then this parameter will be treated as a stochastic parameter with the following valid types:

  - If `None`: Ignore the sampling count and always use all bounding boxes.
  - If `str`: Exactly that label will be used for all images.
  - If `list of str`: `N` random values will be picked per image from that list and used as the labels.
  - If `StochasticParameter`: That parameter will be queried once per batch for `(sum(N),)` values.

  `N` denotes the number of labels to sample per segmentation map (derived from `nb_sample_labels`) and `sum(N)` denotes the sum of `N` s over all images.
• **nb_sample_labels** *(None or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)* – Number of labels to sample (with replacement) per image. As sampling happens with replacement, fewer unique labels may be sampled.

  - If `None`: `labels` is expected to also be `None` or a fixed value of labels to be used for all images.
  - If `int`: Exactly that many labels will be sampled for all images.
  - If `tuple (a, b)`: A random value will be uniformly sampled per image from the discrete interval `[a..b]`.
  - If `list`: A random value will be picked per image from that list.
  - If `StochasticParameter`: That parameter will be queried once per batch for `(B,)` values, where `B` is the number of images.

### Methods

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<td><code>draw_masks(self, batch[, random_state])</code></td>
<td>See <code>draw_masks()</code>.</td>
</tr>
<tr>
<td><code>generate_mask(bbsoi, labels)</code></td>
<td>Generate a mask of the areas of bounding boxes with given labels.</td>
</tr>
</tbody>
</table>

**draw_masks** *(self, batch, random_state=None)*

See `draw_masks()`.

Added in 0.4.0.

**classmethod generate_mask(bbsoi, labels)*

Generate a mask of the areas of bounding boxes with given labels.

Added in 0.4.0.

**Parameters**

- `bbsoi` *(imgaug.augmentables.bbs.BoundingBoxesOnImage)* – The bounding boxes for which to generate the mask.

- `labels` *(None or iterable of str)* – Labels of the bounding boxes to set to 1.0. For an `(x, y)` position, it is enough that any bounding box at the given location has one of the labels. If this is `None`, all bounding boxes will be marked.

**Returns** `float32` mask array with same height and width as `segmap.shape`. Values are in `[0.0, 1.0]`.

**Return type** `ndarray`

**class** `imgaug.augmenters.blend.CheckerboardMaskGen(nb_rows, nb_cols)`

Bases: `imgaug.augmenters.blend.IBatchwiseMaskGenerator`

Generate masks following a checkerboard-like pattern.

This mask generator splits each image into a regular grid of `H` rows and `W` columns. Each cell is then filled with either 1.0 or 0.0. The cell at the top-left is always 1.0. Its right and bottom neighbour cells are 0.0. The 4-neighbours of any cell always have a value opposite to the cell’s value (0.0 vs. 1.0).

Added in 0.4.0.

**Parameters**
• **nb_rows** *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)*
  Number of rows of the checkerboard.
  – If *int*: Exactly that value will be used for all images.
  – If *tuple (a, b)*: A random value will be uniformly sampled per image from the discrete interval *[a..b]*.
  – If *list*: A random value will be picked per image from that list.
  – If *StochasticParameter*: That parameter will be queried once per batch for *(N,)* values – one per image.

• **nb_cols** *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)*
  Number of columns of the checkerboard. Analogous to *nb_rows*.

**Attributes**

*nb_cols* Get the number of columns of the checkerboard grid.

*nb_rows* Get the number of rows of the checkerboard grid.

**Methods**

```python
draw_masks(self, batch[, random_state])
    See draw_masks().

generate_mask(shape, nb_rows, nb_cols)
    Generate a mask following a checkerboard pattern.
```

**draw_masks**(self, batch[, random_state])

See *draw_masks()*.

Added in 0.4.0.

**classmethod generate_mask**(shape, nb_rows, nb_cols)

Generate a mask following a checkerboard pattern.

Added in 0.4.0.

**Parameters**

• *shape* *(tuple of int)*
  Height and width of the output mask.

• **nb_rows** *(int)*
  Number of rows of the checkerboard pattern.

• **nb_cols** *(int)*
  Number of columns of the checkerboard pattern.

**Returns**

*float32* mask array with same height and width as *segmap.shape*. Values are in *[0.0, 1.0]*.

**Return type**

*ndarray*

**nb_cols**

Get the number of columns of the checkerboard grid.

Added in 0.4.0.

**Returns**

The number of columns.

**Return type**

*int*

**nb_rows**

Get the number of rows of the checkerboard grid.
Added in 0.4.0.

**Returns** The number of rows.

**Return type** int

imgaug.augmenters.blend.**FrequencyNoiseAlpha** (exponent=(-4, 4), first=None, second=None, per_channel=False, size_px_max=(4, 16), upscale_method=None, iterations=(1, 3), aggregation_method=['avg', 'max'], sigmoid=0.5, sigmoid_thresh=None, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

**Deprecated.** Use **BlendAlphaFrequencyNoise** instead. **FrequencyNoiseAlpha** is deprecated. Use **BlendAlphaFrequencyNoise** instead. The order of parameters is the same. Parameter ‘first’ was renamed to ‘foreground’. Parameter ‘second’ was renamed to ‘background’.

See **BlendAlphaFrequencyNoise**.

Deprecated since 0.4.0.

**class** imgaug.augmenters.blend.**HorizontalLinearGradientMaskGen** (min_value=(0.0, 0.2), max_value=(0.8, 1.0), start_at=(0.0, 0.2), end_at=(0.8, 1.0))

**Bases:** imgaug.augmenters.blend._LinearGradientMaskGen

Generator that produces horizontal linear gradient masks.

This class receives batches and produces for each row (i.e. image) a horizontal linear gradient that matches the row’s shape (i.e. image shape). The gradient increases linearly from a minimum value to a maximum value along the x-axis. The start and end points (i.e. where the minimum value starts to increase and where it reaches the maximum) may be defines as fractions of the width. E.g. for width 100 and start=0.25, end=0.75, the gradient would have its minimum in interval [0px, 25px] and its maximum in interval [75px, 100px].

Note that this has nothing to do with a derivative along the x-axis.

Added in 0.4.0.

**Parameters**

- **min_value** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Minimum value that the mask will have up to the start point of the linear gradient. Note that **min_value** is allowed to be larger than **max_value**, in which case the gradient will start at the (higher) **min_value** and decrease towards the (lower) **max_value**.
  - If number: Exactly that value will be used for all images.
  - If tuple (a, b): A random value will be uniformly sampled per image from the interval [a, b].
  - If list: A random value will be picked per image from that list.
  - If StochasticParameter: That parameter will be queried once per batch for (N,) values – one per image.
• **max_value** *(number or tuple of number or list of number or im-
gaug.parameters.StochasticParameter, optional)* – Maximum value that the mask will have at the end of the linear gradient.

Datatypes are analogous to *min_value*.

• **start_at** *(number or tuple of number or list of number or im-
gaug.parameters.StochasticParameter, optional)* – Position on the x-axis where the linear gradient starts, given as a fraction of the axis size. Interval is \([0.0, 1.0]\), where 0.0 is at the left of the image. If *end_at < start_at* the gradient will be inverted.

Datatypes are analogous to *min_value*.

• **end_at** *(number or tuple of number or list of number or im-
gaug.parameters.StochasticParameter, optional)* – Position on the x-axis where the linear gradient ends, given as a fraction of the axis size. Interval is \([0.0, 1.0]\), where 0.0 is at the right of the image.

Datatypes are analogous to *min_value*.

### Methods

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<td><em>draw_masks</em>(self, batch[, random_state])</td>
<td>See <em>draw_masks()</em>.</td>
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<tr>
<td><em>generate_mask</em>(shape, min_value, max_value, ... )</td>
<td>Generate a linear horizontal gradient mask.</td>
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**classmethod** *generate_mask* *(shape, min_value, max_value, start_at, end_at)*

Generate a linear horizontal gradient mask.

Added in 0.4.0.

**Parameters**

- **shape** *(tuple of int)* – Shape of the image. The mask will have the same height and width.
- **min_value** *(number)* – Minimum value of the gradient in interval \([0.0, 1.0]\).
- **max_value** *(number)* – Maximum value of the gradient in interval \([0.0, 1.0]\).
- **start_at** *(number)* – Position on the x-axis where the linear gradient starts, given as a fraction of the axis size. Interval is \([0.0, 1.0]\).
- **end_at** *(number)* – Position on the x-axis where the linear gradient ends, given as a fraction of the axis size. Interval is \([0.0, 1.0]\).

**Returns** float32 mask array with same height and width as the image. Values are in \([0.0, 1.0]\).

**Return type** ndarray

**class** *imgaug.augmenters.blend.IBatchwiseMaskGenerator*

Bases: object

Interface for classes generating masks for batches.

Child classes are supposed to receive a batch and generate an iterable of masks, one per row (i.e. image), matching the row shape (i.e. image shape). This is used in *BlendAlphaMask*.

Added in 0.4.0.
Methods

\texttt{draw_masks}(\texttt{self, batch[, random_state]}) \hspace{1cm} \text{Generate a mask with given shape.}

\texttt{draw_masks}(\texttt{self, batch, random_state=\texttt{None}})

Generate a mask with given shape.

Parameters

- \texttt{batch} (\texttt{imgaug.augmentables.batches._BatchInAugmentation}) – Shape of the mask to sample.

- \texttt{random_state} (\texttt{None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional}) – A seed or random number generator to use during the sampling process. If \texttt{None}, the global RNG will be used. See also \texttt{\_\_init\_\_()} for a similar parameter with more details.

Returns

Masks, one per row in the batch. Each mask must be a float32 array in interval [0.0, 1.0]. It must either have the same shape as the row (i.e. the image) or shape (H, W) if all channels are supposed to have the same mask.

Return type

iterable of ndarray

\texttt{class imgaug.augmenters.blend.InvertMaskGen(p, child)}

\texttt{Bases: imgaug.augmenters.blend.IBatchwiseMaskGenerator}

Generator that inverts the outputs of other mask generators.

This class receives batches and calls for each row (i.e. image) a child mask generator to produce a mask. That mask is then inverted for p\% of all rows, i.e. converted to 1.0 - mask.

Added in 0.4.0.

Parameters

- \texttt{p} (\texttt{bool or float or imgaug.parameters.StochasticParameter, optional}) – Probability of inverting each mask produced by the other mask generator.

- \texttt{child} (\texttt{IBatchwiseMaskGenerator}) – The other mask generator to invert.

Methods

\texttt{draw.masks}(\texttt{self, batch[, random_state]}) \hspace{1cm} \text{See draw.masks().}

\texttt{draw.masks}(\texttt{self, batch, random_state=\texttt{None}})

See \texttt{draw.masks()}. Added in 0.4.0.

\texttt{class imgaug.augmenters.blend.RegularGridMaskGen(nb_rows, nb_cols, alpha=[0.0, 1.0])}

\texttt{Bases: imgaug.augmenters.blend.IBatchwiseMaskGenerator}

Generate masks following a regular grid pattern.

This mask generator splits each image into a grid-like pattern of H rows and W columns. Each cell is then filled with an alpha value, sampled randomly per cell.

The difference to \texttt{CheckerboardMaskGen} is that this mask generator samples random alpha values per cell,
while in the checkerboard the alpha values follow a fixed pattern.

Added in 0.4.0.

**Parameters**

- **nb_rows** *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter)* – Number of rows of the regular grid.
  - If int: Exactly that value will be used for all images.
  - If tuple (a, b): A random value will be uniformly sampled per image from the discrete interval \([a..b]\).
  - If list: A random value will be picked per image from that list.
  - If StochasticParameter: That parameter will be queried once per batch for \((N,\) values – one per image.

- **nb_cols** *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter)* – Number of columns of the checkerboard. Analogous to nb_rows.

- **alpha** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Alpha value of each cell.
  - If number: Exactly that value will be used for all images.
  - If tuple (a, b): A random value will be uniformly sampled per image from the interval \([a, b]\).
  - If list: A random value will be picked per image from that list.
  - If StochasticParameter: That parameter will be queried once per batch for \((N,\) values – one per image.

**Methods**

```python
draw_masks(self, batch[, random_state])
See draw_masks().
generate_mask(shape, nb_rows, nb_cols, alphas)
generate_mask(shape, nb_rows, nb_cols, alphas)
```

**draw_masks** *(self, batch, random_state=None)*

See draw_masks().

Added in 0.4.0.

**classmethod generate_mask**(shape, nb_rows, nb_cols, alphas)

Generate a mask following a checkerboard pattern.

Added in 0.4.0.

**Parameters**

- **shape** *(tuple of int)* – Height and width of the output mask.
- **nb_rows** *(int)* – Number of rows of the checkerboard pattern.
- **nb_cols** *(int)* – Number of columns of the checkerboard pattern.
- **alphas** *(ndarray)* – 1D or 2D array containing for each cell the alpha value, i.e. \(nb_rows*nb_cols\) values.
Returns float32 mask array with same height and width as segmap.shape. Values are in [0.0, 1.0].

Return type ndarray

class imgaug.augmenters.blend.SegMapClassIdsMaskGen(class_ids, nb_sample_classes=None)

Bases: imgaug.augmenters.blend.IBatchwiseMaskGenerator

Generator that produces masks highlighting segmentation map classes.

This class produces for each segmentation map in a batch a mask in which the locations of a set of provided classes are highlighted (i.e. 1.0). The classes may be provided as a fixed list of class ids or a stochastic parameter from which class ids will be sampled.

The produced masks are initially of the same height and width as the segmentation map arrays and later upscaled to the image height and width.

Note: Segmentation maps can have multiple channels. If that is the case then for each position \((x, y)\) it is sufficient that any class id in any channel matches one of the desired class ids.

Note: This class will produce an `AssertionError` if there are no segmentation maps in a batch.

Added in 0.4.0.

Parameters

- **class_ids** (`int or tuple of int or list of int or imgaug.parameters.StochasticParameter`) – Segmentation map classes to mark in the produced mask.

  If \(nb\_sample\_classes\) is `None` then this is expected to be either a single `int` (always mark this one class id) or a `list of int` (always mark these class ids).

  If \(nb\_sample\_classes\) is set, then this parameter will be treated as a stochastic parameter with the following valid types:

  - If `int`: Exactly that class id will be used for all segmentation maps.
  - If `tuple (a, b)`: \(N\) random values will be uniformly sampled per segmentation map from the discrete interval \([a..b]\) and used as the class ids.
  - If `list`: \(N\) random values will be picked per segmentation map from that list and used as the class ids.
  - If `StochasticParameter`: That parameter will be queried once per batch for \((\text{sum}(N),)\) values.

  \(N\) denotes the number of classes to sample per segmentation map (derived from \(nb\_sample\_classes\)) and \(\text{sum}(N)\) denotes the sum of \(N\) s over all segmentation maps.

- **nb_sample_classes** (`None or tuple of int or list of int or imgaug.parameters.StochasticParameter`, optional) – Number of class ids to sample (with replacement) per segmentation map. As sampling happens with replacement, fewer unique class ids may be sampled.

  - If `None`: `class_ids` is expected to be a fixed value of class ids to be used for all segmentation maps.
  - If `int`: Exactly that many class ids will be sampled for all segmentation maps.
- If tuple \((a, b)\): A random value will be uniformly sampled per segmentation map from the discrete interval \([a..b]\).
- If list or int: A random value will be picked per segmentation map from that list.
- If StochasticParameter: That parameter will be queried once per batch for \((B, )\) values, where \(B\) is the number of segmentation maps.

### Methods

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| `draw_masks(self, batch[, random_state])` | See `draw_masks()`.
| `generate_mask(segmap, class_ids)` | Generate a mask of where the segmentation map has the given classes. |

### draw_masks

```python
draw_masks (self, batch, random_state=None)
```

See `draw_masks()`.

Added in 0.4.0.

### classmethod generate_mask

```python
generate_mask (segmap, class_ids)
```

Generate a mask of where the segmentation map has the given classes.

Added in 0.4.0.

**Parameters**

- `segmap` ([`imgaug.augmentables.segmap.SegmentationMapsOnImage`]) – The segmentation map for which to generate the mask.
- `class_ids` ([`iterable of int`]) – IDs of the classes to set to 1.0. For an \((x, y)\) position, it is enough that any channel at the given location to have one of these class ids to be marked as 1.0.

**Returns** float32 mask array with same height and width as `segmap.shape`. Values are in \([0.0, 1.0]\).

**Return type** ndarray

### SimplexNoiseAlpha

```python
SimplexNoiseAlpha (first=None, second=None, per_channel=False, size_px_max=(2, 16), upscale_method=None, iterations=(1, 3), aggregation_method='max', sigmoid=True, sigmoid_thresh=None, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Deprecated.** Use `BlendAlphaSimplexNoise` instead. `SimplexNoiseAlpha` is deprecated. Use `BlendAlphaSimplexNoise` instead. The order of parameters is the same. Parameter ‘first’ was renamed to ‘foreground’. Parameter ‘second’ was renamed to ‘background’.

See `BlendAlphaSimplexNoise`.

**Deprecated since 0.4.0.**

### SomeColorsMaskGen

```python
SomeColorsMaskGen (nb_bins=(5, 15), smoothness=(0.1, 0.3), alpha=[0.0, 1.0], rotation_deg=(0, 360), from_colorspace='RGB')
```

Generator that produces masks based on some similar colors in images.
This class receives batches for which to generate masks, iterates over the batch rows (i.e. images) and generates one mask per row. The mask contains high alpha values for some colors, while other colors get low mask values. Which colors are chosen is random. How wide or narrow the selection is (e.g. very specific blue tone or all blue-ish colors) is determined by the hyperparameters.

The color selection method performs roughly the following steps:

1. Split the full color range of the hue in HSV into `nb_bins` bins (i.e. $256/nb\_bins$ different possible hue tones).
2. Shift the bins by `rotation\_deg` degrees. (This way, the 0th bin does not always start at exactly 0deg of hue.)
3. Sample alpha values for each bin.
4. Repeat the `nb_bins` bins until there are 256 bins.
5. Smoothen the alpha values of neighbouring bins using a gaussian kernel. The kernel’s `sigma` is derived from `smoothness`.
6. Associate all hue values in the image with the corresponding bin’s alpha value. This results in the alpha mask.

**Note:** This mask generator will produce an `AssertionError` for batches that contain no images.

Added in 0.4.0.

**Supported dtypes:**

See `change_colorsspaces_()`.

**Parameters**

- `nb_bins` *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)* – Number of bins. For B bins, each bin denotes roughly $360/B$ degrees of colors in the hue channel. Lower values lead to a coarser selection of colors. Expected value range is $[2, 256]$.
  - If `int`: Exactly that value will be used for all images.
  - If `tuple (a, b)`: A random value will be uniformly sampled per image from the discrete interval $[a..b]$.
  - If `list`: A random value will be picked per image from that list.
  - If `StochasticParameter`: That parameter will be queried once per batch for $(N,)$ values – one per image.

- `smoothness` *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Strength of the 1D gaussian kernel applied to the sampled binwise alpha values. Larger values will lead to more similar grayscaling of neighbouring colors. Expected value range is $[0.0, 1.0]$.
  - If `number`: Exactly that value will be used for all images.
  - If `tuple (a, b)`: A random value will be uniformly sampled per image from the interval $[a, b]$.
  - If `list`: A random value will be picked per image from that list.
  - If `StochasticParameter`: That parameter will be queried once per batch for $(N,)$ values – one per image.
**alpha** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Parameter to sample binwise alpha blending factors from. Expected value range is \([0.0, 1.0]\). Note that the alpha values will be smoothed between neighbouring bins. Hence, it is usually a good idea to set this so that the probability distribution peaks are around 0.0 and 1.0, e.g. via a list \([0.0, 1.0]\) or a Beta distribution. It is not recommended to set this to a deterministic value, otherwise all bins and hence all pixels in the generated mask will have the same value.

- If **number**: Exactly that value will be used for all bins.
- If **tuple (a, b)**: A random value will be uniformly sampled per bin from the interval \([a, b]\).
- If **list**: A random value will be picked per bin from that list.
- If **StochasticParameter**: That parameter will be queried once per batch for \((N*B, )\) values – one per image and bin.

**rotation_deg** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Rotational shift of each bin as a fraction of 360 degrees. E.g. 0.0 will not shift any bins, while a value of 0.5 will shift by around 180 degrees. This shift is mainly used so that the 0th bin does not always start at 0deg. Expected value range is \([-360, 360]\). This parameter can usually be kept at the default value.

- If **number**: Exactly that value will be used for all images.
- If **tuple (a, b)**: A random value will be uniformly sampled per image from the interval \([a, b]\).
- If **list**: A random value will be picked per image from that list.
- If **StochasticParameter**: That parameter will be queried once per batch for \((N, )\) values – one per image.

**from_colorsace** *(str, optional)* – The source colorspace (of the input images). See `change_colorspace()`.

### Methods

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| `draw_masks(self, batch[, random_state])` | See `draw_masks()`.
| `generate_mask(image, binwise_alphas, sigma, ...)` | Generate a colorwise alpha mask for a single image.  

**draw_masks** *(self, batch, random_state=None)*

See `draw_masks()`.

**classmethod generate_mask** *(image, binwise_alphas, sigma, rotation_bins, from_colorspace)*

Generate a colorwise alpha mask for a single image.

Added in 0.4.0.

**Parameters**

- **image** *(ndarray)* – Image for which to generate the mask. Must have shape \((H, W, 3)\) in colorspace `from_colorspace`.

- **binwise_alphas** *(ndarray)* – Alpha values of shape \((B, )\) with \(B \in [1, 256]\) and values in interval \([0.0, 1.0]\). Will be upscaled to 256 bins by simple repetition. Each bin represents 1/256 th of the hue.
• **sigma** (*float*) – Sigma of the 1D gaussian kernel applied to the upscaled binwise alpha value array.

• **rotation_bins** (*int*) – By how much to rotate the 256 bin alpha array. The rotation is given in number of bins.

• **from_colorspace** (*str*) – Colorspace of the input image. One of imgaug.augmenters.color.CSPACE_*.  

**Returns**  
float32 mask array of shape (H, W) with values in [0.0, 1.0]

**Return type**  
ndarray

class imgaug.augmenters.blend.StochasticParameterMaskGen(parameter, per_channel)

Bases: imgaug.augmenters.blend.IBatchwiseMaskGenerator

Mask generator that queries stochastic parameters for mask values.

This class receives batches for which to generate masks, iterates over the batch rows (i.e. images) and generates one mask per row. For a row with shape (H, W, C) (= image shape), it generates either a (H, W) mask (if per_channel is false-like) or a (H, W, C) mask (if per_channel is true-like). The per_channel is sampled per batch for each row/image.

Added in 0.4.0.

**Parameters**

• **parameter** (imgaug.parameters.StochasticParameter) – Stochastic parameter to draw mask samples from. Expected to return values in interval [0.0, 1.0] (not all stochastic parameters do that) and must be able to handle sampling shapes (H, W) and (H, W, C) (all stochastic parameters should do that).

• **per_channel** (bool or float or imgaug.parameters.StochasticParameter, optional) – Whether to use the same mask for all channels (False) or to sample a new mask for each channel (True). If this value is a float $p$, then for $p$ percent of all rows (i.e. images) per_channel will be treated as True, otherwise as False.

**Methods**

draw_masks(self, batch[, random_state])  
See draw_masks().

draw_masks(self, batch, random_state=None)
  
  See draw_masks().

class imgaug.augmenters.blend.VerticalLinearGradientMaskGen(min_value=(0.0, 0.2), max_value=(0.8, 1.0), start_at=(0.0, 0.2), end_at=(0.8, 1.0))

Bases: imgaug.augmenters.blend._LinearGradientMaskGen

Generator that produces vertical linear gradient masks.

See HorizontalLinearGradientMaskGen for details.

Added in 0.4.0.

**Parameters**

• **min_value** (number or tuple of number or list of number or im-
gaug.parameters.StochasticParameter, optional) – Minimum value that the mask will have up to the start point of the linear gradient. Note that min_value is allowed to be larger than max_value, in which case the gradient will start at the (higher) min_value and decrease towards the (lower) max_value.

- If number: Exactly that value will be used for all images.
- If tuple (a, b): A random value will be uniformly sampled per image from the interval [a, b].
- If list: A random value will be picked per image from that list.
- If StochasticParameter: That parameter will be queried once per batch for (N,) values – one per image.

• max_value (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Maximum value that the mask will have at the end of the linear gradient.

Datatypes are analogous to min_value.

• start_at (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Position on the y-axis where the linear gradient starts, given as a fraction of the axis size. Interval is [0.0, 1.0], where 0.0 is at the top of the image. If end_at < start_at the gradient will be inverted.

Datatypes are analogous to min_value.

• end_at (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Position on the x-axis where the linear gradient ends, given as a fraction of the axis size. Interval is [0.0, 1.0], where 1.0 is at the bottom of the image.

Datatypes are analogous to min_value.

Methods

draw_masks(self, batch[, random_state]) See draw_masks().
generate_mask(shape, min_value, max_value, ...)


classmethod generate_mask (shape, min_value, max_value, start_at, end_at)
Generate a linear horizontal gradient mask.

Added in 0.4.0.

Parameters

• shape (tuple of int) – Shape of the image. The mask will have the same height and width.
• min_value (number) – Minimum value of the gradient in interval [0.0, 1.0].
• max_value (number) – Maximum value of the gradient in interval [0.0, 1.0].
• start_at (number) – Position on the x-axis where the linear gradient starts, given as a fraction of the axis size. Interval is [0.0, 1.0].
• end_at (number) – Position on the x-axis where the linear gradient ends, given as a fraction of the axis size. Interval is [0.0, 1.0].
Returns float32 mask array with same height and width as the image. Values are in [0.0, 1.0].

Return type ndarray

imgaug.augmenters.blend.blend_alpha(image_fg, image_bg, alpha, eps=0.01)
Blend two images using an alpha blending.

In alpha blending, the two images are naively mixed using a multiplier. Let A be the foreground image and B the background image and a is the alpha value. Each pixel intensity is then computed as a * A_ij + (1-a) * B_ij.

Supported dtypes:
- uint8: yes; fully tested
- uint16: yes; fully tested
- uint32: yes; fully tested
- uint64: yes; fully tested (1)
- int8: yes; fully tested
- int16: yes; fully tested
- int32: yes; fully tested
- int64: yes; fully tested (1)
- float16: yes; fully tested
- float32: yes; fully tested
- float64: yes; fully tested (1)
- float128: no (2)
- bool: yes; fully tested (2)

(1) Tests show that these dtypes work, but a conversion to float128 happens, which only has 96 bits of size instead of true 128 bits and hence not twice as much resolution. It is possible that these dtypes result in inaccuracies, though the tests did not indicate that.

(2) Not available due to the input dtype having to be increased to an equivalent float dtype with two times the input resolution.

(3) Mapped internally to float16.

Parameters
- image_fg ((H,W,C) ndarray) – Foreground image. Shape and dtype kind must match the one of the background image.
- image_bg ((H,W,C) ndarray) – Background image. Shape and dtype kind must match the one of the foreground image.
- alpha (number or iterable of number or ndarray) – The blending factor, between 0.0 and 1.0. Can be interpreted as the opacity of the foreground image. Values around 1.0 result in only the foreground image being visible. Values around 0.0 result in only the background image being visible. Multiple alphas may be provided. In these cases, there must be exactly one alpha per channel in the foreground/background image. Alternatively, for (H,W,C) images, either one (H,W) array or an (H,W,C) array of alphas may be provided, denoting the elementwise alpha value.
• **eps** *(number, optional)* – Controls when an alpha is to be interpreted as exactly 1.0 or exactly 0.0, resulting in only the foreground/background being visible and skipping the actual computation.

**Returns** `image_blend` – Blend of foreground and background image.

**Return type** *(H,W,C) ndarray*

### 13.21 `imgaug.augmenters.blur`

Augmenters that blur images.

List of augmenters:

- `GaussianBlur`
- `AverageBlur`
- `MedianBlur`
- `BilateralBlur`
- `MotionBlur`
- `MeanShiftBlur`

**class** `imgaug.augmenters.blur.AverageBlur` *(k=(1, 7), seed=None, name=None, random_state='deprecated', deterministic='deprecated')*

**bases** `imgaug.augmenters.meta.Augmenter`

Blur an image by computing simple means over neighbourhoods.

The padding behaviour around the image borders is cv2’s `BORDER_REFLECT_101`.

**Supported dtypes:**

- `uint8`: yes; fully tested
- `uint16`: yes; tested
- `uint32`: no (1)
- `uint64`: no (2)
- `int8`: yes; tested (3)
- `int16`: yes; tested
- `int32`: no (4)
- `int64`: no (5)
- `float16`: yes; tested (6)
- `float32`: yes; tested
- `float64`: yes; tested
- `float128`: no
- `bool`: yes; tested (7)

- (1) rejected by `cv2.blur()`
- (2) loss of resolution in `cv2.blur()` (result is `int32`)
• (3) `int8` is mapped internally to `int16`. `int8` itself leads to cv2 error “Unsupported combination of source format (=1), and buffer format (=4) in function ‘getRowSumFilter’” in cv2.

• (4) results too inaccurate

• (5) loss of resolution in cv2.blur() (result is int32)

• (6) float16 is mapped internally to float32

• (7) bool is mapped internally to float32

Parameters

• **k** *(int or tuple of int or tuple of tuple of int or imgaug.parameters.StochasticParameter or tuple of StochasticParameter, optional)* – Kernel size to use.
  – If a single int, then that value will be used for the height and width of the kernel.
  – If a tuple of two int s (a, b), then the kernel size will be sampled from the interval [a..b].
  – If a tuple of two tuples of int s ((a, b), (c, d)), then per image a random kernel height will be sampled from the interval [a..b] and a random kernel width will be sampled from the interval [c..d].
  – If a StochasticParameter, then N samples will be drawn from that parameter per N input images, each representing the kernel size for the n-th image.
  – If a tuple (a, b), where either a or b is a tuple, then a and b will be treated according to the rules above. This leads to different values for height and width of the kernel.

• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See __init__().

• **name** *(None or str, optional)* – See __init__().

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.AverageBlur(k=5)
```
Blur all images using a kernel size of 5x5.

```python
>>> aug = iaa.AverageBlur(k=(2, 5))
```
Blur images using a varying kernel size, which is sampled (per image) uniformly from the interval [2..5].
Blur images using a varying kernel size, which’s height is sampled (per image) uniformly from the interval [5..7] and which’s width is sampled (per image) uniformly from [1..3].

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<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>

**get_parameters**

See `get_parameters()`.

**class imgaug.augmenters.blur.BilateralBlur**

```python
d=(1, 9),
sigma_color=(10, 250),
sigma_space=(10, 250),
seed=None,
name=None,
random_state='deprecated',
deterministic='deprecated'
```

**Bases:** `imgaug.augmenters.meta.Augmenter`

Blur/Denoise an image using a bilateral filter.

Bilateral filters blur homogenous and textured areas, while trying to preserve edges.

See [http://docs.opencv.org/2.4/modules/imgproc/doc/filtering.html#bilateralfilter](http://docs.opencv.org/2.4/modules/imgproc/doc/filtering.html#bilateralfilter) for more information regarding the parameters.

**Supported dtypes:**

- `uint8`: yes; not tested
- `uint16`: ?
- `uint32`: ?
- `uint64`: ?
- `int8`: ?
- `int16`: ?
- `int32`: ?
- `int64`: ?
- `float16`: ?
- `float32`: ?
- `float64`: ?
- `float128`: ?
- `bool`: ?

**Parameters**

- `d` *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)* – Diameter of each pixel neighborhood with value range [1 .. inf). High values for d lead to significantly worse performance. Values equal or less than 10 seem to be good. Use <5 for real-time applications.
  - If a single int, then that value will be used for the diameter.
If a tuple of two integers \((a, b)\), then the diameter will be a value sampled from the interval \([a..b]\).

If a list, then a random value will be sampled from that list per image.

If a StochasticParameter, then \(N\) samples will be drawn from that parameter per \(N\) input images, each representing the diameter for the \(n\)-th image. Expected to be discrete.

- **sigma_color** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Filter sigma in the color space with value range \([1, \infty)\). A large value of the parameter means that farther colors within the pixel neighborhood (see \(\text{sigma_space}\)) will be mixed together, resulting in larger areas of semi-equal color.

  - If a single int, then that value will be used for the diameter.
  - If a tuple of two integers \((a, b)\), then the diameter will be a value sampled from the interval \([a, b]\).
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then \(N\) samples will be drawn from that parameter per \(N\) input images, each representing the diameter for the \(n\)-th image. Expected to be discrete.

- **sigma_space** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Filter sigma in the coordinate space with value range \([1, \infty)\). A large value of the parameter means that farther pixels will influence each other as long as their colors are close enough (see \(\text{sigma_color}\)).

  - If a single int, then that value will be used for the diameter.
  - If a tuple of two integers \((a, b)\), then the diameter will be a value sampled from the interval \([a, b]\).
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then \(N\) samples will be drawn from that parameter per \(N\) input images, each representing the diameter for the \(n\)-th image. Expected to be discrete.

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See \(\text{__init__()}\).

- **name** *(None or str, optional)* – See \(\text{__init__()}\).

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter \(\text{seed}\). Its usage will not yet cause a deprecation warning, but it is still recommended to use \(\text{seed}\) now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method \(\text{to_deterministic()}\) for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.BilateralBlur(
...   d=(3, 10), sigma_color=(10, 250), sigma_space=(10, 250))
```
Blur all images using a bilateral filter with a max distance sampled uniformly from the interval \([3, 10]\) and wide ranges for sigma_color and sigma_space.

### Methods

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<td>Augment a batch.</td>
</tr>
<tr>
<td>augment_batch(self, batch, hooks)</td>
<td><strong>Deprecated.</strong></td>
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<td>augment_batch(self, batch, parents, hooks)</td>
<td>Augment a single batch in-place.</td>
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<td>Find augmenters that match a condition.</td>
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</tr>
<tr>
<td>localize_random_state([self[, recursive]])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>localize_random_state_(self[, recursive])</td>
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<td>pool([self[, processes, maxtasksperchild, seed]])</td>
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<td>remove_augmenters([self, func[, copy,...]])</td>
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<td>reseed(self[, random_state, deterministic_too])</td>
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<td>seed_(self[, entropy, deterministic_tool])</td>
<td>Seed this augmenter and all of its children.</td>
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<td>show_grid(self, images, rows, cols)</td>
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<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>

**get_parameters**(self)
See `get_parameters()`.

class imgaug.augmenters.blur.GaussianBlur(
    sigma=(0.0, 3.0),
    seed=None,
    name=None,
    random_state='deprecated',
    deterministic='deprecated'
)

Bases: `imgaug.augmenters.meta.Augmenter`

Augmenter to blur images using gaussian kernels.

**Supported dtypes:**

See `~imgaug.augmenters.blur.blur_gaussian_`(backend="auto").

**Parameters**

- **sigma** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Standard deviation of the gaussian kernel. Values in the range 0.0 (no blur) to 3.0 (strong blur) are common.
  - If a single float, that value will always be used as the standard deviation.
  - If a tuple (a, b), then a random value from the interval [a, b] will be picked per image.
  - If a list, then a random value will be sampled per image from that list.
  - If a StochasticParameter, then N samples will be drawn from that parameter per N input images.
- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See `__init__()`.
- **name** (None or str, optional) – See `__init__()`.
- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.GaussianBlur(sigma=1.5)
```
Blur all images using a gaussian kernel with a standard deviation of 1.5.

```python
>>> aug = iaa.GaussianBlur(sigma=(0.0, 3.0))
```

Blur images using a gaussian kernel with a random standard deviation sampled uniformly (per image) from the interval [0.0, 3.0].

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**get_parameters**(self)

See get_parameters()

class imaug.augmenters.blur.MeanShiftBlur(spatial_radius=(5.0, 40.0), color_radius=(5.0, 40.0), seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imaug.augmenters.meta.Augmenter

Apply a pyramidal mean shift filter to each image.

See also blur_mean_shift_() for details.

This augmenter expects input images of shape \((H, W)\) or \((H, W, 1)\) or \((H, W, 3)\).

**Note:** This augmenter is quite slow.

Added in 0.4.0.

**Supported dtypes:**

See blur_mean_shift_().

**Parameters**

- **spatial_radius** *(number or tuple of number or list of number or im-\uga.parameters.StochasticParameter, optional)*

  Spatial radius for pixels that are assumed to be similar.

  - If number: Exactly that value will be used for all images.
  - If tuple \((a, b)\): A random value will be uniformly sampled per image from the interval \([a, b]\).
  - If list: A random value will be sampled from that list per image.
  - If StochasticParameter: The parameter will be queried once per batch for \((N, )\) values with \(N\) denoting the number of images.

- **color_radius** *(number or tuple of number or list of number or im-\uga.parameters.StochasticParameter, optional)*

  Color radius for pixels that are assumed to be similar.

  - If number: Exactly that value will be used for all images.
  - If tuple \((a, b)\): A random value will be uniformly sampled per image from the interval \([a, b]\).
If list: A random value will be sampled from that list per image.

- If StochasticParameter: The parameter will be queried once per batch for \(N,\) values with \(N\) denoting the number of images.

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- **name** (None or str, optional) – See __init__().

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.MeanShiftBlur()
```

Create a mean shift blur augmenter.

### Methods

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**get_parameters**

See `get_parameters()`.  

**class** `imgaug.augmenters.blur.MedianBlur (k=(1, 7), seed=None, name=None, random_state='deprecated', deterministic='deprecated')`

Bases: `imgaug.augmenters.meta.Augmenter`

Blur an image by computing median values over neighbourhoods.

Median blurring can be used to remove small dirt from images. At larger kernel sizes, its effects have some similarity with Superpixels.

**Supported dtypes:**

- `uint8`: yes; fully tested
- `uint16`: ?
- `uint32`: ?
- `uint64`: ?
- `int8`: ?
- `int16`: ?
• int32: ?
• int64: ?
• float16: ?
• float32: ?
• float64: ?
• float128: ?
• bool: ?

Parameters

• k (int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional) – Kernel size.
  – If a single int, then that value will be used for the height and width of the kernel. Must be an odd value.
  – If a tuple of two ints (a, b), then the kernel size will be an odd value sampled from the interval [a..b]. a and b must both be odd values.
  – If a list, then a random value will be sampled from that list per image.
  – If a StochasticParameter, then N samples will be drawn from that parameter per N input images, each representing the kernel size for the nth image. Expected to be discrete. If a sampled value is not odd, then that value will be increased by 1.

• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

• name (None or str, optional) – See __init__().

• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.MedianBlur(k=5)
```
Blur all images using a kernel size of 5x5.

```python
>>> aug = iaa.MedianBlur(k=(3, 7))
```
Blur images using varying kernel sizes, which are sampled uniformly from the interval [3..7]. Only odd values will be sampled, i.e. 3 or 5 or 7.
## Methods

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```python
def get_parameters(self)
    See get_parameters().
```

```python
class imgaug.augmenters.blur.MotionBlur(k=(3, 7), angle=(0, 360), direction=(-1.0, 1.0), order=1, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Blur images in a way that fakes camera or object movements.

Supported dtypes:
See `Convolve`.

Parameters

- **k** *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)* —
  Kernel size to use.
  - If a single int, then that value will be used for the height and width of the kernel.
  - If a tuple of two ints `(a, b)`, then the kernel size will be sampled from the interval `[a..b]`.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then N samples will be drawn from that parameter per N input images, each representing the kernel size for the n-th image.

- **angle** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* — Angle of the motion blur in degrees (clockwise, relative to top center direction).
  - If a number, exactly that value will be used.
  - If a tuple `(a, b)`, a random value from the interval `[a, b]` will be uniformly sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, a value will be sampled from the parameter per image.

- **direction** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* — Forward/backward direction of the motion blur. Lower values towards `-1.0` will point the motion blur towards the back (with angle provided via `angle`). Higher values towards `1.0` will point the motion blur forward. A value of `0.0` leads to a uniformly (but still angled) motion blur.
  - If a number, exactly that value will be used.
  - If a tuple `(a, b)`, a random value from the interval `[a, b]` will be uniformly sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, a value will be sampled from the parameter per image.
• **order** *(int or iterable of int or imgaug.ALL or imgaug.parameters.StochasticParameter, optional)* – Interpolation order to use when rotating the kernel according to `angle`. See `__init__`. Recommended to be 0 or 1, with 0 being faster, but less continuous/smooth as `angle` is changed, particularly around multiple of 45 degrees.

• **seed** *(None or int or imgaug.random.RNG or numpy.random.RandomState, optional)* – See `__init__`. Recommended to be 0 or 1, with 0 being faster, but less continuous/smooth as `angle` is changed, particularly around multiple of 45 degrees.

• **name** *(None or str, optional)* – See `__init__`.

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.MotionBlur(k=15)
```

Apply motion blur with a kernel size of 15x15 pixels to images.

```python
>>> aug = iaa.MotionBlur(k=15, angle=[-45, 45])
```

Apply motion blur with a kernel size of 15x15 pixels and a blur angle of either -45 or 45 degrees (randomly picked per image).

### Methods

```python
__call__(self, *args, **kwargs) Alias for augment().
```

```python
augment(self, return_batch, hooks) Augment a batch.
```

```python
augment_batch(self, batch[, hooks]) Deprecated.
```

```python
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
```

```python
augment_batches(self, batches[, parents, hooks]) Augment multiple batches.
```

```python
augment_bounding_boxes(self, boxes[, parents, hooks]) Augment a batch of bounding boxes.
```

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augment_heatmaps(self, heatmaps[, parents, hooks]) Augment a batch of heatmaps.
```

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augment_image(self, image[, hooks]) Augment a single image.
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```python
augment_images(self, images[, parents, hooks]) Augment a batch of images.
```

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augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
```

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augment_line_strings(self, line_strings[, parents, hooks]) Augment a batch of line strings.
```

```python
augment_polygons(self, polygons_on_images[, parents, hooks]) Augment a batch of polygons.
```

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**imgaug.augmenters.blur**

```python
blur_gaussian_ (image, sigma, ksize=None, backend='auto', eps=0.001)
```

Blur an image using gaussian blurring in-place.

This operation may change the input image in-place.

**Supported dtypes:**

if (backend="auto"):

- `uint8`: yes; fully tested (1)
- `uint16`: yes; tested (1)
- `uint32`: yes; tested (2)
- `uint64`: yes; tested (2)
- `int8`: yes; tested (1)
- `int16`: yes; tested (1)
• int32: yes; tested (1)
• int64: yes; tested (2)
• float16: yes; tested (1)
• float32: yes; tested (1)
• float64: yes; tested (1)
• float128: no
• bool: yes; tested (1)

• (1) Handled by cv2. See backend="cv2".
• (2) Handled by scipy. See backend="scipy".

if (backend="cv2"):
    • uint8: yes; fully tested
    • uint16: yes; tested
    • uint32: no (2)
    • uint64: no (3)
    • int8: yes; tested (4)
    • int16: yes; tested
    • int32: yes; tested (5)
    • int64: no (6)
    • float16: yes; tested (7)
    • float32: yes; tested
    • float64: yes; tested
    • float128: no (8)
    • bool: yes; tested (1)

• (1) Mapped internally to float32. Otherwise causes TypeError: src data type = 0 is not supported.
• (2) Causes TypeError: src data type = 6 is not supported.
• (3) Causes cv2.error: OpenCV(3.4.5) (...)\filter.cpp:2957: error: (-213:The function/feature is not implemented) Unsupported combination of source format (=4), and buffer format (=5) in function 'getLinearRowFilter'.
• (4) Mapped internally to int16. Otherwise causes cv2.error: OpenCV(3.4.5) (...)\filter.cpp:2957: error: (-213:The function/feature is not implemented) Unsupported combination of source format (=1), and buffer format (=5) in function 'getLinearRowFilter'.
• (5) Mapped internally to float64. Otherwise causes cv2.error: OpenCV(3.4.5) (...)\filter.cpp:2957: error: (-213:The function/feature is not implemented) Unsupported combination of source format (=1), and buffer format (=5) in function 'getLinearRowFilter'.
source format (=4), and buffer format (=5) in function 'getLinearRowFilter'.

- (6) Causes cv2.error: OpenCV(3.4.5) (...) /filter.cpp:2957: error: (-213:The function/feature is not implemented)
  Unsupported combination of source format (=4), and buffer format (=5) in function 'getLinearRowFilter'.

- (7) Mapped internally to float32. Otherwise causes TypeError: src data type = 23 is not supported.

- (8) Causes TypeError: src data type = 13 is not supported.

if (backend=’scipy’):
  • uint8: yes; fully tested
  • uint16: yes; tested
  • uint32: yes; tested
  • uint64: yes; tested
  • int8: yes; tested
  • int16: yes; tested
  • int32: yes; tested
  • int64: yes; tested
  • float16: yes; tested (1)
  • float32: yes; tested
  • float64: yes; tested
  • float128: no (2)
  • bool: yes; tested (3)

- (1) Mapped internally to float32. Otherwise causes RuntimeError: array type dtype(‘float16’) not supported.

- (2) Causes RuntimeError: array type dtype(‘float128’) not supported.

- (3) Mapped internally to float32. Otherwise too inaccurate.

Parameters

- image (numpy.ndarray) – The image to blur. Expected to be of shape (H, W) or (H, W, C).

- sigma (number) – Standard deviation of the gaussian blur. Larger numbers result in more large-scale blurring, which is overall slower than small-scale blurring.

- ksize (None or int, optional) – Size in height/width of the gaussian kernel. This argument is only understood by the cv2 backend. If it is set to None, an appropriate value for ksize will automatically be derived from sigma. The value is chosen tighter for larger sigmas to avoid as much as possible very large kernel sizes and thereby improve performance.

- backend (‘auto’, ‘cv2’, ‘scipy’, optional) – Backend library to use. If auto, then the likely best library will be automatically picked per image. That is usually equivalent to cv2 (OpenCV) and it will fall back to scipy for datatypes not supported by OpenCV.
blur_mean_shift(image, spatial_window_radius, color_window_radius)

Apply a pyramidal mean shift filter to the input image in-place.

This produces an output image that has similarity with one modified by a bilateral filter. That is different from mean shift segmentation, which averages the colors in segments found by mean shift clustering.

This function is a thin wrapper around cv2.pyrMeanShiftFiltering.

**Note:** This function does not change the image’s colorspace to RGB before applying the mean shift filter. A non-RGB colorspace will hence influence the results.

**Note:** This function is quite slow.

Added in 0.4.0.

**Supported dtypes:**

- `uint8`: yes; fully tested
- `uint16`: no (1)
- `uint32`: no (1)
- `uint64`: no (1)
- `int8`: no (1)
- `int16`: no (1)
- `int32`: no (1)
- `int64`: no (1)
- `float16`: no (1)
- `float32`: no (1)
- `float64`: no (1)
- `float128`: no (1)
- `bool`: no (1)

(1) Not supported by cv2.pyrMeanShiftFiltering.

**Parameters**

- `image (ndarray)` – (H, W) or (H, W, 1) or (H, W, 3) image to blur. Images with no or one channel will be temporarily tiled to have three channels.
- `spatial_window_radius (number)` – Spatial radius for pixels that are assumed to be similar.
- `color_window_radius (number)` – Color radius for pixels that are assumed to be similar.
Returns Blurred input image. Same shape and dtype as the input. (Input image might have been altered in-place.)

Return type ndarray

13.22 imgaug.augmenters.collections

Augmenters that are collections of other augmenters.

List of augmenters:

- RandAugment

Added in 0.4.0.

class imgaug.augmenters.collections.RandAugment(n=2, m=(6, 12), cval=128, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.meta.Sequential

Apply RandAugment to inputs as described in the corresponding paper.

See paper:

Cubuk et al.

RandAugment: Practical automated data augmentation with a reduced search space

Note: The paper contains essentially no hyperparameters for the individual augmentation techniques. The hyperparameters used here come mostly from the official code repository, which however seems to only contain code for CIFAR10 and SVHN, not for ImageNet. So some guesswork was involved and a few of the hyperparameters were also taken from https://github.com/ildoonet/pytorch-randaugment/blob/master/RandAugment/augmentations.py.

This implementation deviates from the code repository for all PIL enhance operations. In the repository these use a factor of $0.1 + M \times 1.8 / M_{\text{max}}$, which would lead to a factor of 0.1 for the weakest M of M=0. For e.g. Brightness that would result in a basically black image. This definition is fine for AutoAugment (from where the code and hyperparameters are copied), which optimizes each transformation’s M individually, but not for RandAugment, which uses a single fixed M. We hence redefine these hyperparameters to $1.0 + S \times M \times 0.9 / M_{\text{max}}$, where S is randomly either 1 or -1.

We also note that it is not entirely clear which transformations were used in the ImageNet experiments. The paper lists some transformations in Figure 2, but names others in the text too (e.g. crops, flips, cutout). While Figure 2 lists the Identity function, this transformation seems to not appear in the repository (and in fact, the function randaugment(N, M) doesn’t seem to exist in the repository either). So we also make a best guess here about what transformations might have been used.

Warning: This augmenter only works with image data, not e.g. bounding boxes. The used PIL-based affine transformations are not yet able to process non-image data. (This augmenter uses PIL-based affine transformations to ensure that outputs are as similar as possible to the paper’s implementation.)

Added in 0.4.0.
Supported dtypes:

minimum of (Fliplr, KeepSizeByResize, Crop, Sequential, SomeOf, Identity, Autocontrast, Equalize, Invert, Affine, Posterize, Solarize, EnhanceColor, EnhanceContrast, EnhanceBrightness, EnhanceSharpeness, Cutout, FilterBlur, FilterSmooth)

Parameters

**n** (int or tuple of int or list of int or imgaug.parameters.StochasticParameter or None, optional) – Parameter N in the paper, i.e. number of transformations to apply. The paper suggests N=2 for ImageNet. See also parameter n in SomeOf for more details.

Note that horizontal flips (p=50%) and crops are always applied. This parameter only determines how many of the other transformations are applied per image.

**m** [int or tuple of int or list of int or imgaug.parameters.StochasticParameter or None, optional] Parameter M in the paper, i.e. magnitude/severity/strength of the applied transformations in interval [0 .. 30] with M=0 being the weakest. The paper suggests for ImageNet M=9 in case of ResNet-50 and M=28 in case of EfficientNet-B7. This implementation uses a default value of (6, 12), i.e. the value is uniformly sampled per image from the interval [6 .. 12]. This ensures greater diversity of transformations than using a single fixed value.

- If int: That value will always be used.
- If tuple (a, b): A random value will be uniformly sampled per image from the discrete interval [a .. b].
- If list: A random value will be picked from the list per image.
- If StochasticParameter: For B images in a batch, B values will be sampled per augmenter (provided the augmenter is dependent on the magnitude).

**cval** [number or tuple of number or list of number or imgaug.ALL or imgaug.parameters.StochasticParameter, optional] The constant value to use when filling in newly created pixels. See parameter fillcolor in Affine for details.

The paper’s repository uses an RGB value of 125, 122, 113. This implementation uses a single intensity value of 128, which should work better for cases where input images don’t have exactly 3 channels or come from a different dataset than used by the paper.

**seed** [None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional] See __init__() for details.

**name** [None or str, optional] See __init__() for details.

**random_state** [None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional] Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

**deterministic** [bool, optional] Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.RandAugment(n=2, m=9)
```

Create a RandAugment augmenter similar to the suggested hyperparameters in the paper.
>>> aug = iaa.RandAugment(m=30)

Create a RandAugment augmenter with maximum magnitude/strength.

>>> aug = iaa.RandAugment(m=(0, 9))

Create a RandAugment augmenter that applies its transformations with a random magnitude between 0 (very weak) and 9 (recommended for ImageNet and ResNet-50). m is sampled per transformation.

>>> aug = iaa.RandAugment(n=(0, 3))

Create a RandAugment augmenter that applies 0 to 3 of its child transformations to images. Horizontal flips (p=50%) and crops are always applied.

Methods

__call__ (self, *args, **kwargs)  Alias for augment().
add(self, augmenter)  Add an augmenter to the list of child augmenters.
append(self, object, /)  Append object to the end of the list.
augment(self[, return_batch, hooks])  Augment a batch.
augment_batch(self, batch[, hooks])  Deprecated.
augment_batch_(self, batch[, parents, hooks])  Augment a single batch in-place.
augment_batches(self[, batches[, hooks]])  Augment multiple batches.
augment_bounding_boxes(self, ...[, parents, ...])  Augment a batch of bounding boxes.
augment_heatmaps(self[, heatmaps[, parents, ...]])  Augment a batch of heatmaps.
augment_image(self[, image[, hooks]])  Augment a single image.
augment_images(self[, images[, parents, hooks]])  Augment a batch of images.
augment_keypoints(self[, keypoints_on_images])  Augment a batch of keypoints/landmarks.
augment_line_strings(self, ...[, parents, hooks])  Augment a batch of line strings.
augment_polygons(self[, polygons_on_images[, ...]])  Augment a batch of polygons.
augment_segmentation_maps(self[, segmaps[, ...]])  Augment a batch of segmentation maps.
clear(self, /)  Remove all items from list.
copy(self)  Create a shallow copy of this Augmenter instance.
copy_random_state(self[, source[, recursive, ...]])  Copy the RNGs from a source augmenter sequence.
copy_random_state_(self, source[, ...])  Copy the RNGs from a source augmenter sequence (in-place).
count(self, value, /)  Return number of occurrences of value.
deepcopy(self)  Create a deep copy of this Augmenter instance.
draw_grid(self, images, rows, cols)  Augment images and draw the results as a single grid-like image.
extend(self, iterable, /)  Extend list by appending elements from the iterable.
find_augmenters(self[, func[, parents, flat]])  Find augmenters that match a condition.
find_augmenters_by_name(self[, name[, regex, ...]])  Find augmenter(s) by name.
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<tr>
<th>Method</th>
<th>Description</th>
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<tr>
<td><code>find_augmenters_by_names(self, ...)</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>See <code>get_children_lists()</code></td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code></td>
</tr>
<tr>
<td><code>index(self, value[, start, stop])</code></td>
<td>Return first index of value.</td>
</tr>
<tr>
<td><code>insert(self, index, object, /)</code></td>
<td>Insert object before index.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>pop(self[, index])</code></td>
<td>Remove and return item at index (default last).</td>
</tr>
<tr>
<td><code>remove(self, value, /)</code></td>
<td>Remove first occurrence of value.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reverse(self, /)</code></td>
<td>Reverse IN PLACE.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>sort(self, /, *[, key, reverse])</code></td>
<td>Stable sort IN PLACE.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

`get_parameters(self)`  
See `get_parameters()`.

13.23 imgaug.augmenters.color

Augmenters that affect image colors or image colorspace.

List of augmenters:

- `InColorspace` (deprecated)
- `WithColorspace`
- `WithBrightnessChannels`
- `MultiplyAndAddToBrightness`
- `MultiplyBrightness`
- `AddToBrightness`
- `WithHueAndSaturation`
- `MultiplyHueAndSaturation`
- `MultiplyHue`
- MultiplySaturation
- RemoveSaturation
- AddToHueAndSaturation
- AddToHue
- AddToSaturation
- ChangeColorspace
- Grayscale
- ChangeColorTemperature
- KMeansColorQuantization
- UniformColorQuantization
- Posterize

```python
class imgaug.augmenters.color.AddToBrightness(add=(-30, 30), to_colorspace=['YCrCb', 'HSV', 'HLS', 'Lab', 'Luv', 'YUV'], from_colorspace='RGB', seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.color.MultiplyAndAddToBrightness`

Add to the brightness channels of input images.

This is a wrapper around `WithBrightnessChannels` and hence performs internally the same projection to random colorspaces.

Added in 0.4.0.

**Supported dtypes:**

See `MultiplyAndAddToBrightness`.

**Parameters**

- **add** (number or tuple of number or list of number or `Imgaug.parameters.StochasticParameter`, optional) – See Add.
- **to_colorspace** (`Imgaug.ALL` or str or list of str or `Imgaug.parameters.StochasticParameter`, optional) – See `WithBrightnessChannels`.
- **from_colorspace** (str, optional) – See `WithBrightnessChannels`.
- **seed** (None or int or `Imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or `numpy.random.RandomState`, optional) – See `__init__()`.
- **name** (None or str, optional) – See `__init__()`.
- **random_state** (None or int or `Imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or `numpy.random.RandomState`, optional) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.
Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.AddToBrightness((-30, 30))
```

Convert each image to a colorspace with a brightness-related channel, extract that channel, add between −30 and 30 and convert back to the original colorspace.

Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
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<tbody>
<tr>
<td><code>__call__</code></td>
<td>Alias for <code>augment()</code></td>
</tr>
<tr>
<td><code>augment()</code></td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><code>augment_batch()</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>augment_batch_(self, batch[, parents, hooks])</code></td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><code>augment_batches(self, batches[, hooks])</code></td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td><code>augment_bounding_boxes(self, ..., [parents, ...])</code></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps(self, heatmaps[, parents, ...])</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(image[, hooks])</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images(images[, parents, hooks])</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints(keypoints_on_images)</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings([parents, hooks])</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons(polylines_on_images[, parents, hooks])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(segmaps[, ...])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(self[, recursive])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children([flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>See <code>get_children_lists()</code>.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(source[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(processes, maxtasksperchild, seed)</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
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<tr>
<th>Method</th>
<th>Description</th>
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<tbody>
<tr>
<td>remove_augmenters(self, func[, copy, ...])</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**class** imgaug.augmenters.color.AddToHue

```python
AddToHue(value=(-255, 255), from_colorspace='RGB',
seed=None, name=None, random_state='deprecated',
deterministic='deprecated')
```

**Bases:** imgaug.augmenters.color.AddToHueAndSaturation

Add random values to the hue of images.

The augmenter first transforms images to HSV colorspace, then adds random values to the H channel and afterwards converts back to RGB.

If you want to change both the hue and the saturation, it is recommended to use AddToHueAndSaturation as otherwise the image will be converted twice to HSV and back to RGB.

This augmenter is a shortcut for AddToHueAndSaturation(value_hue=...).

**Supported dtypes:**

See AddToHueAndSaturation.

**Parameters**

- **value** *(None or int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)*  
  Value to add to the hue of all pixels. This is expected to be in the range $-255$ to $+255$ and will automatically be projected to an angular representation using $(hue/255) * (360/2)$ (OpenCV’s hue representation is in the range $[0, 180]$ instead of $[0, 360]$).
  - If an integer, then that value will be used for all images.
  - If a tuple $(a, b)$, then a value from the discrete range $[a, b]$ will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled from that parameter per image.

- **from_colorspace** *(str, optional)*  
  See change_colorspace().

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)*  
  See __init__().

- **name** *(None or str, optional)*  
  See __init__().

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)*  
  Old name for parameter seed. Its usage
will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.AddToHue((-50, 50))
```

Sample random values from the discrete uniform range [-50..50], convert them to angular representation and add them to the hue, i.e. to the H channel in HSV colorspace.

### Methods

- `__call__` *(self, *args, **kwargs)*  
  Alias for `augment()`.

- `augment(self, return_batch, hooks)`  
  Augment a batch.

- `augment_batch(self, batch[, hooks])`  
  Deprecated.

- `augment_batch_(self, batch[, parents, hooks])`  
  Augment a single batch in-place.

- `augment_batches(self, batches[, hooks])`  
  Augment multiple batches.

- `augment_bounding_boxes(self, ...,[, parents, ...])`  
  Augment a batch of bounding boxes.

- `augment_heatmaps(self, heatmaps[, parents, ...])`  
  Augment a batch of heatmaps.

- `augment_image(self, image[, hooks])`  
  Augment a single image.

- `augment_images(self, images[, parents, hooks])`  
  Augment a batch of images.

- `augment_keypoints(self, keypoints_on_images)`  
  Augment a batch of keypoints/landmarks.

- `augment_line_strings(self, ...,[, parents, hooks])`  
  Augment a batch of line strings.

- `augment_polygons(self, polygons_on_images[, ...])`  
  Augment a batch of polygons.

- `augment_segmentation_maps(self, segmaps[, ...])`  
  Augment a batch of segmentation maps.

- `copy(self)`  
  Create a shallow copy of this Augmenter instance.

- `copy_random_state(self, source[, recursive, ...])`  
  Copy the RNGs from a source augmenter sequence.

- `copy_random_state_(self, source[, ...])`  
  Copy the RNGs from a source augmenter sequence (in-place).

- `deepcopy(self)`  
  Create a deep copy of this Augmenter instance.

- `draw_grid(self, images, rows, cols)`  
  Augment images and draw the results as a single grid-like image.

- `find_augmenters(self, func[, parents, flat])`  
  Find augmenters that match a condition.

- `find_augmenters_by_name(self, name[, regex, ...])`  
  Find augmenter(s) by name.

- `find_augmenters_by_names(self, names[, ...])`  
  Find augmenter(s) by names.

- `get_all_children(self[, flat])`  
  Get all children of this augmenter as a list.

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<th>Description</th>
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</thead>
<tbody>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
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</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
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<td>Remove in-place children of this augmenter that match a condition.</td>
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<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_tool])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

class `imgaug.augmenters.color.AddToHueAndSaturation` (`value=None, value_hue=None, value_saturation=None, per_channel=False, from_colorspace='RGB', seed=None, name=None, random_state='deprecated', deterministic='deprecated'`)

Bases: `imgaug.augmenters.meta.Augmenter`

Increases or decreases hue and saturation by random values.

The augmenter first transforms images to HSV colorspace, then adds random values to the H and S channels and afterwards converts back to RGB.

This augmenter is faster than using WithHueAndSaturation in combination with Add.

TODO add float support

Supported dtypes:

See `change_colorspace_()`.

Parameters

- **value** *(None or int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)* – Value to add to the hue and saturation of all pixels. It is expected to be in the range $-255$ to $+255$.
  - If this is None, `value_hue` and/or `value_saturation` may be set to values other than None.
  - If an integer, then that value will be used for all images.
  - If a tuple `(a, b)`, then a value from the discrete range `[a, b]` will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled from that parameter per image.
• value_hue  
  (None or int or tuple of int or list of int or im-
  gaug.parameters.StochasticParameter, optional) – Value to add to the hue of all pixels. 
  This is expected to be in the range -255 to +255 and will automatically be projected to 
  an angular representation using (hue/255) * (360/2) (OpenCV’s hue representation is 
  in the range [0, 180] instead of [0, 360]). Only this or value may be set, not both.
  
  – If this and value_saturation are both None, value may be set to a non-None value.
  – If an integer, then that value will be used for all images.
  – If a tuple (a, b), then a value from the discrete range [a, b] will be sampled per 
    image.
  – If a list, then a random value will be sampled from that list per image.
  – If a StochasticParameter, then a value will be sampled from that parameter per image.

• value_saturation  
  (None or int or tuple of int or list of int or im-
  gaug.parameters.StochasticParameter, optional) – Value to add to the saturation of 
  all pixels. It is expected to be in the range -255 to +255. Only this or value may be set, 
  not both.
  
  – If this and value_hue are both None, value may be set to a non-None value.
  – If an integer, then that value will be used for all images.
  – If a tuple (a, b), then a value from the discrete range [a, b] will be sampled per 
    image.
  – If a list, then a random value will be sampled from that list per image.
  – If a StochasticParameter, then a value will be sampled from that parameter per image.

• per_channel  
  (bool or float, optional) – Whether to sample per image only one value from 
  value and use it for both hue and saturation (False) or to sample independently one value 
  for hue and one for saturation (True). If this value is a float p, then for p percent of all 
  images per_channel will be treated as True, otherwise as False.

  This parameter has no effect is value_hue and/or value_saturation are used instead of value.

• from_colorspace  
  (str, optional) – See change_colorspace().

• seed  
  (None or int or imgaug.random.RNG or numpy.random.Generator or 
  numpy.random.BitGenerator or numpy.random.SeedSequence or 
  numpy.random.RandomState, optional) – See __init__().

• name  
  (None or str, optional) – See __init__().

• random_state  
  (None or int or imgaug.random.RNG or numpy.random.Generator or 
  numpy.random.BitGenerator or numpy.random.SeedSequence or 
  numpy.random.RandomState, optional) – Old name for parameter seed. Its usage 
  will not yet cause a deprecation warning, but it is still recommended to use seed now.
  Outdated since 0.4.0.

• deterministic  
  (bool, optional) – Deprecated since 0.4.0. See method 
  to_deterministic() for an alternative and for details about what the “deterministic 
  mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.AddToHueAndSaturation((-50, 50), per_channel=True)
```
Add random values between -50 and 50 to the hue and saturation (independently per channel and the same value for all pixels within that channel).

**Methods**

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<td><strong>call</strong>(self, *args, **kwargs)</td>
<td>Alias for <code>augment()</code>.</td>
</tr>
<tr>
<td>augment(self[, return_batch, hooks])</td>
<td>Augment a batch.</td>
</tr>
<tr>
<td>augment_batch(self[, batch, hooks])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>augment_batch_(self, batch[, parents, hooks])</td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td>augment_batches(self[, batch[, hooks]])</td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td>augment_bounding_boxes(self[, ...[, parents, ...]])</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td>augment_heatmaps(self[, heatmaps[, parents, ...]])</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td>augment_image(self[, image[, hooks]])</td>
<td>Augment a single image.</td>
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<tr>
<td>augment_images(self[, image[, parents, hooks]])</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td>augment_keypoints(self[, keypoints_on_images])</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings(self[, ...[, parents, hooks]])</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td>augment_polygons(self[, polygons_on_images[, ...]])</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation_maps(self[, segmaps[, ...]])</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state(self[, source[, recursive, ...]])</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td>copy_random_state_(self[, source[, ...]])</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy(self)</td>
<td>Create a deep copy of this Augmenter instance.</td>
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<td>draw_grid(self, images, rows, cols)</td>
<td>Augment images and draw the results as a single grid-like image.</td>
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<tr>
<td>find_augmenters(self, func[, parents, flat])</td>
<td>Find augmenters that match a condition.</td>
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<tr>
<td>find_augmenters_by_name(self[, name[, regex, ...]])</td>
<td>Find augmenter(s) by name.</td>
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<tr>
<td>find_augmenters_by_names(self[, names[, ...]])</td>
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</tr>
<tr>
<td>get_all_children(self[, flat])</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
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<td>get_children_lists(self)</td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td>get_parameters(self)</td>
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</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
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</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
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<td>seed_(self[, entropy, deterministic_tool])</td>
<td>Seed this augmenter and all of its children.</td>
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<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>

get_parameters(self)
See get_parameters().

class imgaug.augmenters.color.AddToSaturation(value=(-75, 75),
from_colorspace='RGB', seed=None,
nname=None, random_state='deprecated',
deterministic='deprecated')

Bases: imgaug.augmenters.color.AddToHueAndSaturation

Add random values to the saturation of images.

The augmenter first transforms images to HSV colorspace, then adds random values to the S channel and afterwards converts back to RGB.

If you want to change both the hue and the saturation, it is recommended to use AddToHueAndSaturation as otherwise the image will be converted twice to HSV and back to RGB.

This augmenter is a shortcut for AddToHueAndSaturation(value_saturation=...).

Supported dtypes:
See AddToHueAndSaturation.

Parameters

- **value** *(None or int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)* – Value to add to the saturation of all pixels. It is expected to be in the range \(-255\) to \(+255\).
  - If an integer, then that value will be used for all images.
  - If a tuple \((a, b)\), then a value from the discrete range \([a, b]\) will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled from that parameter per image.

- **from_colorspace** *(str, optional)* – See change_colorspace().

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See __init__().

- **name** *(None or str, optional)* – See __init__().

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.AddToSaturation((-50, 50))
```

Sample random values from the discrete uniform range \([-50..50]\), and add them to the saturation, i.e. to the S channel in HSV colorspace.

**Methods**

```python
__call__ (self, *args, **kwargs) Alias for `augment()`.
augment(self, return_batch, hooks) Augment a batch.
augment_batch(self, batch[, hooks]) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self, batch[, hooks]) Augment multiple batches.
augment_bounding_boxes(self, ...[, parents, ...]) Augment a batch of bounding boxes.
augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
augment_image(self, image[, hooks]) Augment a single image.
augment_images(self, images[, parents, hooks]) Augment a batch of images.
augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
augment_line_strings(self, ...[, parents, hooks]) Augment a batch of line strings.
augment_polygons(self, polygons_on_images[, ...]) Augment a batch of polygons.
augment_segmentation_maps(self, segmaps[, ...]) Augment a batch of segmentation maps.
copy(self) Create a shallow copy of this Augmenter instance.
copy_random_state(self, source[, recursive, ...]) Copy the RNGs from a source augmenter sequence.
copy_random_state_(self, source[, ...]) Copy the RNGs from a source augmenter sequence (in-place).
deepcopy(self) Create a deep copy of this Augmenter instance.
draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.
find_augmenters(self, func[, parents, flat]) Find augmenters that match a condition.
find_augmenters_by_name(self, name[, regex, ...]) Find augmenter(s) by name.
find_augmenters_by_names(self, names[, ...]) Find augmenter(s) by names.
get_all_children(self[, flat]) Get all children of this augmenter as a list.
get_children_lists(self) Get a list of lists of children of this augmenter.
get_parameters(self) See `get_parameters()`.
```
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<tr>
<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters</code></td>
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<tr>
<td><code>remove_augmenters_inplace</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</tbody>
</table>

### `class imgaug.augmenters.color.ChangeColorTemperature`

**Bases:** `imgaug.augmenters.meta.Augmenter`

Change the temperature to a provided Kelvin value.

Low Kelvin values around 1000 to 4000 will result in red, yellow or orange images. Kelvin values around 10000 to 40000 will result in progressively darker blue tones.


Basic method to change color temperatures taken from [https://stackoverflow.com/a/11888449](https://stackoverflow.com/a/11888449)

Added in 0.4.0.

**Supported dtypes:**

See `change_color_temperatures_()`.

**Parameters kelvin** (number or tuple of number or list of number or `imgaug.parameters.StochasticParameter`, optional) – Temperature in Kelvin. The temperatures of images will be modified to this value. Must be in the interval [1000, 40000].

- If a number, exactly that value will always be used.
- If a tuple (a, b), then a value from the interval [a, b] will be sampled per image.
- If a list, then a random value will be sampled from that list per image. * If a `StochasticParameter`, then a value will be sampled per image from that parameter.
Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.ChangeColorTemperature((1100, 10000))
```

Create an augmenter that changes the color temperature of images to a random value between 1100 and 10000 Kelvin.

Methods

- `__call__` (self, *args, **kwargs) Alias for `augment()`.
- `augment` (self, return_batch, hooks): Augment a batch.
- `augment_batch` (self, batch[, hooks]): Augment a single batch.
- `augment_batch_(self, batch[, parents, hooks])`: Deprecated.
- `augment_batches` (self, batches[, hooks]): Augment multiple batches.
- `augment_bounding_boxes` (self, [...[, parents, ...]]): Augment a batch of bounding boxes.
- `augment_heatmaps` (self[, heatmaps[, parents, ...]]): Augment a batch of heatmaps.
- `augment_image` (self, image[, hooks]): Augment a single image.
- `augment_images` (self, images[, parents, hooks]): Augment a batch of images.
- `augment_keypoints` (self[, keypoints_on_images]): Augment a batch of keypoints/landmarks.
- `augment_line_strings` (self[, [...[, parents, hooks]]): Augment a batch of line strings.
- `augment_polygons` (self, polygons_on_images[, ...]): Augment a batch of polygons.
- `augment_segmentation` (self, segmaps[, ...]): Augment a batch of segmentation maps.
- `copy` (self): Create a shallow copy of this Augmenter instance.
- `copy_random_state` (self[, source[, recursive, ...]]): Copy the RNGs from a source augmenter sequence.
- `copy_random_state_` (self[, recursive]): Copy the RNGs from a source augmenter sequence (in-place).
- `deepcopy` (self): Create a deep copy of this Augmenter instance.
- `draw_grid` (self, images, rows, cols): Augment images and draw the results as a single grid-like image.
- `find_augmenters` (self, func[, parents, flat]): Find augmenters that match a condition.
- `find_augmenters_by_name` (self, name[, regex, ...]): Find augmenter(s) by name.
- `find_augmenters_by_names` (self, names[, ...]): Find augmenter(s) by names.
- `get_all_children` (self[, flat]): Get all children of this augmenter as a list.
- `get_children_lists` (self): Get a list of lists of children of this augmenter.
- `get_parameters` (self): See `get_parameters()`.
- `localize_random_state` (self[, recursive]): Assign augmenter-specific RNGs to this augmenter and its children.
- `localize_random_state_` (self[, recursive]): Assign augmenter-specific RNGs to this augmenter and its children.
- `pool` (self[, processes, maxtasksperchild, seed]): Create a pool used for multicore augmentation.

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<tbody>
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<td><code>remove_augmenters(self, func[, copy,...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_{self, func[, parents]}</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_{self[, entropy, deterministic_too]}</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
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<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
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</table>

### get_parameters(self)

See `get_parameters()`.  

### class imgaug.augmenters.color.ChangeColorspace

```python
class ChangeColorspace(to_colorspace,  
                      from_colorspace='RGB', alpha=1.0,  
                      seed=None, name=None,  
                      random_state='deprecated',  
                      deterministic='deprecated')
```

Bases: `imgaug.augmenters.meta.Augmenter`

Augmenter to change the colorspace of images.

**Note:** This augmenter is not tested. Some colorspaces might work, others might not.

```
.. note:

This augmenter tries to project the colorspace value range on 0-255. It outputs dtype=uint8 images.
```

### Supported dtypes:

See `change_colorspace_()`.

### Parameters

- **to_colorspace** *(str or list of str or imgaug.parameters.StochasticParameter)* – The target colorspace. Allowed strings are: RGB, BGR, GRAY, CIE, YCrCb, HSV, HLS, Lab, Luv. These are also accessible via `imgaug.augmenters.color.CSPACE_<NAME>`, e.g. `imgaug.augmenters.CSPACE_YCrCb`.
  
  - If a string, it must be among the allowed colorspaces.
  
  - If a list, it is expected to be a list of strings, each one being an allowed colorspace. A random element from the list will be chosen per image.
  
  - If a StochasticParameter, it is expected to return string. A new sample will be drawn per image.

- **from_colorspace** *(str, optional)* – The source colorspace (of the input images). See `to_colorspace`. Only a single string is allowed.

- **alpha** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – The alpha value of the new colorspace.
when overlayed over the old one. A value close to 1.0 means that mostly the new colorspace is visible. A value close to 0.0 means, that mostly the old image is visible.

- If an int or float, exactly that value will be used.
- If a tuple \((a, b)\), a random value from the range \(a \leq x \leq b\) will be sampled per image.
- If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, a value will be sampled from the parameter per image.

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__`.

- **name** *(None or str, optional)* – See `__init__`.

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Methods**

```python
__call__(self, *args, **kwargs) Alias for augment().

augment(self[, return_batch, hooks]) Augment a batch.

augment_batch(self[, batch[, hooks]]) Deprecated.

augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.

augment_batches(self[, batches[, hooks]]) Augment multiple batches.

augment_bounding_boxes(self[, ...[, parents, ...]]) Augment a batch of bounding boxes.

augment_heatmaps(self[, heatmaps[, parents, ...]]) Augment a batch of heatmaps.

augment_image(self[, image[, hooks]]) Augment a single image.

augment_images(self[, images[, parents, hooks]]) Augment a batch of images.

augment_keypoints(self[, keypoints_on_images]) Augment a batch of keypoints/landmarks.

augment_line_strings(self[, ...[, parents, hooks]]) Augment a batch of line strings.

augment_polygons(self[, polygons_on_images[, ...]]) Augment a batch of polygons.

augment_segmentation_maps(self[, segmaps[, ...]]) Augment a batch of segmentation maps.

copy(self) Create a shallow copy of this Augmenter instance.

copy_random_state(self[, source[, recursive, ...]]) Copy the RNGs from a source augmenter sequence.

copy_random_state_(self[, source[, ...]]) Copy the RNGs from a source augmenter sequence (in-place).

depercopy(self) Create a deep copy of this Augmenter instance.
```

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<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
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<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
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<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
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<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td><code>-localize_random_state_(self[, recursive])</code></td>
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<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
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<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```
BGR = 'BGR'
CIE = 'CIE'
COLORSPACES = {'BGR', 'CIE', 'GRAY', 'HLS', 'HSV', 'Lab', 'Luv', 'RGB', 'YCrCb'}
CV_VARS = {'BGR2CIE': <MagicMock id='140084716444416'>, 'BGR2GRAY': <MagicMock id='140084716431904'>, ...
GRAY = 'GRAY'
HLS = 'HLS'
HSV = 'HSV'
Lab = 'Lab'
Luv = 'Luv'
RGB = 'RGB'
YCrCb = 'YCrCb'
```

```
get_parameters(self)
See `get_parameters()`.  
```

class imgaug.augmenters.color.Grayscale(alpha=1, from_colorspace='RGB', seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.color.ChangeColorspace

Augmenter to convert images to their grayscale versions.
**Note:** Number of output channels is still 3, i.e. this augmenter just “removes” color.

TODO check dtype support

**Supported dtypes:**
See `change_colorspace()`.

**Parameters**

- **alpha** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – The alpha value of the grayscale image when overlayed over the old image. A value close to 1.0 means, that mostly the new grayscale image is visible. A value close to 0.0 means, that mostly the old image is visible.
  - If a number, exactly that value will always be used.
  - If a tuple `(a, b)`, a random value from the range `a <= x <= b` will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, a value will be sampled from the parameter per image.
- **from_colorspace** *(str, optional)* – The source colorspace (of the input images). See `change_colorspace()`.
- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.
- **name** *(None or str, optional)* – See `__init__()`.
- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Grayscale(alpha=1.0)
```

Creates an augmenter that turns images to their grayscale versions.

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Grayscale(alpha=(0.0, 1.0))
```

Creates an augmenter that turns images to their grayscale versions with an alpha value in the range `0 <= alpha <= 1`. An alpha value of 0.5 would mean, that the output image is 50 percent of the input image and 50 percent of the grayscale image (i.e. 50 percent of color removed).
Methods

```python
__call__ (self, *args, **kwargs) Alias for augment().
augment(self, return_batch, hooks) Augment a batch.
augment_batch(self, batch[, hooks]) Deprecated.
augment_batch_ (self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self, batches[, hooks, ...]) Augment multiple batches.
augment_bounding_boxes(self, ..., [parents, ...]) Augment a batch of bounding boxes.
augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
augment_image(self, image[, hooks]) Augment a single image.
augment_images(self, images[, parents, hooks]) Augment a batch of images.
augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
augment_line_strings(self, ..., [parents, hooks]) Augment a batch of line strings.
augment_polygons(self, polygons_on_images[, ...]) Augment a batch of polygons.
augment_segmentation_maps(self, segmaps[, ...]) Augment a batch of segmentation maps.
copy(self) Create a shallow copy of this Augmenter instance.
copy_random_state(self[, recursive, ...]) Copy the RNGs from a source augmenter sequence.
copy_random_state_ (self[, recursive]) Copy the RNGs from a source augmenter sequence (in-place).
deepcopy(self) Create a deep copy of this Augmenter instance.
draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.
find_augmenters(self, func[, parents, flat]) Remove this augmenter or children that match a condition.
find_augmenters_by_name(self, name[, regex, ...]) Find augmenter(s) by name.
find_augmenters_by_names(self, names[, ...]) Find augmenter(s) by names.
get_all_children(self[, flat]) Get all children of this augmenter as a list.
get_children_lists(self) Get a list of lists of children of this augmenter.
get_parameters(self) See get_parameters().
localize_random_state(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
localize_random_state_ (self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
pool(self[, processes, maxtasksperchild, seed]) Create a pool used for multicore augmentation.
remove_augmenters(self, func[, copy, ...]) Remove this augmenter or children that match a condition.
remove_augmenters_ (self, func[, parents]) Remove in-place children of this augmenter that match a condition.
remove_augmenters_inplace(self, func[, parents]) Deprecated.
reseed(self[, random_state, deterministic_too]) Deprecated.
seed_(self[, entropy, deterministic_too]) Seed this augmenter and all of its children.
```

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<td><code>show_grid</code></td>
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<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>

```python
imgaug.augmenters.color.InColorspace
to_colorspace='RGB', children=None, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Deprecated.** Use `WithColorspace` instead.

Convert images to another colorspace.

```python
class imgaug.augmenters.color.KMeansColorQuantization(n_colors=(2, 16),
from_colorspace='RGB',
to_colorspace=['RGB', 'Lab'],
max_size=128,
interpolation='linear',
seed=None, name=None,
random_state='deprecated',
deterministic='deprecated')
```

**Bases:** `imgaug.augmenters.color._AbstractColorQuantization`

Quantize colors using k-Means clustering.

This “collects” the colors from the input image, groups them into \( k \) clusters using k-Means clustering and replaces the colors in the input image using the cluster centroids.

This is slower than `UniformColorQuantization`, but adapts dynamically to the color range in the input image.

**Note:** This augmenter expects input images to be either grayscale or to have 3 or 4 channels and use colorspace `from_colorspace`. If images have 4 channels, it is assumed that the 4th channel is an alpha channel and it will not be quantized.

**Supported dtypes:**

if (image size <= max_size):

```python
minimum of ( ChangeColorspace, quantize_kmeans() )
```

if (image size > max_size):

```python
minimum of ( ChangeColorspace, quantize_kmeans(),
imresize_single_image() )
```

**Parameters**

- **n_colors** *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)* – Target number of colors in the generated output image. This corresponds to the number of clusters in k-Means, i.e. \( k \). Sampled values below 2 will always be clipped to 2.
  - If a number, exactly that value will always be used.
  - If a tuple \((a, b)\), then a value from the discrete interval \([a..b]\) will be sampled per image.
- If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, then a value will be sampled per image from that parameter.

- **to_colorspace** *(None or str or list of str or imgaug.parameters.StochasticParameter)* – The colorspace in which to perform the quantization. See change_colorspace() for valid values. This will be ignored for grayscale input images.
  - If None the colorspace of input images will not be changed.
  - If a string, it must be among the allowed colorspaces.
  - If a list, it is expected to be a list of strings, each one being an allowed colorspace. A random element from the list will be chosen per image.
  - If a StochasticParameter, it is expected to return string. A new sample will be drawn per image.

- **from_colorspace** *(str, optional)* – The colorspace of the input images. See to_colorspace. Only a single string is allowed.

- **max_size** *(int or None, optional)* – Maximum image size at which to perform the augmentation. If the width or height of an image exceeds this value, it will be downscaled before running the augmentation so that the longest side matches max_size. This is done to speed up the augmentation. The final output image has the same size as the input image. Use None to apply no downsampling.

- **interpolation** *(int or str, optional)* – Interpolation method to use during downsampling when max_size is exceeded. Valid methods are the same as in imresize_single_image().

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See __init__().

- **name** *(None or str, optional)* – See __init__().

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.KMeansColorQuantization()
```

Create an augmenter to apply k-Means color quantization to images using a random amount of colors, sampled uniformly from the interval [2..16]. It assumes the input image colorspace to be RGB and clusters colors randomly in RGB or Lab colorspace.

```python
>>> aug = iaa.KMeansColorQuantization(n_colors=8)
```

Create an augmenter that quantizes images to (up to) eight colors.
Create an augmenter that quantizes images to (up to) `n` colors, where `n` is randomly and uniformly sampled from the discrete interval `[4..16]`.

```python
>>> aug = iaa.KMeansColorQuantization(n_colors=(4, 16))
```

Create an augmenter that quantizes input images that are in BGR colorspace. The quantization happens in RGB or Lab colorspace, into which the images are temporarily converted.

```python
>>> aug = iaa.KMeansColorQuantization(
    from_colorspace=iaa.CSPACE_BGR)
```

Create an augmenter that quantizes images by clustering colors randomly in either RGB or HSV colorspace. The assumed input colorspace of images is RGB.

**Attributes**

- `n_colors` Alias for property `counts`.

**Methods**

- `__call__` (self, *args, **kwargs) 
  Alias for `augment()`.
- `augment` (self, return_batch, hooks) 
  Augment a batch.
- `augment_batch` (self, batch[, hooks]) 
  Augment a single batch.
- `augment_batch_inplace` (self, batch[, parents, hooks]) 
  Augment a single batch in-place.
- `augment_batches` (self, batches[, parents, ...]) 
  Augment multiple batches.
- `augment_bounding_boxes` (self, ..., [parents, ...]) 
  Augment a batch of bounding boxes.
- `augment_heatmaps` (self, heatmaps[, parents, ...]) 
  Augment a batch of heatmaps.
- `augment_image` (self, image[, hooks]) 
  Augment a single image.
- `augment_images` (self, images[, parents, hooks]) 
  Augment a batch of images.
- `augment_keypoints` (self, keypoints_on_images) 
  Augment a batch of keypoints/landmarks.
- `augment_line_strings` (self, ..., [parents, hooks]) 
  Augment a batch of line strings.
- `augment_polygons` (self, polygons_on_images[, ...]) 
  Augment a batch of polygons.
- `augment_segmentation_maps` (self, segmaps[, ...]) 
  Augment a batch of segmentation maps.
- `copy` (self) 
  Create a shallow copy of this Augmenter instance.
- `copy_random_state` (self, source[, recursive, ...]) 
  Copy the RNGs from a source augmenter sequence.
- `copy_random_state_inplace` (self, source[, ...]) 
  Copy the RNGs from a source augmenter sequence (in-place).
- `deepcopy` (self) 
  Create a deep copy of this Augmenter instance.
- `draw_grid` (self, images, rows, cols) 
  Augment images and draw the results as a single grid-like image.
- `find_augmenters` (self, func[, parents, flat]) 
  Find augmenters that match a condition.
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</tr>
<tr>
<td><code>localize_random_state</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
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<td><code>localize_random_state_(self[, recursive])</code></td>
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<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
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<tr>
<td><code>remove_augmenters</code></td>
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<td><code>remove_augmenters_(self, func[, parents])</code></td>
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</tr>
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</tr>
<tr>
<td><code>reseed</code></td>
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<td><code>seed_</code></td>
<td>Seed this augmenter and all of its children.</td>
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<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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**n_colors**

Alias for property `counts`. Added in 0.4.0.

```python
class imgaug.augmenters.color.MultiplyAndAddToBrightness(mul=(0.7, 1.3),
            add=(-30, 30),
            to_colorspace=['YCrCb', 'HSV', 'HLS', 'Lab', 'Luv', 'YUV'],
            from_colorspace='RGB',
            random_order=True,
            seed=None,
            name=None, random_state='deprecated',
            deterministic='deprecated')
```

**Bases:** `imgaug.augmenters.color.WithBrightnessChannels`

Multiply and add to the brightness channels of input images.

This is a wrapper around `WithBrightnessChannels` and hence performs internally the same projection to random colorspaces.

Added in 0.4.0.

**Supported dtypes:**

See `WithBrightnessChannels`.

**Parameters**
• **mul** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See Multiply.

• **add** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See Add.

• **to_colorspace** (imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional) – See WithBrightnessChannels.

• **from_colorspace** (str, optional) – See WithBrightnessChannels.

• **random_order** (bool, optional) – Whether to apply the add and multiply operations in random order (True). If False, this augmenter will always first multiply and then add.

• **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

• **name** (None or str, optional) – See __init__().

• **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.MultiplyAndAddToBrightness(mul=(0.5, 1.5), add=(-30, 30))
```

Convert each image to a colorspace with a brightness-related channel, extract that channel, multiply it by a factor between 0.5 and 1.5, add a value between -30 and 30 and convert back to the original colorspace.

Methods

```python
__call__(self, *args, **kwargs) Alias for augment().

augment(self, return_batch, hooks) Augment a batch.

augment_batch(self, batch, hooks) Deprecated.

augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.

augment_batches(self, batches[, parents, hooks,...]) Augment multiple batches.

augment_bounding_boxes(self, ...[, parents,...]) Augment a batch of bounding boxes.

augment_heatmaps(self, heatmaps[, parents,...]) Augment a batch of heatmaps.

augment_image(self, image[, hooks]) Augment a single image.

augment_images(self, images[, parents, hooks]) Augment a batch of images.

augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
```

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<td></td>
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<td>deterministic one.</td>
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### Class `imgaug.augmenters.color.MultiplyBrightness`

```python
class imgaug.augmenters.color.MultiplyBrightness
    (mul=(0.7, 1.3),
     to_colorspace=['YCrCb', 'HSV', 'HLS', 'Lab', 'Luv', 'YUV'],
     from_colorspace='RGB',
     seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases:** `imgaug.augmenters.color.MultiplyAndAddToBrightness`

Multiply the brightness channels of input images.

This is a wrapper around `WithBrightnessChannels` and hence performs internally the same projection to random colorspace.
Added in 0.4.0.

**Supported dtypes:**

See `MultiplyAndAddToBrightness`.

**Parameters**

- `mul` *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – See `Multiply`.

- `to_colorspace` *(imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional)* – See `WithBrightnessChannels`.

- `from_colorspace` *(str, optional)* – See `WithBrightnessChannels`.

- `seed` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.

- `name` *(None or str, optional)* – See `__init__()`.

- `random_state` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- `deterministic` *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.MultiplyBrightness((0.5, 1.5))
```

Convert each image to a colorspace with a brightness-related channel, extract that channel, multiply it by a factor between 0.5 and 1.5, and convert back to the original colorspace.

**Methods**

```python
__call__(self, *args, **kwargs)
    Alias for augment().

augment(self, return_batch, hooks)
    Augment a batch.

augment_batch(self, batch[, hooks])
    Deprecated.

augment_batch_(self, batch[, parents, hooks])
    Augment a single batch in-place.

augment_batches(self, batches[, hooks,...])
    Augment multiple batches.

augment_bounding_boxes(self, ...[, parents,...])
    Augment a batch of bounding boxes.

augment_heatmaps(self, heatmaps[, parents,...])
    Augment a batch of heatmaps.

augment_image(self, image[, hooks])
    Augment a single image.

augment_images(self, images[, parents, hooks])
    Augment a batch of images.

augment_keypoints(self, keypoints_on_images)
    Augment a batch of keypoints/landmarks.
```

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<tr>
<td><code>augment_polygons(self, polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
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<tr>
<td><code>augment_segmentation_maps(self, segmaps[, ...])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(self, source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(self, source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
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<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
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<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
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<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
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<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
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<td><code>get_all_children(self[, flat])</code></td>
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<td><code>get_children_lists(self)</code></td>
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</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
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<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
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</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**class imgaug.augmenters.color.MultiplyHue**

```
class imgaug.augmenters.color.MultiplyHue (mul=(-3.0, 3.0), from_colorspace='RGB',
seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases:** imgaug.augmenters.color.MultiplyHueAndSaturation

Multiply the hue of images by random values.

The augmenter first transforms images to HSV colorspace, then multiplies the pixel values in the H channel and afterwards converts back to RGB.

This augmenter is a shortcut for MultiplyHueAndSaturation (mul_hue=...).

**Supported dtypes:**
See `MultiplyHueAndSaturation`.

Parameters

- **mul** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Multiplier with which to multiply all hue values. This is expected to be in the range \(-10.0\) to \(+10.0\) and will automatically be projected to an angular representation using \((\text{hue}/255) \times (360/2)\) (OpenCV’s hue representation is in the range \([0, 180]\) instead of \([0, 360]\)). Only this or `mul` may be set, not both.
  - If a number, then that multiplier will be used for all images.
  - If a tuple \((a, b)\), then a value from the continuous range \([a, b]\) will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled from that parameter per image.

- **from_colorspace** *(str, optional)* – See `change_colorspace_()`.

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.

- **name** *(None or str, optional)* – See `__init__()`.

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.MultiplyHue((0.5, 1.5))
```

Multiply the hue channel of images using random values between 0.5 and 1.5.

Methods

```python
__call__(self, *args, **kwargs)  # Alias for `augment()`.
augment(self[, return_batch, hooks])  # Augment a batch.
augment_batch(self[, batch, hooks])  # Deprecated.
augment_batch_(self, batch[, parents, hooks])  # Augment a single batch in-place.
augment_batches(self, batches[, hooks, ...])  # Augment multiple batches.
augment_bounding_boxes(self, ...[, parents, ...])  # Augment a batch of bounding boxes.
augment_heatmaps(self, heatmaps[, parents, ...])  # Augment a batch of heatmaps.
```

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<thead>
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<th>Method</th>
<th>Description</th>
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<tbody>
<tr>
<td><code>augment_image</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
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<tr>
<td><code>draw_grid</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
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<tr>
<td><code>find_augmenters</code></td>
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<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
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<tr>
<td><code>remove_augmenters</code></td>
<td>Remove this augmenter or children that match a condition.</td>
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<tr>
<td><code>remove_augmenters_inplace</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>reseed</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</tbody>
</table>
class imgaug.augmenters.color.MultiplyHueAndSaturation (mul=None, mul_hue=None, mul_saturation=None, per_channel=False, from_colorspace='RGB', seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.color.WithHueAndSaturation

Multiply hue and saturation by random values.

The augmenter first transforms images to HSV colorspace, then multiplies the pixel values in the H and S channels and afterwards converts back to RGB.

This augmenter is a wrapper around WithHueAndSaturation.

Supported dtypes:
See WithHueAndSaturation.

Parameters

- **mul** (None or number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Multiplier with which to multiply all hue and saturation values of all pixels. It is expected to be in the range $-10.0$ to $+10.0$. Note that values of 0.0 or lower will remove all saturation.
  - If this is None, **mul_hue** and/or **mul_saturation** may be set to values other than None.
  - If a number, then that multiplier will be used for all images.
  - If a tuple $(a, b)$, then a value from the continuous range $[a, b]$ will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled from that parameter per image.

- **mul_hue** (None or number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Multiplier with which to multiply all hue values. This is expected to be in the range $-10.0$ to $+10.0$ and will automatically be projected to an angular representation using $(\text{hue}/255) \times (360/2)$ (OpenCV’s hue representation is in the range $[0, 180]$ instead of $[0, 360]$). Only this or **mul** may be set, not both.
  - If this and **mul_saturation** are both None, **mul** may be set to a non-None value.
  - If a number, then that multiplier will be used for all images.
  - If a tuple $(a, b)$, then a value from the continuous range $[a, b]$ will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled from that parameter per image.

- **mul_saturation** (None or number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Multiplier with which to multiply all saturation values. It is expected to be in the range 0.0 to +10.0. Only this or **mul** may be set, not both.
  - If this and **mul_hue** are both None, **mul** may be set to a non-None value.
  - If a number, then that value will be used for all images.
– If a tuple (a, b), then a value from the continuous range [a, b] will be sampled per image.
– If a list, then a random value will be sampled from that list per image.
– If a StochasticParameter, then a value will be sampled from that parameter per image.

• **per_channel** (bool or float, optional) – Whether to sample per image only one value from `mul` and use it for both hue and saturation (False) or to sample independently one value for hue and one for saturation (True). If this value is a float, then for p percent of all images `per_channel` will be treated as True, otherwise as False.

This parameter has no effect if `mul_hue` and/or `mul_saturation` are used instead of `mul`.

• **from_colorspace** (str, optional) – See `change_colorspace()`.

• **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See `__init__()`.

• **name** (None or str, optional) – See `__init__()`.

• **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

• **deterministic** (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.MultiplyHueAndSaturation((0.5, 1.5), per_channel=True)
```

Multiply hue and saturation by random values between 0.5 and 1.5 (independently per channel and the same value for all pixels within that channel). The hue will be automatically projected to an angular representation.

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.MultiplyHueAndSaturation(mul_hue=(0.5, 1.5))
```

Multiply only the hue by random values between 0.5 and 1.5.

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.MultiplyHueAndSaturation(mul_saturation=(0.5, 1.5))
```

Multiply only the saturation by random values between 0.5 and 1.5.

Methods

```python
__call__(self, *args, **kwargs)  Alias for augment().
augment(self[, return_batch, hooks])  Augment a batch.
augment_batch(self, batch[, hooks])  Deprecated.
augment_batch_(self, batch[, parents, hooks])  Augment a single batch in-place.
```

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<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>
```python
class imgaug.augmenters.color.MultiplySaturation(mul=(0.0, 3.0), 
    from_colorspace='RGB', 
    seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.color.MultiplyHueAndSaturation`

Multiply the saturation of images by random values.

The augmenter first transforms images to HSV colorspace, then multiplies the pixel values in the H channel and afterwards converts back to RGB.

This augmenter is a shortcut for `MultiplyHueAndSaturation(mul_saturation=...)`.

Supported dtypes:

See `MultiplyHueAndSaturation`.

**Parameters**

- `mul` *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Multiplier with which to multiply all saturation values. It is expected to be in the range 0.0 to +10.0.
  - If a number, then that value will be used for all images.
  - If a tuple `(a, b)`, then a value from the continuous range `[a, b]` will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled from that parameter per image.

- `from_colorspace` *(str, optional)* – See `change_colorspace_()`.

- `seed` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.

- `name` *(None or str, optional)* – See `__init__()`.

- `random_state` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- `deterministic` *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.MultiplySaturation((0.5, 1.5))
```

Multiply the saturation channel of images using random values between 0.5 and 1.5.

**Methods**
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<td>Alias for <code>augment()</code></td>
</tr>
<tr>
<td>augment(self, return_batch, hooks)</td>
<td>Augment a batch.</td>
</tr>
<tr>
<td>augment_batch(self, batch[, hooks])</td>
<td><strong>Deprecated.</strong></td>
</tr>
<tr>
<td>augment_batch(self, batch[, parents, hooks])</td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td>augment_batches(self, batches[, hooks, ...])</td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td>augment_bounding_boxes(self, ...[, parents, ...])</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td>augment_heatmaps(self, heatmaps[, parents, ...])</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td>augment_image(self, image[, hooks])</td>
<td>Augment a single image.</td>
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<td>augment_images(self, images[, parents, hooks])</td>
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<th>Method</th>
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<tr>
<td><code>to_deterministic(self[, n])</code></td>
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**class** `imgaug.augmenters.color.Posterize` *(nb_bits=(1, 8), from_colorspace='RGB', to_colorspace=None, max_size=None, interpolation='linear', seed=None, name=None, random_state='deprecated', deterministic='deprecated')*

Bases: `imgaug.augmenters.color.UniformColorQuantizationToNBits`  
Alias for `UniformColorQuantizationToNBits`.

Added in 0.4.0.

Supported dtypes:

See `UniformColorQuantizationToNBits`.

**Methods**

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**class** `imgaug.augmenters.color.RemoveSaturation` (`mul=1, from_colorspace='RGB', seed=None, name=None, random_state='deprecated', deterministic='deprecated')`

**Bases:** `imgaug.augmenters.color.MultiplySaturation`

Decrease the saturation of images by varying degrees.

This creates images looking similar to Grayscale.

This augmenter is the same as `MultiplySaturation((0.0, 1.0))`.

Added in 0.4.0.

**Supported dtypes:**

See `MultiplySaturation`.

**Parameters**

- **mul** (number or tuple of number or list of number or `imgaug.parameters.StochasticParameter`, optional) – Inverse multiplier to use for the saturation values. High values denote stronger color removal. E.g. 1.0 will remove all saturation, 0.0 will remove nothing. Expected value range is [0.0, 1.0].
  - If a number, then that value will be used for all images.
  - If a tuple (a, b), then a value from the continuous range [a, b] will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled from that parameter per image.

- **from_colorspace** (str, optional) – See `change_colorspace_()`.

- **seed** (None or int or `imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or `numpy.random.RandomState`, optional) – See `__init__()`.  

13.23. `imgaug.augmenters.color`
• **name** *(None or str, optional)* – See `__init__()`.  
• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.  
• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.RemoveSaturation((0.0, 1.0))
```

Create an augmenter that decreases saturation by varying degrees.

```python
>>> aug = iaa.RemoveSaturation(1.0)
```

Create an augmenter that removes all saturation from input images. This is similar to `Grayscale`.

```python
>>> aug = iaa.RemoveSaturation(from_colorspace=iaa.CSPACE_BGR)
```

Create an augmenter that decreases saturation of images in BGR colorspace by varying degrees.

### Methods

- `__call__`(self, *args, **kwargs)  
  Alias for `augment()`.

- `augment`(self[, return_batch, hooks])  
  Augment a batch.

- `augment_batch`(self[, batch[, hooks]])  
  **Deprecated**.

- `augment_batch_(self, batch[, parents, hooks])`  
  Augment a single batch in-place.

- `augment_bounding_boxes`(self, [...[, parents, ...]])  
  Augment a batch of bounding boxes.

- `augment_heatmaps`(self[, heatmaps[, parents, ...]])  
  Augment a batch of heatmaps.

- `augment_image`(self[, image[, hooks]])  
  Augment a single image.

- `augment_images`(self[, images[, parents, hooks]])  
  Augment a batch of images.

- `augment_keypoints`(self[, keypoints_on_images])  
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- `augment_line_strings`(self, [...[, parents, hooks]])  
  Augment a batch of line strings.

- `augment_polygons`(self[, polygons_on_images[, ...]])  
  Augment a batch of polygons.

- `augment_segmentation_maps`(self[, segmaps[, ...]])  
  Augment a batch of segmentation maps.

- `copy`(self)  
  Create a shallow copy of this Augmenter instance.

- `copy_random_state`(self[, source[, recursive, ...]])  
  Copy the RNGs from a source augmenter sequence.

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```python
class imgaug.augmenters.color.UniformColorQuantization(n_colors=2, 16, from_colorspace='RGB', to_colorspace=None, max_size=None, interpolation='linear', seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.color._AbstractColorQuantization`

Quantize colors into N bins with regular distance.

For uint8 images the equation is \(\text{floor}(v/q) \times q + q/2\) with \(q = 256/N\), where \(v\) is a pixel intensity value and \(N\) is the target number of colors after quantization.

This augmenter is faster than `KMeansColorQuantization`, but the set of possible output colors is constant (i.e. independent of the input images). It may produce unsatisfying outputs for input images that are made up of very similar colors.

**Note:** This augmenter expects input images to be either grayscale or to have 3 or 4 channels and use colorspace `from_colorspace`. If images have 4 channels, it is assumed that the 4th channel is an alpha channel and it will...
not be quantized.

**Supported dtypes:**

if (image size <= max_size):
    minimum of ( ChangeColorspace, quantize_uniform_() )

if (image size > max_size):
    minimum of ( ChangeColorspace, quantize_uniform_(),
                imresize_single_image() )

**Parameters**

- **n_colors** *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)* – Target number of colors to use in the generated output image.
  - If a number, exactly that value will always be used.
  - If a tuple \((a, b)\), then a value from the discrete interval \([a..b]\) will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled per image from that parameter.

- **to_colorspace** *(None or str or list of str or imgaug.parameters.StochasticParameter)* – The colorspace in which to perform the quantization. See `change_colorspace_()` for valid values. This will be ignored for grayscale input images.
  - If None the colorspace of input images will not be changed.
  - If a string, it must be among the allowed colorspaces.
  - If a list, it is expected to be a list of strings, each one being an allowed colorspace. A random element from the list will be chosen per image.
  - If a StochasticParameter, it is expected to return string. A new sample will be drawn per image.

- **from_colorspace** *(str, optional)* – The colorspace of the input images. See `to_colorspace`.
  Only a single string is allowed.

- **max_size** *(None or int, optional)* – Maximum image size at which to perform the augmentation. If the width or height of an image exceeds this value, it will be downscaled before running the augmentation so that the longest side matches `max_size`. This is done to speed up the augmentation. The final output image has the same size as the input image. Use None to apply no downsampling.

- **interpolation** *(int or str, optional)* – Interpolation method to use during downsampling when `max_size` is exceeded. Valid methods are the same as in `imresize_single_image()`.

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.
• **name** *(None or str, optional)* – See `__init__()`.

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter *seed*. Its usage will not yet cause a deprecation warning, but it is still recommended to use *seed* now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.UniformColorQuantization()
```

Create an augmenter to apply uniform color quantization to images using a random amount of colors, sampled uniformly from the discrete interval [2..16].

```python
>>> aug = iaa.UniformColorQuantization(n_colors=8)
```

Create an augmenter that quantizes images to (up to) eight colors.

```python
>>> aug = iaa.UniformColorQuantization(n_colors=(4, 16))
```

Create an augmenter that quantizes images to (up to) \(n\) colors, where \(n\) is randomly and uniformly sampled from the discrete interval [4..16].

```python
>>> aug = iaa.UniformColorQuantization(from_colorspace=iaa.CSPACE_BGR,
>>>       to_colorspace=[iaa.CSPACE_RGB, iaa.CSPACE_HSV])
```

Create an augmenter that uniformly quantizes images in either RGB or HSV colorspace (randomly picked per image). The input colorspace of all images has to be BGR.

### Attributes

**n_colors** Alias for property *counts*.

### Methods

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<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self, random_state, deterministic_too)</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self, entropy, deterministic_too)</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self, n)</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**n_colors**

- Alias for property `counts`.
- Added in 0.4.0.
class imgaug.augmenters.color.UniformColorQuantizationToNBits(nb_bits=(1, 8),
  from_colorspace='RGB',
  to_colorspace=None,
  max_size=None,
  interpolation='linear',
  seed=None,
  name=None,
  random_state='deprecated',
  deterministic='deprecated')

Bases: imgaug.augmenters.color._AbstractColorQuantization

Quantize images by setting $8-B$ bits of each component to zero.

This augmenter sets the $8-B$ highest frequency (rightmost) bits of each array component to zero. For $B$ bits this is equivalent to changing each component’s intensity value $v$ to $v' = v \& (2^{8-B} - 1)$, e.g. for $B=3$ this results in $v' = c \& ~(2^{3-1} - 1) = c \& ~3 = c \& ~0000 0011 = c \& 1111 1100$.

This augmenter behaves for $B$ similarly to UniformColorQuantization($2^B$), but quantizes each bin with interval $(a, b)$ to $a$ instead of to $a + (b-a)/2$.

This augmenter is comparable to PIL.ImageOps.posterize().

Note: This augmenter expects input images to be either grayscale or to have 3 or 4 channels and use colorspace from_colorspace. If images have 4 channels, it is assumed that the 4th channel is an alpha channel and it will not be quantized.

Added in 0.4.0.

Supported dtypes:

if (image size <= max_size):

    minimum of ( ChangeColorspace, quantize_uniform() )

) 

if (image size > max_size):

    minimum of ( ChangeColorspace,
                 quantize_uniform(),
                 imresize_single_image() )

)

Parameters

- **nb_bits** *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)* –

  Number of bits to keep in each image’s array component.

  - If a number, exactly that value will always be used.

  - If a tuple $(a, b)$, then a value from the discrete interval $[a..b]$ will be sampled per image.

  - If a list, then a random value will be sampled from that list per image.

  - If a StochasticParameter, then a value will be sampled per image from that parameter.
• **to_colorspace** *(None or str or list of str or imgaug.parameters.StochasticParameter)* – The colorspace in which to perform the quantization. See `change_colorspace()` for valid values. This will be ignored for grayscale input images.
  - If `None` the colorspace of input images will not be changed.
  - If a string, it must be among the allowed colorspaces.
  - If a list, it is expected to be a list of strings, each one being an allowed colorspace. A random element from the list will be chosen per image.
  - If a StochasticParameter, it is expected to return string. A new sample will be drawn per image.

• **from_colorspace** *(str, optional)* – The colorspace of the input images. See `to_colorspace`.
  Only a single string is allowed.

• **max_size** *(None or int, optional)* – Maximum image size at which to perform the augmentation. If the width or height of an image exceeds this value, it will be downscaled before running the augmentation so that the longest side matches `max_size`. This is done to speed up the augmentation. The final output image has the same size as the input image. Use `None` to apply no downscaling.

• **interpolation** *(int or str, optional)* – Interpolation method to use during downsampling when `max_size` is exceeded. Valid methods are the same as in `imresize_single_image()`.

• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.

• **name** *(None or str, optional)* – See `__init__()`.

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
generous augmentation as iaa
>>> aug = iaa.UniformColorQuantizationToNBits()
```

Create an augmenter to apply uniform color quantization to images using a random amount of bits to remove, sampled uniformly from the discrete interval `[1..8]`.

```python
generous augmentation as iaa
>>> aug = iaa.UniformColorQuantizationToNBits(nb_bits=(2, 8))
```

Create an augmenter that quantizes images by removing $8 - B$ rightmost bits from each component, where $B$ is uniformly sampled from the discrete interval `[2..8]`.

```python
generous augmentation as iaa
>>> aug = iaa.UniformColorQuantizationToNBits(
>>>     from_colorspace=iaa.CSPACE_BGR,
>>>     to_colorspace=[iaa.CSPACE_RGB, iaa.CSPACE_HSV])
```
Create an augmenter that uniformly quantizes images in either RGB or HSV colorspace (randomly picked per image). The input colorspace of all images has to be BGR.

Methods

__call__(self, *args, **kwargs) Alias for augment().
augment(self[, return_batch, hooks]) Augment a batch.
augment_batch(self[, batch, hooks]) Deprecated.
augment_batch(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self, batches[, hooks, ...]) Augment multiple batches.
augment_bounding_boxes(self, ...[, parents, ...]) Augment a batch of bounding boxes.
augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
augment_image(self, image[, hooks]) Augment a single image.
augment_images(self, images[, parents, hooks]) Augment a batch of images.
augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
augment_line_strings(self, ...[, parents, hooks]) Augment a batch of line strings.
augment_polygons(self, polygons_on_images[, ...]) Augment a batch of polygons.
augment_segmentation_maps(self, segmaps[, ...]) Augment a batch of segmentation maps.
copy(self) Create a shallow copy of this Augmenter instance.
copy_random_state(self[, source[, recursive,...]]) Copy the RNGs from a source augmenter sequence.
copy_random_state_(self[, recursive]) Copy the RNGs from a source augmenter sequence (in-place).
deedcopy(self) Create a deep copy of this Augmenter instance.
draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.
find_augmenters(self, func[, parents, flat]) Find augmenters that match a condition.
find_augmenters_by_name(self, name[, regex, ...]) Find augmenter(s) by name.
find_augmenters_by_names(self, names[, ...]) Find augmenter(s) by names.
get_all_children(self[, flat]) Get all children of this augmenter as a list.
get_children_lists(self) Get a list of lists of children of this augmenter.
get_parameters(self) See get_parameters().
localize_random_state(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
localize_random_state_(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
pool(self[, processes, maxtasksperchild, seed]) Create a pool used for multicore augmentation.
remove_augmenters(self, func[, copy, ...]) Remove this augmenter or children that match a condition.
remove_augmenters_(self, func[, parents]) Remove in-place children of this augmenter that match a condition.

Continued on next page
remove_augmenters_inplace(self, func) Deprecated.
reseed(self, random_state, deterministic_too) Deprecated.
seed_(self, entropy, deterministic_tool) Seed this augmenter and all of its children.
show_grid(self, images, rows, cols) Augment images and plot the results as a single grid-like image.
to_deterministic(self, n) Convert this augmenter from a stochastic to a deterministic one.

class imgaug.augmenters.color.WithBrightnessChannels (children=None,
from_colorspace=’RGB’,
seed=None, name=None,
deterministic=’deprecated’) Bases: imgaug.augmenters.meta.Augmenter
Augmenter to apply child augmenters to brightness-related image channels.

This augmenter first converts an image to a random colorspace containing a brightness-related channel (e.g. V in HSV), then extracts that channel and applies its child augmenters to this one channel. Afterwards, it reintegrates the augmented channel into the full image and converts back to the input colorspace.

Added in 0.4.0.

Supported dtypes:
See change_colorspaces_().

Parameters

• children (imgaug.augmenters.meta.Augmenter or list of imgaug.augmenters.meta.Augmenter or None, optional) – One or more augmenters to apply to the brightness channels. They receive images with a single channel and have to modify these.

• to_colorspace (imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional) – Colorspace in which to extract the brightness-related channels. Currently, imgaug.augmenters.color.CSPACE_YCrCb, CSPACE_HSV, CSPACE_HLS, CSPACE_Lab, CSPACE_Luv, CSPACE_YUV, CSPACE_CIE are supported.

  – If imgaug.ALL: Will pick imagewise a random colorspace from all supported colorspaces.

  – If str: Will always use this colorspace.

  – If list or str: Will pick imagewise a random colorspace from this list.

  – If StochasticParameter: A parameter that will be queried once per batch to generate all target colorspaces. Expected to return strings matching the CSPACE_* constants.

• from_colorspace (str, optional) – See change_colorspace().

• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

• name (None or str, optional) – See __init__().
• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* — Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* — Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.WithBrightnessChannels(iaa.Add((-50, 50)))
```

Add -50 to 50 to the brightness-related channels of each image.

```python
>>> aug = iaa.WithBrightnessChannels(
>>>     iaa.Add((-50, 50)), to_colorspace=[iaa.CSPACE_Lab, iaa.CSPACE_HSV])
```

Add -50 to 50 to the brightness-related channels of each image, but pick those brightness-related channels only from Lab (L) and HSV (V) colorspaces.

```python
>>> aug = iaa.WithBrightnessChannels(
>>>     iaa.Add((-50, 50)), from_colorspace=iaa.CSPACE_BGR)
```

Add -50 to 50 to the brightness-related channels of each image, where the images are provided in BGR colorspace instead of the standard RGB.

### Methods

- `__call__`(self, *args, **kwargs) — Alias for `augment()`.
- `augment`(self[, return_batch, hooks]) — Augment a batch.
- `augment_batch`(self[, batch[, hooks]]) — Deprecated.
- `augment_batch_(self, batch[, parents, hooks])` — Augment a single batch in-place.
- `augment_batches`(self[, batches[, parents, ...]]) — Augment multiple batches.
- `augment_bounding_boxes`(self[, parents, ...]) — Augment a batch of bounding boxes.
- `augment_heatmaps`(self[, heatmaps[, parents, ...]]) — Augment a batch of heatmaps.
- `augment_image`(self[, image[, hooks]]) — Augment a single image.
- `augment_images`(self[, images[, parents, hooks]]) — Augment a batch of images.
- `augment_keypoints`(self[, keypoints_on_images]) — Augment a batch of keypoints/landmarks.
- `augment_line_strings`(self[, parents, ...]) — Augment a batch of line strings.
- `augment_polygons`(self[, polygons_on_images[, ...]]) — Augment a batch of polygons.
- `augment_segmentation_maps`(self[, segmaps[,...]]) — Augment a batch of segmentation maps.
- `copy`(self) — Create a shallow copy of this Augmenter instance.
Table 121 – continued from previous page

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>copy_random_state(self, source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
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<td><code>copy_random_state_(self, source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
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<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
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<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
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<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
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<td><code>find_augmenters_by_name(self, name[, regex,...])</code></td>
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<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
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<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
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<td><code>get_parameters(self)</code></td>
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</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
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<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy,...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

### Class `imgaug.augmenters.color.WithColorspace` ([source](https://github.com/aleju/imgaug/blob/master/imgaug/augmenters/color.py#L387-L428))

Apply child augmenters within a specific colorspace.

This augmenter takes a source colorspace A and a target colorspace B as well as children C. It changes images from A to B, then applies the child augmenters C and finally changes the colorspace back from B to A. See also `ChangeColorspaces()` for more.

**Supported dtypes:**

See `change_colorspaces_()`.

**Parameters**

```python
class imgaug.augmenters.color.WithColorspace(to_colorspace='RGB',
                                          from_colorspace='RGB',
                                          children=None, seed=None, name=None,
                                          random_state='deprecated',
                                          deterministic='deprecated')
```

Bases: `imgaug.augmenters.meta.Augmenter`
• to_colorspace (str) – See change_colorspace().

• from_colorspace (str, optional) – See change_colorspace().

• children (imgaug.augmenters.meta.Augmenter or list of imgaug.augmenters.meta.Augmenter or None, optional) – One or more augmenters to apply to converted images.

• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

• name (None or str, optional) – See __init__().

• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.WithColorspace(
>>>     to_colorspace=iaa.CSPACE_HSV,
>>>     from_colorspace=iaa.CSPACE_RGB,
>>>     children=iaa.WithChannels(
>>>         0,
>>>         iaa.Add((0, 50))
>>>     )
>>> )
```

Convert to HSV colorspace, add a value between 0 and 50 (uniformly sampled per image) to the Hue channel, then convert back to the input colorspace (RGB).

Methods

```python
__call__ (self, *args, **kwargs) Alias for augment().

augment(self[, return_batch, hooks]) Augment a batch.

augment_batch(self[, batch[, parents[, hooks]]]) Deprecated.

augment_batch_(self[, batch[, parents[, hooks]]]) Augment a single batch in-place.

augment_batches(self[, batches[, parents, ...]]) Augment multiple batches.

augment_bounding_boxes(self[, batches[, parents, ...]]) Augment a batch of bounding boxes.

augment_heatmaps(self[, heatmaps[, parents, ...]]) Augment a batch of heatmaps.

augment_image(self[, image[, hooks]]) Augment a single image.

augment_images(self[, images[, parents, hooks]]) Augment a batch of images.

augment_keypoints(self[, keypoints_on_images]) Augment a batch of keypoints/landmarks.
```
Table 122 – continued from previous page

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>augment_line_strings(self, ...[, parents, hooks])</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons(self, polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(self, segmaps[, ...])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(self, source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_inplace(self[, recursive])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
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<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
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<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
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<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
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<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
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<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>

**class** `imgaug.augmenters.color.WithHueAndSaturation`

```python
class imgaug.augmenters.color.WithHueAndSaturation:
    Bases: `imgaug.augmenters.meta.Augmenter`
```

Apply child augmenters to hue and saturation channels.
This augmenter takes an image in a source colorspace, converts it to HSV, extracts the H (hue) and S (saturation) channels, applies the provided child augmenters to these channels and finally converts back to the original colorspace.

The image array generated by this augmenter and provided to its children is in int16 (sic! only augmenters that can handle int16 arrays can be children!). The hue channel is mapped to the value range \([0, 255]\). Before converting back to the source colorspace, the saturation channel’s values are clipped to \([0, 255]\). A modulo operation is applied to the hue channel’s values, followed by a mapping from \([0, 255]\) to \([0, 180]\) (and finally the colorspace conversion).

**Supported dtypes:**
See `change_colorspaces_()`.

**Parameters**

- `from_colorspace` (str, optional) – See `change_colorspace()`.
- `children` (imgaug.augmenters.meta.Augmenter or list of imgaug.augmenters.meta.Augmenter or None, optional) – One or more augmenters to apply to converted images. They receive int16 images with two channels (hue, saturation) and have to modify these.
- `seed` (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See `__init__()`. Outdated since 0.4.0.
- `name` (None or str, optional) – See `__init__()`.
- `deterministic` (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.WithHueAndSaturation(  
    iaa.WithChannels(0, iaa.Add((0, 50)))
)  
```

Create an augmenter that will add a random value between 0 and 50 (uniformly sampled per image) hue channel in HSV colorspace. It automatically accounts for the hue being in angular representation, i.e. if the angle goes beyond 360 degrees, it will start again at 0 degrees. The colorspace is finally converted back to RGB (default setting).

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.WithHueAndSaturation(  
    [  
      iaa.WithChannels(0, iaa.Add((-30, 10))),
      iaa.WithChannels(1, [  
        iaa.Multiply((0.5, 1.5)),
        iaa.LinearContrast((0.75, 1.25))
      ])
    ])
```
Create an augmenter that adds a random value sampled uniformly from the range $[-30, 10]$ to the hue and multiplies the saturation by a random factor sampled uniformly from $[0.5, 1.5]$. It also modifies the contrast of the saturation channel. After these steps, the HSV image is converted back to RGB.

**Methods**

```python
__call__(self, *args, **kwargs) Alias for augment().
augment(self, return_batch, hooks) Augment a batch.
augment_batch(self, batch, hooks) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self, batches[, hooks, ...]) Augment multiple batches.
augment_bounding_boxes(self, ...[, parents, ...]) Augment a batch of bounding boxes.
augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
augment_image(self, image[, hooks]) Augment a single image.
augment_images(self, images[, parents, hooks]) Augment a batch of images.
augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
augment_line_strings(self, ...[, parents, hooks]) Augment a batch of line strings.
augment_polygons(self, polygons_on_images[, ...]) Augment a batch of polygons.
augment_segmentation_maps(self, segmaps[, ...]) Augment a batch of segmentation maps.
copy(self) Create a shallow copy of this Augmenter instance.
copy_random_state(self[, source[, recursive, ...]]) Copy the RNGs from a source augmenter sequence.
copy_random_state_(self[, recursive]) Copy the RNGs from a source augmenter sequence (in-place).
deepcopy(self) Create a deep copy of this Augmenter instance.
draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.
find_augmenters(self, func[, parents, flat]) Find augmenters that match a condition.
find_augmenters_by_name(self, name[, regex, ...]) Find augmenter(s) by name.
find_augmenters_by_names(self, names[, ...]) Find augmenter(s) by names.
get_all_children(self[, flat]) Get all children of this augmenter as a list.
get_children_lists(self) See get_children_lists().
get_parameters(self) See get_parameters().
localize_random_state(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
localize_random_state_(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
pool(self[, processes, maxtasksperchild, seed]) Create a pool used for multicore augmentation.
remove_augmenters(self, func[, copy, ...]) Remove this augmenter or children that match a condition.
remove_augmenters_(self, func[, parents]) Remove in-place children of this augmenter that match a condition.
```
Table 123 – continued from previous page

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**get_children_lists**(self)

See `get_children_lists()`.

**get_parameters**(self)

See `get_parameters()`.

**imgaug.augmenters.color.change_color_temperature**(image, kelvin, from_colorspace='RGB')

Change the temperature of an image to a given value in Kelvin.

Added in 0.4.0.

**Supported dtypes:**

See `change_color_temperatures_`.

**Parameters**

- **image** *(ndarray)* – The image which’s color temperature is supposed to be changed. Expected to be of shape \((H, W, 3)\) array.

- **kelvin** *(number)* – The temperature in Kelvin. Expected value range is in the interval \((1000, 4000)\).

- **from_colorspace** *(str, optional)* – The source colorspace. See `change_colorspaces_()`.

**Returns** Image with target color temperature.

**Return type** *ndarray*

**imgaug.augmenters.color.change_color_temperatures_**(images, kelvins, from_colorspaces='RGB')

Change in-place the temperature of images to given values in Kelvin.

Added in 0.4.0.

**Supported dtypes:**

See `change_colorspace_`.

**Parameters**

- **images** *(ndarray or list of ndarray)* – The images which’s color temperature is supposed to be changed. Either a list of \((H, W, 3)\) arrays or a single \((N, H, W, 3)\) array.

- **kelvins** *(iterable of number)* – Temperatures in Kelvin. One per image. Expected value range is in the interval \((1000, 4000)\).

- **from_colorspaces** *(str or list of str, optional)* – The source colorspace. See `change_colorspaces_()`.

**Returns** Images with target color temperatures. The input array(s) might have been changed in-place.
Return type  ndarray or list of ndarray

```
imgaug.augmenters.color.change_colorspace_(image, to_colorspace, from_colorspace='RGB')
```

Change the colorspace of an image inplace.

**Note:** All outputs of this function are uint8. For some colorspaces this may not be optimal.

**Note:** Output grayscale images will still have three channels.

Supported dtypes:

- `uint8`: yes; fully tested
- `uint16`: no
- `uint32`: no
- `uint64`: no
- `int8`: no
- `int16`: no
- `int32`: no
- `int64`: no
- `float16`: no
- `float32`: no
- `float64`: no
- `float128`: no
- `bool`: no

Parameters

- `image` *(ndarray)* – The image to convert from one colorspace into another. Usually expected to have shape `(H, W, 3)`.
- `to_colorspace` *(str)* – The target colorspace. See the CSPACE constants, e.g. `imgaug.augmenters.color.CSPACE_RGB`.

Returns  Image with target colorspace. *Can* be the same array instance as was originally provided (i.e. changed inplace). Grayscale images will still have three channels.

**Return type**  ndarray

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> import numpy as np
>>> # fake RGB image
```
>>> image_rgb = np.arange(4*4*3).astype(np.uint8).reshape((4, 4, 3))
>>> image_bgr = iaa.change_colorspace_(np.copy(image_rgb), iaa.CSPACE_BGR)

imgaug.augmenters.color.change_colorspaces_ (images, to_colorspaces,
from_colorspaces='RGB')

Change the colorspaces of a batch of images inplace.

**Note:** All outputs of this function are uint8. For some colorspaces this may not be optimal.

**Note:** Output grayscale images will still have three channels.

**Supported dtypes:**

See change_colorspace_().

**Parameters**

- **images** *(ndarray or list of ndarray)* – The images to convert from one colorspace into another. Either a list of (H, W, 3) arrays or a single (N, H, W, 3) array.
- **to_colorspaces** *(str or iterable of str)* – The target colorspaces. Either a single string (all images will be converted to the same colorspace) or an iterable of strings (one per image). See the CSPACE constants, e.g. imgaug.augmenters.color.CSPACE_RGB.
- **from_colorspaces** *(str or list of str, optional)* – The source colorspace. Analogous to to_colorspace. Defaults to RGB.

**Returns** Images with target colorspaces. Can contain the same array instances as were originally provided (i.e. changed in-place). Grayscale images will still have three channels.

**Return type** ndarray or list of ndarray

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> import numpy as np
>>> # fake RGB image
>>> image_rgb = np.arange(4*4*3).astype(np.uint8).reshape((4, 4, 3))
>>> images_rgb = [np.copy(image_rgb) for image_rgb in images_rgb]
>>> images_bgr = iaa.change_colorspaces_(images_rgb_copy, iaa.CSPACE_BGR)
```

Create three example RGB images and convert them to BGR colorspace.

```python
>>> images_rgb_copy = [np.copy(image_rgb) for image_rgb in images_rgb]
>>> images_various = iaa.change_colorspaces_
>>> images_rgb_copy, [iaa.CSPACE_BGR, iaa.CSPACE_HSV, iaa.CSPACE_GRAY])
```

Change the colorspace of the first image to BGR, the one of the second image to HSV and the one of the third image to grayscale (note that in the latter case the image will still have shape (H, W, 3), not (H, W, 1)).

**imgaug.augmenters.color.posterize(arr, nb_bits)**

Alias for quantize_uniform_to_n_bits().

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This function is an alias for `quantize_uniform_to_n_bits()` and was added for users familiar with the same function in PIL.

Added in 0.4.0.

**Supported dtypes:**
See `quantize_uniform_to_n_bits()`.

**Parameters**
- `arr (ndarray)` – See `quantize_uniform_to_n_bits()`.
- `nb_bits (int)` – See `quantize_uniform_to_n_bits()`.

**Returns** Array with quantized components.

**Return type** `ndarray`

```
imgaug.augmenters.color.quantize_colors_kmeans(image, n_colors, n_max_iter=10, eps=1.0)
```

**Deprecated.** Use `imgaug.augmenters.colors.quantize_kmeans` instead.

Outdated name of `quantize_kmeans()`.

Deprecation since 0.4.0.

```
imgaug.augmenters.color.quantize_colors_uniform(image, n_colors)
```

**Deprecated.** Use `imgaug.augmenters.colors.quantize_uniform` instead.

Outdated name for `quantize_uniform()`.

Deprecation since 0.4.0.

```
imgaug.augmenters.color.quantize_kmeans(arr, nb_clusters, nb_max_iter=10, eps=1.0)
```

Quantize an array into N bins using k-means clustering.

If the input is an image, this method returns an image with a maximum of N colors. Similar colors are grouped to their mean. The k-means clustering happens across channels and not channelwise.

**Code similar to** [https://docs.opencv.org/3.0-beta/doc/py_tutorials/py_ml/py_kmeans/py_kmeans_opencv/py_kmeans_opencv.html](https://docs.opencv.org/3.0-beta/doc/py_tutorials/py_ml/py_kmeans/py_kmeans_opencv/py_kmeans_opencv.html)

**Warning:** This function currently changes the RNG state of both OpenCV’s internal RNG and imgaug’s global RNG. This is necessary in order to ensure that the k-means clustering happens deterministically.

Added in 0.4.0. (Previously called `quantize_colors_kmeans()`.)

**Supported dtypes:**
- `uint8`: yes; fully tested
- `uint16`: no
- `uint32`: no
- `uint64`: no
- `int8`: no
- `int16`: no
- `int32`: no
- `int64`: no
- `float16`: no
Parameters

- **arr** (*ndarray*) – Array to quantize. Expected to be of shape \((H, W)\) or \((H, W, C)\) with \(C\) usually being 1 or 3.
- **nb_clusters** (*int*) – Number of clusters to quantize into, i.e. \(k\) in k-means clustering. This corresponds to the maximum number of colors in an output image.
- **nb_max_iter** (*int*, *optional*) – Maximum number of iterations that the k-means clustering algorithm is run.
- **eps** (*float*, *optional*) – Minimum change of all clusters per k-means iteration. If all clusters change by less than this amount in an iteration, the clustering is stopped.

Returns Image with quantized colors.

Return type *ndarray*

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> import numpy as np

>>> image = np.arange(4 * 4 * 3, dtype=np.uint8).reshape((4, 4, 3))
>>> image_quantized = iaa.quantize_kmeans(image, 6)
```

Generates a 4x4 image with 3 channels, containing consecutive values from 0 to 4*4*3, leading to an equal number of colors. These colors are then quantized so that only 6 are remaining. Note that the six remaining colors do have to appear in the input image.

**imgaug.augmenters.color.quantize_uniform** (*arr*, *nb_bins*, *to_bin_centers=True*)

Quantize an array into \(N\) equally-sized bins in-place.

This can be used to quantize/posterize an image into \(N\) colors. 

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For `uint8` arrays the equation is \( \text{floor}(v/q) \times q + q/2 \) with \( q = 256/N \), where \( v \) is a pixel intensity value and \( N \) is the target number of bins (roughly matches number of colors) after quantization.

Added in 0.4.0.

**Supported dtypes:**

- `uint8`: yes; fully tested
- `uint16`: no
- `uint32`: no
- `uint64`: no
- `int8`: no
- `int16`: no
- `int32`: no
- `int64`: no
- `float16`: no
- `float32`: no
- `float64`: no
- `float128`: no
- `bool`: no

**Parameters**

- `arr (ndarray)` – Array to quantize, usually an image. Expected to be of shape \((H, W)\) or \((H, W, C)\) with \(C\) usually being 1 or 3. This array may be changed in-place.
- `nb_bins (int)` – Number of equally-sized bins to quantize into. This corresponds to the maximum number of colors in an output image.
- `to_bin_centers (bool)` – Whether to quantize each bin \((a, b)\) to \(a + (b-a)/2\) (center of bin, True) or to \(a\) (lower boundary, False).

**Returns** Array with quantized components. This may be the input array with components changed in-place.

**Return type** `ndarray`

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> import numpy as np
>>> image = np.arange(4 * 4 * 3, dtype=np.uint8).reshape((4, 4, 3))
>>> image_quantized = iaa.quantize_uniform(np.copy(image), 6)
```

Generates a 4\(\times\)4 image with 3 channels, containing consecutive values from 0 to 4\(\times\)4\(\times\)3, leading to an equal number of colors. Each component is then quantized into one of 6 bins that regularly split up the value range of \([0..255]\), i.e. the resolution w.r.t. to the value range is reduced.

`imgaug.augmenters.color.quantize_uniform_to_n_bits(arr, nb_bits)`
Reduce each component in an array to a maximum number of bits.

See `quantize_uniform_to_n_bits()` for details.
 Added in 0.4.0.

**Supported dtypes:**

See `quantize_uniform_to_n_bits()`.

**Parameters**

- `arr (ndarray)` – See `quantize_uniform_to_n_bits()`.
- `nb_bits (int)` – See `quantize_uniform_to_n_bits()`.

**Returns** Array with quantized components.

**Return type** `ndarray`

```python
imgaug.augmenters.color.quantize_uniform_to_n_bits_(arr, nb_bits)
```

Reduce each component in an array to a maximum number of bits in-place.

This operation sets the $B-B$ highest frequency (rightmost) bits to zero. For $B$ bits this is equivalent to changing each component’s intensity value $v$ to $v' = v \& (2^{8-B} - 1)$, e.g. for $B=3$ this results in $v' = c \& ~2^{3-1} - 1 = c \& ~3 = c \& ~0000 0011 = c \& 1111 1100$.

This is identical to `quantize_uniform()` with `nb_bins=2**nb_bits` and `to_bin_centers=False`.

This function produces the same outputs as `PIL.ImageOps.posterize()`, but is significantly faster.

Added in 0.4.0.

**Supported dtypes:**

See `quantize_uniform()`.

**Parameters**

- `arr (ndarray)` – Array to quantize, usually an image. Expected to be of shape $(H, W)$ or $(H, W, C)$ with $C$ usually being 1 or 3. This array may be changed in-place.
- `nb_bits (int)` – Number of bits to keep in each array component.

**Returns** Array with quantized components. This may be the input array with components changed in-place.

**Return type** `ndarray`

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> import numpy as np
>>> image = np.arange(4 * 4 * 3, dtype=np.uint8).reshape((4, 4, 3))
>>> image_quantized = iaa.quantize_uniform_to_n_bits_(np.copy(image), 6)
```

Generates a $4 \times 4$ image with 3 channels, containing consecutive values from 0 to $4 \times 4 \times 3$, leading to an equal number of colors. These colors are then quantized so that each component’s $8-6=2$ rightmost bits are set to zero.

## 13.24 imgaug.augmenters.contrast

Augmenters that perform contrast changes.

List of augmenters:
**GammaContrast**

**SigmoidContrast**

**LogContrast**

**LinearContrast**

**AllChannelsHistogramEqualization**

**HistogramEqualization**

**AllChannelsCLAHE**

**CLAHE**

```python
class imgaug.augmenters.contrast.AllChannelsCLAHE(
    clip_limit=(0.1, 8),
    tile_grid_size_px=(3, 12),
    tile_grid_size_px_min=3,
    per_channel=False,
    seed=None,
    name=None,
    random_state='deprecated',
    deterministic='deprecated')
```

**Bases:** `imgaug.augmenters.meta.Augmenter`

Apply CLAHE to all channels of images in their original colorspace.

CLAHE (Contrast Limited Adaptive Histogram Equalization) performs histogram equalization within image patches, i.e. over local neighbourhoods.

In contrast to `imgaug.augmenters.contrast.CLAHE`, this augmenter operates directly on all channels of the input images. It does not perform any colorspace transformations and does not focus on specific channels (e.g. L in Lab colorspace).

**Supported dtypes:**

- `uint8`: yes; fully tested
- `uint16`: yes; tested
- `uint32`: no (1)
- `uint64`: no (2)
- `int8`: no (2)
- `int16`: no (2)
- `int32`: no (2)
- `int64`: no (2)
- `float16`: no (2)
- `float32`: no (2)
- `float64`: no (2)
- `float128`: no (1)
- `bool`: no (1)

(1) rejected by cv2

(2) results in error in cv2: `cv2.error: OpenCV(3.4.2) (...) /clahe.cpp:351: error: (-215:Assertion failed) src.type() == (((0) & ((1 <<
Parameters

- **clip_limit** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See imgaug.augmenters.contrast.CLAHE.

- **tile_grid_size_px** (int or tuple of int or list of int or imgaug.parameters.StochasticParameter or tuple of tuple of int or tuple of list of int or tuple of imgaug.parameters.StochasticParameter, optional) – See imgaug.augmenters.contrast.CLAHE.

- **tile_grid_size_px_min** (int, optional) – See imgaug.augmenters.contrast.CLAHE.

- **per_channel** (bool or float, optional) – Whether to use the same value for all channels (False) or to sample a new value for each channel (True). If this value is a float, then for p percent of all images per_channel will be treated as True, otherwise as False.

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- **name** (None or str, optional) – See __init__().

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.AllChannelsCLAHE()
Create an augmenter that applies CLAHE to all channels of input images.
```

```python
>>> aug = iaa.AllChannelsCLAHE(clip_limit=(1, 10))
Same as in the previous example, but the clip_limit used by CLAHE is uniformly sampled per image from the interval [1, 10]. Some images will therefore have stronger contrast than others (i.e. higher clip limit values).
```

```python
>>> aug = iaa.AllChannelsCLAHE(clip_limit=(1, 10), per_channel=True)
Same as in the previous example, but the clip_limit is sampled per image and channel, leading to different levels of contrast for each channel.
```

Methods
__call__(self, *args, **kwargs) Alias for augment().

augment(self[, return_batch, hooks]) Augment a batch.

augment_batch(self[, batch[, hooks]]) Deprecated.

augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.

augment_batches(self, batches[, hooks,...]) Augment multiple batches.

augment_bounding_boxes(self, ...[, parents, ...]) Augment a batch of bounding boxes.

augment_heatmaps(self[, heatmaps[, parents, ...]]) Augment a batch of heatmaps.

augment_image(self, image[, hooks]) Augment a single image.

augment_images(self, images[, parents, hooks]) Augment a batch of images.

augment_keypoints(self[, keypoints_on_images]) Augment a batch of keypoints/landmarks.

augment_line_strings(self, ...[, parents, hooks]) Augment a batch of line strings.

augment_polygons(self, polygons_on_images[, ...]) Augment a batch of polygons.

augment_segmentation_maps(self, segmaps[, ...]) Augment a batch of segmentation maps.

copy(self) Create a shallow copy of this Augmenter instance.

copy_random_state(self[, source[, recursive,...]]) Copy the RNGs from a source augmenter sequence.

copy_random_state_(self[, recursive]) Copy the RNGs from a source augmenter sequence (in-place).

depcopy(self) Create a deep copy of this Augmenter instance.

draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.

find_augmenters(self, func[, parents, flat]) Find augmenters that match a condition.

find_augmenters_by_name(self, name[, regex,...]) Find augmenter(s) by name.

find_augmenters_by_names(self, names[, ...]) Find augmenter(s) by names.

get_all_children(self[, flat]) Get all children of this augmenter as a list.

get_children_lists(self) Get a list of lists of children of this augmenter.

get_parameters(self) See get_parameters().

localize_random_state(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.

localize_random_state_(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.

pool(self[, processes, maxtasksperchild, seed]) Create a pool used for multicore augmentation.

remove_augmenters(self, func[, copy,...]) Remove this augmenter or children that match a condition.

remove_augmenters_inplace(self, func[, parents]) Deprecated.

reseed(self[, random_state, deterministic_too]) Deprecated.

seed_(self[, entropy, deterministic_too]) Seed this augmenter and all of its children.

show_grid(self, images, rows, cols) Augment images and plot the results as a single grid-like image.

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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**get_parameters(self)**

See `get_parameters()`.

class `imgaug.augmenters.contrast.AllChannelsHistogramEqualization`

```python
class imgaug.augmenters.contrast.AllChannelsHistogramEqualization (seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.meta.Augmenter`

Apply Histogram Eq. to all channels of images in their original colorspace.

In contrast to `imgaug.augmenters.contrast.HistogramEqualization`, this augmenter operates directly on all channels of the input images. It does not perform any colorspace transformations and does not focus on specific channels (e.g. L in Lab colorspace).

**Supported dtypes:**

- uint8: yes; fully tested
- uint16: no (1)
- uint32: no (2)
- uint64: no (1)
- int8: no (1)
- int16: no (1)
- int32: no (1)
- int64: no (1)
- float16: no (2)
- float32: no (1)
- float64: no (1)
- float128: no (2)
- bool: no (1)

- (1) causes cv2 error: cv2.error: OpenCV(3.4.5) (...) /histogram.cpp:3345: error: (-215:Assertion failed) src.type() == CV_8UC1 in function 'equalizeHist'
- (2) rejected by cv2

**Parameters**

- `seed` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.
- `name` *(None or str, optional)* – See `__init__()`.
• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter *seed*. Its usage will not yet cause a deprecation warning, but it is still recommended to use *seed* now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.AllChannelsHistogramEqualization()
```

Create an augmenter that applies histogram equalization to all channels of input images in the original colorspace.

```python
>>> aug = iaa.Alpha((0.0, 1.0), iaa.AllChannelsHistogramEqualization())
```

Same as in the previous example, but alpha-blends the contrast-enhanced augmented images with the original input images using random blend strengths. This leads to random strengths of the contrast adjustment.

### Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
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<tbody>
<tr>
<td><code>_call_</code> *(self, *args, *<em>kwargs)</em></td>
<td>Alias for <code>augment()</code>.</td>
</tr>
<tr>
<td><code>augment</code> <em>(self, return_batch, hooks)</em></td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><code>augment_batch</code> <em>(self, batch[, hooks])</em></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>augment_batch_(self, batch[, parents, hooks])</code></td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><code>augment_batches</code> <em>(self, batches[, hooks,...])</em></td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td><code>augment_bounding_boxes</code> <em>(self, [...], parents, ...)</em></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps</code> <em>(self, heatmaps[, parents, ...])</em></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image</code> <em>(self, image[, hooks])</em></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images</code> <em>(self, images[, parents, hooks])</em></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints</code> <em>(self, keypoints_on_images)</em></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings</code> <em>(self, [...], parents, hooks)</em></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons</code> <em>(self, polygons_on_images[, ...])</em></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps</code> <em>(self, segmaps[, ...])</em></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy</code> <em>(self)</em></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state</code> <em>(self, source[, recursive, ...])</em></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(self, source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy</code> <em>(self)</em></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
</tbody>
</table>
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<table>
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</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
</tbody>
</table>
| `get_parameters(self)` | See `get_parameters()`.
| `localize_random_state(self[, recursive])` | Assign augmenter-specific RNGs to this augmenter and its children. |
| `localize_random_state_(self[, recursive])` | Assign augmenter-specific RNGs to this augmenter and its children. |
| `pool(self[, processes, maxtasksperchild, seed])` | Create a pool used for multicore augmentation. |
| `remove_augmenters(self, func[, copy, ...])` | Remove this augmenter or children that match a condition. |
| `remove_augmenters_(self, func[, parents])` | Remove in-place children of this augmenter that match a condition. |
| `remove_augmenters_inplace(self, func[, parents])` | Deprecated. |
| `reseed(self[, random_state, deterministic_too])` | Deprecated. |
| `seed_(self[, entropy, deterministic_too])` | Seed this augmenter and all of its children. |
| `show_grid(self, images, rows, cols)` | Augment images and plot the results as a single grid-like image. |
| `to_deterministic(self[, n])` | Convert this augmenter from a stochastic to a deterministic one. |

### CLAHE

```python
class imgaug.augmenters.contrast.CLAHE(clip_limit=(0.1, 8), tile_grid_size_px=(3, 12), tile_grid_size_px_min=3, from_colorspace='RGB', to_colorspace='Lab', seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases:** `imgaug.augmenters.meta.Augmenter`

Apply CLAHE to L/V/L channels in HLS/HSV/Lab colorspaces.

This augmenter applies CLAHE (Contrast Limited Adaptive Histogram Equalization) to images, a form of histogram equalization that normalizes within local image patches. The augmenter transforms input images to a target colorspace (e.g. Lab), extracts an intensity-related channel from the converted images (e.g. L for Lab), applies CLAHE to the channel and then converts the resulting image back to the original colorspace.

Grayscale images (images without channel axis or with only one channel axis) are automatically handled, `from_colorspace` does not have to be adjusted for them. For images with four channels (e.g. RGBA), the fourth channel is ignored in the colorspace conversion (e.g. from an RGBA image, only the RGB part is converted, normalized, converted back and concatenated with the input A channel). Images with unusual channel numbers (2, 5 or more than 5) are normalized channel-by-channel (same behaviour as `AllChannelsCLAHE`, though a warning will be raised).

If you want to apply CLAHE to each channel of the original input image’s colorspace (without any colorspace conversion), use `imgaug.augmenters.contrast.AllChannelsCLAHE` instead.

13.24. `imgaug.augmenters.contrast`
Supported dtypes:

- uint8: yes; fully tested
- uint16: no (1)
- uint32: no (1)
- uint64: no (1)
- int8: no (1)
- int16: no (1)
- int32: no (1)
- int64: no (1)
- float16: no (1)
- float32: no (1)
- float64: no (1)
- float128: no (1)
- bool: no (1)

(1) This augmenter uses ChangeColorspace, which is currently limited to uint8.

Parameters

- **clip_limit** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Clipping limit. Higher values result in stronger contrast. OpenCV uses a default of 40, though values around 5 seem to already produce decent contrast.
  - If a number, then that value will be used for all images.
  - If a tuple (a, b), then a value from the range [a, b] will be used per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled per image from that parameter.

- **tile_grid_size_px** (int or tuple of int or list of int or imgaug.parameters.StochasticParameter or tuple of tuple of int or tuple of list of int or tuple of imgaug.parameters.StochasticParameter, optional) – Kernel size, i.e. size of each local neighbourhood in pixels.
  - If an int, then that value will be used for all images for both kernel height and width.
  - If a tuple (a, b), then a value from the discrete interval [a..b] will be uniformly sampled per image.
  - If a list, then a random value will be sampled from that list per image and used for both kernel height and width.
  - If a StochasticParameter, then a value will be sampled per image from that parameter per image and used for both kernel height and width.
  - If a tuple of tuple of int given as ((a, b), (c, d)), then two values will be sampled independently from the discrete ranges [a..b] and [c..d] per image and used as the kernel height and width.
– If a tuple of lists of int, then two values will be sampled independently per image, one from the first list and one from the second, and used as the kernel height and width.

– If a tuple of StochasticParameter, then two values will be sampled independently per image, one from the first parameter and one from the second, and used as the kernel height and width.

• tile_grid_size_px_min (int, optional) – Minimum kernel size in px, per axis. If the sampling results in a value lower than this minimum, it will be clipped to this value.

• from_colorspace (["RGB", "BGR", "HSV", “HLS”, “Lab”), optional) – Colorspace of the input images. If any input image has only one or zero channels, this setting will be ignored and it will be assumed that the input is grayscale. If a fourth channel is present in an input image, it will be removed before the colorspace conversion and later re-added. See also change_colorspace() for details.

• to_colorspace ([“Lab”, “HLS”, “HSV”), optional) – Colorspace in which to perform CLAHE. For Lab, CLAHE will only be applied to the first channel (L), for HLS to the second (L) and for HSV to the third (V). To apply CLAHE to all channels of an input image (without colorspace conversion), see imgaug.augmenters.contrast.AllChannelsCLAHE.

• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

• name (None or str, optional) – See __init__().

• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CLAHE()
```

Create a standard CLAHE augmenter.

```python
>>> aug = iaa.CLAHE(clip_limit=(1, 10))
```

Create a CLAHE augmenter with a clip limit uniformly sampled from [1..10], where 1 is rather low contrast and 10 is rather high contrast.

```python
>>> aug = iaa.CLAHE(tile_grid_size_px=(3, 21))
```

Create a CLAHE augmenter with kernel sizes of SxS, where S is uniformly sampled from [3..21]. Sampling happens once per image.
Create a CLAHE augmenter with kernel sizes of $S \times S$, where $S$ is sampled from $N(7, 2)$, but does not go below 3.

```python
>>> aug = iaa.CLAHE(tile_grid_size_px=((3, 21), [3, 5, 7]))
```

Create a CLAHE augmenter with kernel sizes of $H \times W$, where $H$ is uniformly sampled from $[3..21]$ and $W$ is randomly picked from the list $[3, 5, 7]$.

```python
>>> aug = iaa.CLAHE(
>>>     from_colorspace=iaa.CSPACE_BGR,
>>>     to_colorspace=iaa.CSPACE_HSV)
```

Create a CLAHE augmenter that converts images from BGR colorspace to HSV colorspace and then applies the local histogram equalization to the $V$ channel of the images (before converting back to BGR). Alternatively, Lab (default) or HLS can be used as the target colorspace. Grayscale images (no channels / one channel) are never converted and are instead directly normalized (i.e. `from_colorspace` does not have to be changed for them).

**Methods**

```python
__call__(self, *args, **kwargs) Alias for `augment()`.
```

```python
augment(self[, return_batch, hooks]) Augment a batch.
augment_batch(self[, batch[, hooks]]) Deprecated.
augment_batch_(self[, batch[, parents, hooks]]) Augment a single batch in-place.
augment_batches(self[, batches[, hooks]]) Augment multiple batches.
augment_bounding_boxes(self[, ...[, parents, ...]]) Augment a batch of bounding boxes.
augment_heatmaps(self[, ...[, parents, ...]]) Augment a batch of heatmaps.
augment_image(self[, image[, hooks]]) Augment a single image.
augment_images(self[, images[, parents, hooks]]) Augment a batch of images.
augment_keypoints(self[, key-points_on_images]) Augment a batch of keypoints/landmarks.
augment_line_strings(self[, ...[, parents, hooks]]) Augment a batch of line strings.
augment_polygons(self[, polygons_on_images[, ...]]) Augment a batch of polygons.
augment_segmentation_maps(self[, segmaps[, ...]]) Augment a batch of segmentation maps.
copy(self) Create a shallow copy of this Augmenter instance.
copy_random_state(self[, source[, recursive, ...]]) Copy the RNGs from a source augmenter sequence.
copy_random_state_(self[, source[, ...]]) Copy the RNGs from a source augmenter sequence (in-place).
deprecated(self) Create a deep copy of this Augmenter instance.
draw_grid(self[, images, rows, cols]) Augment images and draw the results as a single grid-like image.
find_augmenters(self[, func[, parents, flat]]) Find augmenters that match a condition.
find_augmenters_by_name(self[, name[, regex, ...]]) Find augmenter(s) by name.
find_augmenters_by_names(self[, names[, ...]]) Find augmenter(s) by names.
get_all_children(self[, flat]) Get all children of this augmenter as a list.
```
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<table>
<thead>
<tr>
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</tr>
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<tbody>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
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<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
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<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
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<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**BGR = 'BGR'**

**HLS = 'HLS'**

**HSV = 'HSV'**

**Lab = 'Lab'**

**RGB = 'RGB'**

```python
class imgaug.augmenters.contrast.GammaContrast(gamma=(0.7, 1.7), per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated'))
```

Adjust image contrast by scaling pixel values to \(255 \times (v/255)^{\gamma}\).

Values in the range \(\gamma \in (0.5, 2.0)\) seem to be sensible.

**Supported dtypes:**

See `adjust_contrast_gamma()`.

**Parameters**

- `gamma (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)` - Exponent for the contrast adjustment. Higher values darken the image.
  - If a number, then that value will be used for all images.
  - If a tuple \((a, b)\), then a value from the range \([a, b]\) will be used per image.
  - If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, then a value will be sampled per image from that parameter.

- `per_channel` *(bool or float, optional)* – Whether to use the same value for all channels (False) or to sample a new value for each channel (True). If this value is a float \(p\), then for \(p\) percent of all images `per_channel` will be treated as True, otherwise as False.

- `seed` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.

- `name` *(None or str, optional)* – See `__init__()`.

- `random_state` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- `deterministic` *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa

>>> aug = iaa.GammaContrast((0.5, 2.0))

Modify the contrast of images according to \(255 \times ((v/255)^\gamma)\), where \(v\) is a pixel value and \(\gamma\) is sampled uniformly from the interval \([0.5, 2.0]\) (once per image).

```python
>>> aug = iaa.GammaContrast((0.5, 2.0), per_channel=True)

Same as in the previous example, but \(\gamma\) is sampled once per image and channel.

### Methods

```python
__call__ (self, *args, **kwargs) Alias for `augment()`.

`augment` (self[, return_batch, hooks]) Augment a batch.

`augment_batch` (self, batch[, hooks]) Deprecated.

`augment_batch_(self, batch[, parents, hooks])` Augment a single batch in-place.

`augment_batches` (self, batches[, hooks,...]) Augment multiple batches.

`augment_bounding_boxes` (self, ...[, parents,...]) Augment a batch of bounding boxes.

`augment_heatmaps` (self, heatmaps[, parents,...]) Augment a batch of heatmaps.

`augment_image` (self, image[, hooks]) Augment a single image.

`augment_images` (self, images[, parents, hooks]) Augment a batch of images.

`augment_keypoints` (self, keypoints_on_images) Augment a batch of keypoints/landmarks.

`augment_line_strings` (self, ...[, parents,...]) Augment a batch of line strings.
```
Table 127 – continued from previous page

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</thead>
<tbody>
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<td>augment_polygons(self, polygons_on_images[, ...])</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation_maps(self, segmaps[, ...])</td>
<td>Augment a batch of segmentation maps.</td>
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<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
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<td>copy_random_state(self, source[, recursive, ...])</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
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<td>copy_random_state_(self, source[, ...])</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy(self)</td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td>draw_grid(self, images, rows, cols)</td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td>find_augmenters(self, func[, parents, flat])</td>
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<td>localize_random_state(self[, recursive])</td>
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<td>Deprecated.</td>
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<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
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<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.contrast.HistogramEqualization(from_colorspace='RGB',
    to_colorspace='Lab',
    seed=None, name=None,
    random_state=‘deprecated’,
    deterministic=‘deprecated’)

Bases: imgaug.augmenters.meta.Augmenter
```

Apply Histogram Eq. to L/V/L channels of images in HLS/HSV/Lab colorspaces.

This augmenter is similar to `imgaug.augmenters.contrast.CLAHE`.

The augmenter transforms input images to a target colorspace (e.g. Lab), extracts an intensity-related channel from the converted images (e.g. L for Lab), applies Histogram Equalization to the channel and then converts the resulting image back to the original colorspace.
Grayscale images (images without channel axis or with only one channel axis) are automatically handled. `from_colorspace` does not have to be adjusted for them. For images with four channels (e.g. RGBA), the fourth channel is ignored in the colorspace conversion (e.g. from an RGBA image, only the RGB part is converted, normalized, converted back and concatenated with the input A channel). Images with unusual channel numbers (2, 5 or more than 5) are normalized channel-by-channel (same behaviour as `AllChannelsHistogramEqualization`, though a warning will be raised).

If you want to apply HistogramEqualization to each channel of the original input image’s colorspace (without any colorspace conversion), use `imgaug.augmenters.contrast.AllChannelsHistogramEqualization` instead.

Supported dtypes:

- `uint8`: yes; fully tested
- `uint16`: no (1)
- `uint32`: no (1)
- `uint64`: no (1)
- `int8`: no (1)
- `int16`: no (1)
- `int32`: no (1)
- `int64`: no (1)
- `float16`: no (1)
- `float32`: no (1)
- `float64`: no (1)
- `float128`: no (1)
- `bool`: no (1)

(1) This augmenter uses `AllChannelsHistogramEqualization`, which only supports `uint8`.

Parameters

- `from_colorspace` (['RGB', 'BGR', 'HSV', 'HLS', 'Lab'], optional) – Colorspace of the input images. If any input image has only one or zero channels, this setting will be ignored and it will be assumed that the input is grayscale. If a fourth channel is present in an input image, it will be removed before the colorspace conversion and later re-added. See also `change_colorspace()` for details.

- `to_colorspace` (['Lab', 'HLS', 'HSV'], optional) – Colorspace in which to perform Histogram Equalization. For Lab, the equalization will only be applied to the first channel (L), for HLS to the second (L) and for HSV to the third (V). To apply histogram equalization to all channels of an input image (without colorspace conversion), see `imgaug.augmenters.contrast.AllChannelsHistogramEqualization`.

- `seed` (None or int or `imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or `numpy.random.RandomState`, optional) – See `__init__()`.

- `name` (None or str, optional) – See `__init__()`.
• **random_state** *(None or int or imgaug.random.RNG or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.HistogramEqualization()
Create an augmenter that converts images to HLS/HSV/Lab colorspaces, extracts intensity-related channels (i.e. L/V/L), applies histogram equalization to these channels and converts back to the input colorspace.

```python
>>> aug = iaa.Alpha((0.0, 1.0), iaa.HistogramEqualization())
Same as in the previous example, but alpha blends the result, leading to various strengths of contrast normalization.

```python
>>> aug = iaa.HistogramEqualization(
>>> from_colorspace=iaa.CSPACE_BGR,
>>> to_colorspace=iaa.CSPACE_HSV)
Same as in the first example, but the colorspace of input images has to be BGR (instead of default RGB) and the histogram equalization is applied to the V channel in HSV colorspace.

**Methods**

```python
def __call__(self, *args, **kwargs) Alias for augment().
def augment(self, return_batch, hooks) Augment a batch.
def augment_batch(self, batch[, hooks]) Deprecated.
def augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
def augment_batches(self, batches[, parents, ...]) Augment multiple batches.
def augment_bounding_boxes(self, ..., [parents, ...]) Augment a batch of bounding boxes.
def augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
def augment_image(self, image[, hooks]) Augment a single image.
def augment_images(self, images[, parents, hooks]) Augment a batch of images.
def augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
def augment_line_strings(self, ..., [parents, hooks]) Augment a batch of line strings.
def augment_polygons(self, polygons_on_images[, ...]) Augment a batch of polygons.
def augment_segmentation_maps(self, segmaps[, ...]) Augment a batch of segmentation maps.
```
Table 128 – continued from previous page

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children([flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists()</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters()</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state([recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(recursive)</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool([processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(func[, parents])</code></td>
<td><strong>Deprecated.</strong></td>
</tr>
<tr>
<td><code>reseed([random_state, deterministic_too])</code></td>
<td><strong>Deprecated.</strong></td>
</tr>
<tr>
<td><code>seed([entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic([n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```
BGR = 'BGR'
HLS = 'HLS'
HSV = 'HSV'
Lab = 'Lab'
RGB = 'RGB'
get_parameters(self)
    See get_parameters().
```

```python
class imgaug.augmenters.contrast.LinearContrast(alpha=(0.6, 1.4), per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.contrast._ContrastFuncWrapper
```

Adjust contrast by scaling each pixel to $127 + \alpha \times (v-127)$.

Supported dtypes:
See :func:`adjust_contrast_linear()`.

**Parameters**

- **alpha** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Multiplier to linearly pronounce (>1.0), dampen (0.0 to 1.0) or invert (<0.0) the difference between each pixel value and the dtype’s center value, e.g. 127 for uint8.
  - If a number, then that value will be used for all images.
  - If a tuple (a, b), then a value from the interval [a, b] will be used per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled per image from that parameter.

- **per_channel** (bool or float, optional) – Whether to use the same value for all channels (False) or to sample a new value for each channel (True). If this value is a float p, then for p percent of all images per_channel will be treated as True, otherwise as False.

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See :meth:`__init__()`.

- **name** (None or str, optional) – See :meth:`__init__()`.

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.LinearContrast((0.4, 1.6))
```

Modify the contrast of images according to \(127 + \alpha \times (v - 127)'\), where \(v\) is a pixel value and \(\alpha\) is sampled uniformly from the interval \([0.4, 1.6]\) (once per image).

```python
>>> aug = iaa.LinearContrast((0.4, 1.6), per_channel=True)
```

Same as in the previous example, but \(\alpha\) is sampled once per image and channel.

**Methods**

```python
__call__(self, *args, **kwargs) Alias for augment().
augment(self[, return_batch, hooks]) Augment a batch.
augment_batch(self, batch[, hooks]) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
```

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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>augment_batches</code></td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td><code>augment_bounding_boxes</code></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>reseed</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
<tr>
<td><code>seed</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic</code></td>
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</tr>
</tbody>
</table>

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<table>
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<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>augment_bounding_boxes</code></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_image</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
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<td>Find augmenters that match a condition.</td>
</tr>
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<td>Find augmenter(s) by name.</td>
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<tr>
<td><code>find_augmenters_by_names</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists</code></td>
<td>Get a list of lists of children of this augmenter.</td>
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<tr>
<td><code>get_parameters</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
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<tr>
<td><code>remove_augmenters</code></td>
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<td><code>reseed</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
<tr>
<td><code>seed</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>
class imgaug.augmenters.contrast.LogContrast(gain=(0.4, 1.6), per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated'))

Bases: imgaug.augmenters.contrast._ContrastFuncWrapper

Adjust image contrast by scaling pixels to $255 \cdot \text{gain} \cdot \log_2(1 + v/255)$.

This augmenter is fairly similar to imgaug.augmenters.arithmetic.Multiply.

Supported dtypes:
See adjust_contrast_log().

Parameters

- **gain** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Multiplier for the logarithm result. Values around 1.0 lead to a contrast-adjusted images. Values above 1.0 quickly lead to partially broken images due to exceeding the datatype’s value range.
  - If a number, then that value will be used for all images.
  - If a tuple $(a, b)$, then a value from the interval $[a, b]$ will uniformly sampled be used per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled per image from that parameter.

- **per_channel** (bool or float, optional) – Whether to use the same value for all channels (False) or to sample a new value for each channel (True). If this value is a float $p$, then for $p$ percent of all images per_channel will be treated as True, otherwise as False.

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- **name** (None or str, optional) – See __init__().

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa

>>> aug = iaa.LogContrast(gain=(0.6, 1.4))

Modify the contrast of images according to $255 \cdot \text{gain} \cdot \log_2(1 + v/255)$, where $v$ is a pixel value and gain is sampled uniformly from the interval $[0.6, 1.4]$ (once per image).

>>> aug = iaa.LogContrast(gain=(0.6, 1.4), per_channel=True)
```
Same as in the previous example, but gain is sampled once per image and channel.

Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>call</strong></td>
<td>Alias for augment().</td>
</tr>
<tr>
<td>augment</td>
<td>Augment a batch.</td>
</tr>
<tr>
<td>augment_batch</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>augment_batch_(self, batch[, parents, hooks])</td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td>augment_batches</td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td>augment_bounding_boxes</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td>augment_heatmaps</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td>augment_image</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td>augment_images</td>
<td>Augment a batch of images.</td>
</tr>
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<td>augment_keypoints</td>
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<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>copy</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td>copy_random_state_(self, source[, recursive, ...])</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy</td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td>draw_grid</td>
<td>Augment images and draw the results as a single grid-like image.</td>
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<td>Get all children of this augmenter.</td>
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<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td>get_parameters</td>
<td>See get_parameters().</td>
</tr>
<tr>
<td>localize_random_state</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>localize_random_state_(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>pool</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace</td>
<td>Deprecated.</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>reseed(self[, random_state, deterministic_tool])</code></td>
<td>Deprecated. Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_tool])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**class imgaug.augmenters.contrast.SigmoidContrast**

```
SigmoidContrast(gain=(5, 6), cutoff=(0.3, 0.6), per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Adjust image contrast to $255 \times 1/(1 + \exp(gain \times (cutoff - I_{ij}/255)))$.

Values in the range $\text{gain}=(5, 20)$ and $\text{cutoff}=(0.25, 0.75)$ seem to be sensible.

A combination of $\text{gain}=5.5$ and $\text{cutoff}=0.45$ is fairly close to the identity function.

**Supported dtypes:**

See `adjust_contrast_sigmoid()`.

**Parameters**

- **gain** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Multiplier for the sigmoid function’s output. Higher values lead to quicker changes from dark to light pixels.
  - If a number, then that value will be used for all images.
  - If a tuple $(a, b)$, then a value from the interval $[a, b]$ will be sampled uniformly per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled per image from that parameter.

- **cutoff** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Cutoff that shifts the sigmoid function in horizontal direction. Higher values mean that the switch from dark to light pixels happens later, i.e. the pixels will remain darker.
  - If a number, then that value will be used for all images.
  - If a tuple $(a, b)$, then a value from the range $[a, b]$ will be used per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled per image from that parameter.

- **per_channel** (bool or float, optional) – Whether to use the same value for all channels (False) or to sample a new value for each channel (True). If this value is a float $p$, then for $p$ percent of all images `per_channel` will be treated as `True`, otherwise as `False`.

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See `__init__()`.  

• name (None or str, optional) – See __init__().

• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.SigmoidContrast(gain=(3, 10), cutoff=(0.4, 0.6))
```

Modify the contrast of images according to $255 \times 1/(1+\exp(gain \times (cutoff-v/255)))$, where $v$ is a pixel value, gain is sampled uniformly from the interval $[3, 10]$ (once per image) and cutoff is sampled uniformly from the interval $[0.4, 0.6]$ (also once per image).

```python
>>> aug = iaa.SigmoidContrast(
>>>     gain=(3, 10), cutoff=(0.4, 0.6), per_channel=True
>>> )
```

Same as in the previous example, but gain and cutoff are each sampled once per image and channel.

Methods

```python
__call__(self, *args, **kwargs) Alias for augment().

augment(self[, return_batch, hooks]) Augment a batch.

augment_batch(self[, batch[, hooks]]) Augment a batch in-place.

augment_batches(self[, batches[, hooks]]) Augment multiple batches.

augment_bounding_boxes(self[, bounding_boxes[, parents[, hooks]]]) Augment a batch of bounding boxes.

augment_heatmaps(self[, heatmaps[, parents[, hooks]]]) Augment a batch of heatmaps.

augment_image(self[, image[, hooks]]) Augment a single image.

augment_images(self[, images[, parents[, hooks]]]) Augment a batch of images.

augment_keypoints(self[, keypoints_on_images]) Augment a batch of keypoints/landmarks.

augment_line_strings(self[, line_strings[, parents[, hooks]]]) Augment a batch of line strings.

augment_polygons(self[, polygons_on_images]) Augment a batch of polygons.

augment_segmentation_maps(self[, segmaps]) Augment a batch of segmentation maps.

copy(self) Create a shallow copy of this Augmenter instance.

copy_random_state(self[, source[, recursive[, parents[, hooks]]]]) Copy the RNGs from a source augmenter sequence.

copy_random_state_(self[, source[, ...]]) Copy the RNGs from a source augmenter sequence (in-place).
```

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<th>Description</th>
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<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
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<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
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<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

`imgaug.augmenters.contrast.adjust_contrast_gamma(arr, gamma)`

Adjust image contrast by scaling pixel values to $255 \times (v/255)^{\gamma}$.

**Supported dtypes:**

- `uint8`: yes; fully tested (1) (2) (3)
- `uint16`: yes; tested (2) (3)
- `uint32`: yes; tested (2) (3)
- `uint64`: yes; tested (2) (3) (4)
- `int8`: limited; tested (2) (3) (5)
- `int16`: limited; tested (2) (3) (5)
- `int32`: limited; tested (2) (3) (5)
- `int64`: limited; tested (2) (3) (4) (5)
- `float16`: limited; tested (5)
- `float32`: limited; tested (5)
- `float64`: limited; tested (5)
- `float128`: no (6)
- `bool`: no (7)
• (1) Handled by cv2. Other dtypes are handled by skimage.

• (2) Normalization is done as $I_{ij}/\text{max}$, where $\text{max}$ is the maximum value of the dtype, e.g. 255 for uint8. The normalization is reversed afterwards, e.g. $\text{result} \times 255$ for uint8.

• (3) Integer-like values are not rounded after applying the contrast adjustment equation (before inverting the normalization to $[0.0, 1.0]$ space), i.e. projection from continuous space to discrete happens according to floor function.

• (4) Note that scikit-image doc says that integers are converted to float64 values before applying the contrast normalization method. This might lead to inaccuracies for large 64bit integer values. Tests showed no indication of that happening though.

• (5) Must not contain negative values. Values $\geq 0$ are fully supported.

• (6) Leads to error in scikit-image.

• (7) Does not make sense for contrast adjustments.

Parameters

• arr (numpy.ndarray) – Array for which to adjust the contrast. Dtype uint8 is fastest.
• gamma (number) – Exponent for the contrast adjustment. Higher values darken the image.

Returns

Array with adjusted contrast.

Return type

numpy.ndarray

`imgaug.augmenters.contrast.adjust_contrast_linear(arr, alpha)`

Adjust contrast by scaling each pixel to $127 + \alpha \cdot (v - 127)$.

Supported dtypes:

• uint8: yes; fully tested (1) (2)
• uint16: yes; tested (2)
• uint32: yes; tested (2)
• uint64: no (3)
• int8: yes; tested (2)
• int16: yes; tested (2)
• int32: yes; tested (2)
• int64: no (2)
• float16: yes; tested (2)
• float32: yes; tested (2)
• float64: yes; tested (2)
• float128: no (2)
• bool: no (4)

• (1) Handled by cv2. Other dtypes are handled by raw numpy.
• (2) Only tested for reasonable alphas with up to a value of around 100.
• (3) Conversion to float64 is done during augmentation, hence uint64, int64, and float128 support cannot be guaranteed.
• (4) Does not make sense for contrast adjustments.

Parameters

• **arr** (*numpy.ndarray*) – Array for which to adjust the contrast. Dtype **uint8** is fastest.

• **alpha** (*number*) – Multiplier to linearly pronounce (>1.0), dampen (0.0 to 1.0) or invert (<0.0) the difference between each pixel value and the dtype’s center value, e.g. 127 for uint8.

Returns

Array with adjusted contrast.

Return type: *numpy.ndarray*

```python
imgaug.augmenters.contrast.adjust_contrast_log(arr, gain)
```

Adjust image contrast by scaling pixels to \(255 \times \text{gain} \times \log_2(1+v/255)\).

Supported dtypes:

- **uint8**: yes; fully tested (1) (2) (3)
- **uint16**: yes; tested (2) (3)
- **uint32**: no; tested (2) (3) (8)
- **uint64**: no; tested (2) (3) (4) (8)
- **int8**: limited; tested (2) (3) (5)
- **int16**: limited; tested (2) (3) (5)
- **int32**: no; tested (2) (3) (5) (8)
- **int64**: no; tested (2) (3) (5) (8)
- **float16**: limited; tested (5)
- **float32**: limited; tested (5)
- **float64**: limited; tested (5)
- **float128**: no (6)
- **bool**: no (7)

• (1) Handled by **cv2**. Other dtypes are handled by **skimage**.

• (2) Normalization is done as \(I_{ij}/\text{max}\), where max is the maximum value of the dtype, e.g. 255 for **uint8**. The normalization is reversed afterwards, e.g. \(\text{result} \times 255\) for **uint8**.

• (3) Integer-like values are not rounded after applying the contrast adjustment equation (before inverting the normalization to \([0.0, 1.0]\) space), i.e. projection from continuous space to discrete happens according to floor function.

• (4) Note that scikit-image doc says that integers are converted to **float64** values before applying the contrast normalization method. This might lead to inaccuracies for large 64bit integer values. Tests showed no indication of that happening though.

• (5) Must not contain negative values. Values \(\geq 0\) are fully supported.

• (6) Leads to error in scikit-image.

• (7) Does not make sense for contrast adjustments.

• (8) No longer supported since numpy 1.17. Previously: ‘yes’ for **uint32, uint64**; ‘limited’ for **int32, int64**.
Parameters

- **arr** (*numpy.ndarray*) – Array for which to adjust the contrast. Dtype `uint8` is fastest.
- **gain** (*number*) – Multiplier for the logarithm result. Values around 1.0 lead to a contrast-adjusted images. Values above 1.0 quickly lead to partially broken images due to exceeding the datatype’s value range.

**Returns** Array with adjusted contrast.

**Return type** *numpy.ndarray*

```
imgaug.augmenters.contrast.adjust_contrast_sigmoid(arr, gain, cutoff)
```

Adjust image contrast to \(255 \times \frac{1}{1 + \exp(gain \times (cutoff - I_{ij}/255))}\).

**Supported dtypes:**

- `uint8`: yes; fully tested (1) (2) (3)
- `uint16`: yes; tested (2) (3)
- `uint32`: yes; tested (2) (3)
- `uint64`: yes; tested (2) (3) (4)
- `int8`: limited; tested (2) (3) (5)
- `int16`: limited; tested (2) (3) (5)
- `int32`: limited; tested (2) (3) (5)
- `int64`: limited; tested (2) (3) (4) (5)
- `float16`: limited; tested (5)
- `float32`: limited; tested (5)
- `float64`: limited; tested (5)
- `float128`: no (6)
- `bool`: no (7)

- (1) Handled by `cv2`. Other dtypes are handled by `skimage`.
- (2) Normalization is done as \(I_{ij}/\max\), where \(\max\) is the maximum value of the dtype, e.g. 255 for `uint8`. The normalization is reversed afterwards, e.g. \(\text{result} \times 255\) for `uint8`.
- (3) Integer-like values are not rounded after applying the contrast adjustment equation before inverting the normalization to \([0.0, 1.0]\) space, i.e. projection from continuous space to discrete happens according to floor function.
- (4) Note that scikit-image doc says that integers are converted to `float64` values before applying the contrast normalization method. This might lead to inaccuracies for large 64bit integer values. Tests showed no indication of that happening though.
- (5) Must not contain negative values. Values >=0 are fully supported.
- (6) Leads to error in scikit-image.
- (7) Does not make sense for contrast adjustments.

**Parameters**

- **arr** (*numpy.ndarray*) – Array for which to adjust the contrast. Dtype `uint8` is fastest.
• gain (number) – Multiplier for the sigmoid function’s output. Higher values lead to quicker changes from dark to light pixels.

• cutoff (number) – Cutoff that shifts the sigmoid function in horizontal direction. Higher values mean that the switch from dark to light pixels happens later, i.e. the pixels will remain darker.

**Returns** Array with adjusted contrast.

**Return type** numpy.ndarray

### 13.25 imgaug.augmenters.convolutional

Augmenters that are based on applying convolution kernels to images.

List of augmenters:

- **Convolve**
- **Sharpen**
- **Emboss**
- **EdgeDetect**
- **DirectedEdgeDetect**

For MotionBlur, see blur.py.

**class** imgaug.augmenters.convolutional.Convolve(matrix=None, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

**Bases:** imgaug.augmenters.meta.Augmenter

Apply a convolution to input images.

**Supported dtypes:**

- uint8: yes; fully tested
- uint16: yes; tested
- uint32: no (1)
- uint64: no (2)
- int8: yes; tested (3)
- int16: yes; tested
- int32: no (2)
- int64: no (2)
- float16: yes; tested (4)
- float32: yes; tested
- float64: yes; tested
- float128: no (1)
- bool: yes; tested (4)

- (1) rejected by cv2.filter2D().
• (2) causes error: cv2.error: OpenCV(3.4.2) (/filter.cpp:4487: error: (-213:The function/feature is not implemented) Unsupported combination of source format (=1), and destination format (=1) in function ‘getLinearFilter’.

• (3) mapped internally to int16.

• (4) mapped internally to float32.

Parameters

• **matrix** *(None or (H, W) ndarray or imgaug.parameters.StochasticParameter or callable, optional)* –

  The weight matrix of the convolution kernel to apply.
  
  – If None, the input images will not be changed.
  
  – If a 2D numpy array, that array will always be used for all images and channels as the kernel.
  
  – If a callable, that method will be called for each image via `parameter(image, C, random_state)`. The function must either return a list of C matrices (i.e. one per channel) or a 2D numpy array (will be used for all channels) or a 3D HxWxC numpy array. If a list is returned, each entry may be None, which will result in no changes to the respective channel.

• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See **init**().

• **name** *(None or str, optional)* – See **init**().

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> matrix = np.array([[-1, 4, -1],
                      [0, -1, 0]])
>>> aug = iaa.Convolve(matrix=matrix)
```

Convolves all input images with the kernel shown in the matrix variable.

```python
>>> def gen_matrix(image, nb_channels, random_state):
>>>     matrix_A = np.array([[-1, 4, -1],
>>>                          [0, -1, 0]])
>>>     matrix_B = np.array([[0, 1, 0],
>>>                          [1, -4, 1],
>>>                          [0, 1, 0]])
>>>     return matrix_A, matrix_B
```

(continues on next page)
>>> if image.shape[0] % 2 == 0:
>>>     return [matrix_A] * nb_channels
>>> else:
>>>     return [matrix_B] * nb_channels
>>> aug = iaa.Convolve(matrix=gen_matrix)

Convolves images that have an even height with matrix A and images having an odd height with matrix B.

Methods

__call__ (self, *args, **kwargs)  Alias for augment().

augment(self, return_batch, hooks)  Augment a single image.

augment_batch(self, batch[, hooks])  Deprecated.

augment_batch(self, batch[, parents, hooks])  Augment a single batch in-place.

augment_batches(self, batch[, hooks,...])  Augment multiple batches.

augment_bounding_boxes(self, ...[, parents,...])  Augment a batch of bounding boxes.

augment_heatmaps(self, heatmaps[, parents,...])  Augment a batch of heatmaps.

augment_image(self, image[, hooks])  Augment a single image.

augment_images(self, images[, parents, hooks])  Augment a batch of images.

augment_keypoints(self, keypoints_on_images)  Augment a batch of keypoints/landmarks.

augment_line_strings(self, ...[, parents,...])  Augment a batch of line strings.

augment_polygons(self, polygons_on_images[, ...])  Augment a batch of polygons.

augment_segmentation_maps(self, segmaps[, ...])  Augment a batch of segmentation maps.

copy(self)  Create a shallow copy of this Augmenter instance.

copy_random_state(self, source[, recursive,...])  Copy the RNGs from a source augmenter sequence.

copy_random_state_(self, source,...)  Copy the RNGs from a source augmenter sequence (in-place).

deedcopy(self)  Create a deep copy of this Augmenter instance.

draw_grid(self, images, rows, cols)  Augment images and draw the results as a single grid-like image.

find_augmenters(self, func[, parents, flat])  Find augmenters that match a condition.

find_augmenters_by_name(self, name[, regex,...])  Find augmenter(s) by name.

find_augmenters_by_names(self, names[, ...])  Find augmenter(s) by names.

get_all_children(self[, flat])  Get all children of this augmenter as a list.

get_children_lists(self)  Get a list of lists of children of this augmenter.

get_parameters(self)  See get_parameters().

localize_random_state(self, recursive)  Assign augmenter-specific RNGs to this augmenter and its children.

localize_random_state_(self, recursive)  Assign augmenter-specific RNGs to this augmenter and its children.

pool(self[, processes, maxtasksperchild, seed])  Create a pool used for multicore augmentation.
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<th>Description</th>
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<td>remove_augmenters(self, func[, copy, ...])</td>
<td>Remove this augmenter or children that match a condition.</td>
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<tr>
<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self, func[,</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>parents])</td>
<td></td>
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<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

get_parameters(self)

See get_parameters().

class imgaug.augmenters.convolutional.DirectedEdgeDetect(alpha=(0.0, 0.75),
direction=(0.0, 1.0), seed=None, name=None, random_state='deprecated',
deterministic='deprecated')

Bases: imgaug.augmenters.convolutional.Convolve

Detect edges from specified angles and alpha-blend with the input image.

This augmenter first detects edges along a certain angle. Usually, edges are detected in x- or y-direction, while here the edge detection kernel is rotated to match a specified angle. The result of applying the kernel is a black (non-edges) and white (edges) image. That image is alpha-blended with the input image.

Supported dtypes:

See Convolve.

Parameters

- **alpha** (number or tuple of number or list of number or im-gaug.parameters.StochasticParameter, optional) – Blending factor of the edge image. At 0.0, only the original image is visible, at 1.0 only the edge image is visible.
  - If a number, exactly that value will always be used.
  - If a tuple (a, b), a random value will be sampled from the interval [a, b] per image.
  - If a list, a random value will be sampled from that list per image.
  - If a StochasticParameter, a value will be sampled from that parameter per image.

- **direction** (number or tuple of number or list of number or im-gaug.parameters.StochasticParameter, optional) – Angle (in degrees) of edges to pronounce, where 0 represents 0 degrees and 1.0 represents 360 degrees (both clockwise, starting at the top). Default value is (0.0, 1.0), i.e. pick a random angle per image.
  - If a number, exactly that value will always be used.
  - If a tuple (a, b), a random value will be sampled from the interval [a, b] will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
– If a StochasticParameter, a value will be sampled from the parameter per image.

• **seed** *(None or int or imgaug.random.RNG or numpy.random.RNG or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See **__init__()**.

• **name** *(None or str, optional)* – See **__init__()**.

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.RNG or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter **seed**. Its usage will not yet cause a deprecation warning, but it is still recommended to use **seed** now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method **to_deterministic()** for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.DirectedEdgeDetect(alpha=1.0, direction=0)
```

Turn input images into edge images in which edges are detected from the top side of the image (i.e. the top sides of horizontal edges are part of the edge image, while vertical edges are ignored).

```python
>>> aug = iaa.DirectedEdgeDetect(alpha=1.0, direction=90/360)
```

Same as before, but edges are detected from the right. Horizontal edges are now ignored.

```python
>>> aug = iaa.DirectedEdgeDetect(alpha=1.0, direction=(0.0, 1.0))
```

Same as before, but edges are detected from a random angle sampled uniformly from the interval [0deg, 360deg].

```python
>>> aug = iaa.DirectedEdgeDetect(alpha=(0.0, 0.3), direction=0)
```

Similar to the previous examples, but here the edge image is alpha-blended with the input image. The result is a mixture between the edge image and the input image. The blending factor is randomly sampled between 0% and 30%.

### Methods

```python
__call__(self, *args, **kwargs) Alias for augment().
augment(self[, return_batch, hooks]) Augment a single image.
augment_batch(self[, batch[, hooks]]) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self[, batches[, parents, ...]]) Augment multiple batches.
augment_bounding_boxes(self[, ...[, parents, ...]]) Augment a batch of bounding boxes.
augment_heatmaps(self[, heatmaps[, parents, ...]]) Augment a batch of heatmaps.
augment_image(self[, image[, hooks]]) Augment a single image.
```

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<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>augment_images(self, images[, parents, hooks])</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td>augment_keypoints(self, keypoints_on_images)</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings(self, ...[, parents, hooks])</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td>augment_polygons(self, polygons_on_images[, ...])</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation_maps(self, segmaps[, ...])</td>
<td>Augment a batch of segmentation maps.</td>
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<tr>
<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
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<tr>
<td>copy_random_state(self, source[, recursive, ...])</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
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<td>get_all_children(self[, flat])</td>
<td>Get all children of this augmenter as a list.</td>
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<td>get_children_lists(self)</td>
<td>Get a list of lists of children of this augmenter.</td>
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<tr>
<td>get_parameters(self)</td>
<td>See get_parameters().</td>
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<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**class** imgaug.augmenters.convolutional.EdgeDetect

```python
(alpha=(0.0, 0.75), seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases:** imgaug.augmenters.convolutional.Convolve

Generate a black & white edge image and alpha-blend it with the input image.

**Supported dtypes:**

See Convolve.
Parameters

- **alpha** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)*  – Blending factor of the edge image. At 0.0, only the original image is visible, at 1.0 only the edge image is visible.
  - If a number, exactly that value will always be used.
  - If a tuple \((a, b)\), a random value will be sampled from the interval \([a, b]\) per image.
  - If a list, a random value will be sampled from that list per image.
  - If a StochasticParameter, a value will be sampled from that parameter per image.
- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)*  – See `__init__()`.
- **name** *(None or str, optional)*  – See `__init__()`.
- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)*  – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
- **deterministic** *(bool, optional)*  – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.EdgeDetect(alpha=(0.0, 1.0))
```

Detect edges in an image, mark them as black (non-edge) and white (edges) and alpha-blend the result with the original input image using a random blending factor between 0% and 100%.

Methods

```python
__call__(self, *args, **kwargs)  # Alias for `augment()`.
augment(self[, return_batch, hooks])  # Augment a batch.
augment_batch(self[, batch[, hooks]])  # Deprecated.
augment_batch_(self[, batch[, parents[, hooks]]])  # Augment a single batch in-place.
augment_batches(self[, batches[, hooks,...]])  # Augment multiple batches.
augment_bounding_boxes(self[, ...[, parents,...]])  # Augment a batch of bounding boxes.
augment_heatmaps(self[, heatmaps[, parents,...]])  # Augment a batch of heatmaps.
augment_image(self[, image[, hooks]])  # Augment a single image.
augment_images(self[, images[, parents[, hooks]]])  # Augment a batch of images.
augment_keypoints(self[, keypoints_on_images])  # Augment a batch of keypoints/landmarks.
augment_line_strings(self[, ...[, parents,...]])  # Augment a batch of line strings.
```

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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>augment_polygons(self, polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(self, segmasks[, ...])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(self, source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(self, source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[, name[, regex, ...]])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**class** `imgaug.augmenters.convolutional.Emboss(alpha=(0.0, 1.0), strength=(0.25, 1.0), seed=None, name=None, random_state='deprecated', deterministic='deprecated')`

**Bases:** `imgaug.augmenters.convolutional.Convolve`

Emboss images and alpha-blend the result with the original input images.

The embossed version pronounces highlights and shadows, letting the image look as if it was recreated on a metal plate (“embossed”).

**Supported dtypes:**

See `Convolve`.

**Parameters**
• **alpha** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Blending factor of the embossed image. At 0.0, only the original image is visible, at 1.0 only its embossed version is visible.
  
  – If a number, exactly that value will always be used.
  
  – If a tuple (a, b), a random value will be sampled from the interval [a, b) per image.
  
  – If a list, a random value will be sampled from that list per image.
  
  – If a StochasticParameter, a value will be sampled from that parameter per image.

• **strength** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Parameter that controls the strength of the embossing. Sane values are somewhere in the interval [0.0, 2.0] with 1.0 being the standard embossing effect. Default value is 1.0.
  
  – If a number, exactly that value will always be used.
  
  – If a tuple (a, b), a random value will be sampled from the interval [a, b) per image.
  
  – If a list, a random value will be sampled from that list per image.
  
  – If a StochasticParameter, a value will be sampled from the parameter per image.

• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See __init__().

• **name** *(None or str, optional)* – See __init__().

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Emboss(alpha=(0.0, 1.0), strength=(0.5, 1.5))
```

Emboss an image with a strength sampled uniformly from the interval [0.5, 1.5] and alpha-blend the result with the original input image using a random blending factor between 0% and 100%.

### Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>call</strong></td>
<td>Alias for augment().</td>
</tr>
<tr>
<td>augment(self[, return_batch, hooks])</td>
<td>Augment a batch.</td>
</tr>
<tr>
<td>augment_batch(self, batch[, hooks])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>augment_batch_(self, batch[, parents, hooks])</td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td>augment_batches(self, batch[, hooks, ...])</td>
<td>Augment multiple batches.</td>
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</tbody>
</table>
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<table>
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<tr>
<th>Method</th>
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<tr>
<td>augment_bounding_boxes</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td>augment_heatmaps</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td>augment_image</td>
<td>Augment a single image.</td>
</tr>
<tr>
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<tr>
<td>augment_segmentation_maps</td>
<td>Augment a batch of segmentation maps.</td>
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<td>copy</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td>copy_random_state_(self[, recursive])</td>
<td>Copy the RNGs from a source augmenter sequence</td>
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<td></td>
<td>(in-place).</td>
</tr>
<tr>
<td>deepcopy</td>
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<tr>
<td>draw_grid</td>
<td>Augment images and draw the results as a single</td>
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<td></td>
<td>grid-like image.</td>
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<tr>
<td>find_augmenters</td>
<td>Find augmenters that match a condition.</td>
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<td>Get all children of this augmenter as a list.</td>
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<td>get_parameters</td>
<td>See get_parameters().</td>
</tr>
<tr>
<td>localize_random_state</td>
<td>Assign augmenter-specific RNGs to this augmenter</td>
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<td>localize_random_state_(self[, recursive])</td>
<td>and its children.</td>
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<td>pool</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
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<td>remove_augmenters</td>
<td>Remove this augmentor or children that match a</td>
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<tr>
<td>remove_augmenters_inplace</td>
<td>condition.</td>
</tr>
<tr>
<td>reseed</td>
<td>Remove in-place children of this augmenter that</td>
</tr>
<tr>
<td></td>
<td>match a condition.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_tool])</td>
<td>Seed this augmenter and all of its children.</td>
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<tr>
<td>show_grid</td>
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<td>to_deterministic</td>
<td>Convert this augmenter from a stochastic to a</td>
</tr>
<tr>
<td></td>
<td>deterministic one.</td>
</tr>
</tbody>
</table>
class imgaug.augmenters.convolutional.Sharpen(alpha=(0.0, 0.2), lightness=(0.8, 1.2), seed=None, name=None, random_state='deprecated', deterministic='deprecated'))

Bases: imgaug.augmenters.convolutional.Convolve

Sharpen images and alpha-blend the result with the original input images.

Supported dtypes:
See Convolve.

Parameters

- **alpha** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Blending factor of the sharpened image. At 0.0, only the original image is visible, at 1.0 only its sharpened version is visible.
  - If a number, exactly that value will always be used.
  - If a tuple (a, b), a random value will be sampled from the interval [a, b] per image.
  - If a list, a random value will be sampled from that list per image.
  - If a StochasticParameter, a value will be sampled from that parameter per image.

- **lightness** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Lightness/brightness of the sharpened image. Sane values are somewhere in the interval [0.5, 2.0]. The value 0.0 results in an edge map. Values higher than 1.0 create bright images. Default value is 1.0.
  - If a number, exactly that value will always be used.
  - If a tuple (a, b), a random value will be sampled from the interval [a, b] per image.
  - If a list, a random value will be sampled from that list per image.
  - If a StochasticParameter, a value will be sampled from that parameter per image.

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- **name** (None or str, optional) – See __init__().

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Sharpen(alpha=(0.0, 1.0))
```
Sharpen's input images and blends the sharpened image with the input image using a random blending factor between 0% and 100% (uniformly sampled).

```python
>>> aug = iaa.Sharpen(alpha=(0.0, 1.0), lightness=(0.75, 2.0))
```

Sharpen's input images with a variable *lightness* sampled uniformly from the interval [0.75, 2.0] and with a fully random blending factor (as in the above example).

**Methods**

<table>
<thead>
<tr>
<th>Method</th>
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</tr>
</thead>
<tbody>
<tr>
<td><code>__call__</code></td>
<td>Alias for <code>augment()</code></td>
</tr>
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<td><code>augment</code></td>
<td>Augment a batch.</td>
</tr>
<tr>
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<td>Augment a single batch in-place.</td>
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<td><code>copy_random_state_</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
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<tr>
<td><code>get_parameters</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td><code>localize_random_state_</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
</tbody>
</table>

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### 13.26 imgaug.augmenters.debug

Augmenters that help with debugging.

List of augmenters:

- `SaveDebugImageEveryNBatches`

Added in 0.4.0.

```python
class imgaug.augmenters.debug.SaveDebugImageEveryNBatches(destination, interval, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.debug._SaveDebugImage`

Visualize data in batches and save corresponding plots to a folder.

Added in 0.4.0.

**Supported dtypes:**

See `draw_debug_image()`.

**Parameters**

- `destination` (*str or _ImageDestination*) – Path to a folder. The saved images will follow a filename pattern of `batch_<batch_id>.png`. The latest image will additionally be saved to `latest.png`.

- `interval` (*int*) – Interval in batches. If set to $N$, every $N$th batch an image will be generated and saved, starting with the first observed batch. Note that the augmenter only counts batches that it sees. If it is executed conditionally or re-instantiated, it may not see all batches or the counter may be wrong in other ways.

- `seed` (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See `__init__()`. 

- `name` (None or str, optional) – See `__init__()`.

- `random_state` (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter `seed`. Its usage
will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> import tempfile
>>> folder_path = tempfile.mkdtemp()
>>> seq = iaa.Sequential(
>>>     iaa.Sequential(
>>>         iaa.Fliplr(0.5),
>>>         iaa.Crop(px=(0, 16)),
>>>     ), random_order=True),
>>> iaa.SaveDebugImageEveryNBatches(folder_path, 100)
>>> )
```

### Methods

- `__call__` *(self, *args, **kwargs)* – Alias for `augment()`.
- `augment(self[, return_batch, hooks])` Augment a batch.
- `augment_batch(self[, batch[, hooks]])` Deprecation.
- `augment_batch_(self, batch[, parents, hooks])` Augment a single batch in-place.
- `augment_batches(self, batches[, hooks])` Augment multiple batches.
- `augment_bounding_boxes(self, ...[, parents, ...])` Augment a batch of bounding boxes.
- `augment_heatmaps(self, heatmaps[, parents, ...])` Augment a batch of heatmaps.
- `augment_image(self, image[, hooks])` Augment a single image.
- `augment_images(self, images[, parents, hooks])` Augment a batch of images.
- `augment_keypoints(self, keypoints_on_images)` Augment a batch of keypoints/landmarks.
- `augment_line_strings(self, ...[, parents, hooks])` Augment a batch of line strings.
- `augment_polygons(self, polygons_on_images[, ...])` Augment a batch of polygons.
- `augment_segmentation_maps(self, segmaps[, ...])` Augment a batch of segmentation maps.
- `copy(self)` Create a shallow copy of this Augmenter instance.
- `copy_random_state(self[, source[, recursive, ...]])` Copy the RNGs from a source augmenter sequence.
- `copy_random_state_(self[, source[, ...]])` Copy the RNGs from a source augmenter sequence (in-place).
- `deepcopy(self)` Create a deep copy of this Augmenter instance.
- `draw_grid(self, images, rows, cols)` Augment images and draw the results as a single grid-like image.
- `find_augmenters(self, func[, parents, flat])` Find augmenters that match a condition.

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- `find_augmenters_by_name(self, name[, regex, ...])`
  Find augmenter(s) by name.

- `find_augmenters_by_names(self, names[, ...])`
  Find augmenter(s) by names.

- `get_all_children(self[, flat])`
  Get all children of this augmenter as a list.

- `get_children_lists(self)`
  Get a list of lists of children of this augmenter.

- `get_parameters(self)`
  Get the parameters of this augmenter.

- `localize_random_state(self[, recursive])`
  Assign augmenter-specific RNGs to this augmenter and its children.

- `localize_random_state_(self[, recursive])`
  Assign augmenter-specific RNGs to this augmenter and its children.

- `pool(self[, processes, maxtasksperchild, seed])`
  Create a pool used for multicore augmentation.

- `remove_augmenters(self, func[, copy, ...])`
  Remove this augmenter or children that match a condition.

- `remove_augmenters_(self, func[, parents])`
  Remove in-place children of this augmenter that match a condition.

- `remove_augmenters_inplace(self, func[, parents])`  
  Deprecated.

- `reseed(self[, random_state, deterministic_too])`  
  Deprecated.

- `seed_(self[, entropy, deterministic_too])`
  Seed this augmenter and all of its children.

- `show_grid(self, images, rows, cols)`
  Augment images and plot the results as a single grid-like image.

- `to_deterministic(self[, n])`
  Convert this augmenter from a stochastic to a deterministic one.

---

**get_parameters** *(self)*

Get the parameters of this augmenter.

**Returns** List of parameters of arbitrary types (usually child class of `StochasticParameter`, but not guaranteed to be).

**Return type** list

---

`imgaug.augmenters.debug.draw_debug_image` *(images, heatmaps= None, segmentation_maps= None, keypoints= None, bounding_boxes= None, polygons= None, line_strings= None)*

Generate a debug image grid of a single batch and various datatypes.

Added in 0.4.0.

**Supported dtypes:**

- `uint8`: yes; tested
- `uint16`: ?
- `uint32`: ?
- `uint64`: ?
- `int8`: ?
- `int16`: ?
- `int32`: ?
- `int64`: ?
• float16: ?
• float32: ?
• float64: ?
• float128: ?
• bool: ?

Parameters

- **images** (*ndarray* or *list of ndarray*) – Images in the batch. Must always be provided. Batches without images cannot be visualized.
- **heatmaps** (*None* or *list of imgaug.augmentables.heatmaps.HeatmapsOnImage*, *optional*) – Heatmaps on the provided images.
- **segmentation_maps** (*None* or *list of imgaug.augmentables.segmaps.SegmentationMapsOnImage*, *optional*) – Segmentation maps on the provided images.
- **keypoints** (*None* or *list of imgaug.augmentables.kps.KeypointsOnImage*, *optional*) – Keypoints on the provided images.
- **bounding_boxes** (*None* or *list of imgaug.augmentables.bbs.BoundingBoxesOnImage*, *optional*) – Bounding boxes on the provided images.
- **polygons** (*None* or *list of imgaug.augmentables.polys.PolygonsOnImage*, *optional*) – Polygons on the provided images.
- **line_strings** (*None* or *list of imgaug.augmentables.lines.LineStringsOnImage*, *optional*) – Line strings on the provided images.

Returns

Visualized batch as RGB image.

Return type

*ndarray*

Examples

```python
>>> import numpy as np
>>> import imgaug.augmenters as iaa
>>> image = np.zeros((64, 64, 3), dtype=np.uint8)
>>> debug_image = iaa.draw_debug_image(images=[image, image])
Generate a debug image for two empty images.

>>> from imgaug.augmentables.kps import KeypointsOnImage
>>> kpsoi = KeypointsOnImage.from_xy_array([(10.5, 20.5), (30.5, 30.5)], shape=image.shape)
>>> debug_image = iaa.draw_debug_image(images=[image, image], keypoints=[kpsoi, kpsoi])
Generate a debug image for two empty images, each having two keypoints drawn on them.

>>> from imgaug.augmentables.batches import UnnormalizedBatch
>>> segmap_arr = np.zeros((32, 32, 1), dtype=np.int32)
>>> kp_tuples = [(10.5, 20.5), (30.5, 30.5)]
>>> batch = UnnormalizedBatch(images=[image, image],
>>>                           segmentation_maps=[segmap_arr, segmap_arr],
>>>                           keypoints=[kp_tuples, kp_tuples])
```
Generate a debug image for two empty images, each having an empty segmentation map and two keypoints drawn on them. This example uses `UnnormalizedBatch` to show how to mostly evade going through `imgaug` classes.

### 13.27 `imgaug.augmenters.edges`

Augmenters that deal with edge detection.

List of augmenters:

- **Canny**

`EdgeDetect` and `DirectedEdgeDetect` are currently still in `convolutional.py`.

```python
class imgaug.augmenters.edges.Canny(alpha=(0.0, 1.0), hysteresis_thresholds=((60, 140), (160, 240)), sobel_kernel_size=(3, 7), colorizer=None, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.meta.Augmenter`

Apply a canny edge detector to input images.

**Supported dtypes:**

- `uint8`: yes; fully tested
- `uint16`: no; not tested
- `uint32`: no; not tested
- `uint64`: no; not tested
- `int8`: no; not tested
- `int16`: no; not tested
- `int32`: no; not tested
- `int64`: no; not tested
- `float16`: no; not tested
- `float32`: no; not tested
- `float64`: no; not tested
- `float128`: no; not tested
- `bool`: no; not tested

**Parameters**

- `alpha` *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Blending factor to use in alpha blending. A value close to 1.0 means that only the edge image is visible. A value close to 0.0 means that only the original image is visible. A value close to 0.5 means that the images...
are merged according to $0.5\cdot\text{image} + 0.5\cdot\text{edge\_image}$. If a sample from this parameter is 0, no action will be performed for the corresponding image.

- If an int or float, exactly that value will be used.
- If a tuple $(a, b)$, a random value from the range $a \leq x \leq b$ will be sampled per image.
- If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, a value will be sampled from the parameter per image.

• **hysteresis\_thresholds** *(number or tuple of number or list of number or imgaug\_parameters.StochasticParameter or tuple of tuple of number or tuple of list of number or tuple of tuple of imgaug\_parameters.StochasticParameter, optional)* – Min and max values to use in hysteresis thresholding. (This parameter seems to have not very much effect on the results.) Either a single parameter or a tuple of two parameters. If a single parameter is provided, the sampling happens once for all images with $(N,2)$ samples being requested from the parameter, where each first value denotes the hysteresis minimum and each second the maximum. If a tuple of two parameters is provided, one sampling of $(N,)$ values is independently performed per parameter (first parameter: hysteresis minimum, second: hysteresis maximum).

- If this is a single number, both min and max value will always be exactly that value.
- If this is a tuple of numbers $(a, b)$, two random values from the range $a \leq x \leq b$ will be sampled per image.
- If this is a list, two random values will be sampled from that list per image.
- If this is a StochasticParameter, two random values will be sampled from that parameter per image.
- If this is a tuple $(\text{min}, \text{max})$ with min and max both not being numbers, they will be treated according to the rules above (i.e. may be a number, tuple, list or StochasticParameter). A single value will be sampled per image and parameter.

• **sobel\_kernel\_size** *(int or tuple of int or list of int or imgaug\_parameters.StochasticParameter, optional)* – Kernel size of the sobel operator initially applied to each image. This corresponds to apertureSize in cv2.Canny(). If a sample from this parameter is $\leq 1$, no action will be performed for the corresponding image. The maximum for this parameter is 7 (inclusive). Higher values are not accepted by OpenCV. If an even value $v$ is sampled, it is automatically changed to $v-1$.

- If this is a single integer, the kernel size always matches that value.
- If this is a tuple of integers $(a, b)$, a random discrete value will be sampled from the range $a \leq x \leq b$ per image.
- If this is a list, a random value will be sampled from that list per image.
- If this is a StochasticParameter, a random value will be sampled from that parameter per image.

• **colorizer** *(None or imgaug\_augmenters\_edges.IBinaryImageColorizer, optional)* – A strategy to convert binary edge images to color images. If this is None, an instance of RandomColorBinaryImageColorizer is created, which means that each edge image is converted into an uint8 image, where edge and non-edge pixels each have a different color that was uniformly randomly sampled from the space of all uint8 colors.
• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See `__init__()*.  
• **name** *(None or str, optional) – See `__init__()*.  
• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.  
• **deterministic** *(bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Canny()

Create an augmenter that generates random blends between images and their canny edge representations.

```python
>>> aug = iaa.Canny(alpha=(0.0, 0.5))
```

Create a canny edge augmenter that generates edge images with a blending factor of max 50\%, i.e. the original (non-edge) image is always at least partially visible.

```python
>>> aug = iaa.Canny(
...    alpha=(0.0, 0.5),
...    colorizer=iaa.RandomColorsBinaryImageColorizer(
...      color_true=255,
...      color_false=0
...    )
...)
```

Same as in the previous example, but the edge image always uses the color white for edges and black for the background.

```python
>>> aug = iaa.Canny(alpha=(0.5, 1.0), sobel_kernel_size=[3, 7])
```

Create a canny edge augmenter that initially preprocessed images using a sobel filter with kernel size of either 3x3 or 13x13 and alpha-blends with result using a strength of 50\% (both images equally visible) to 100\% (only edge image visible).

```python
>>> aug = iaa.Alpha(
...    (0.0, 1.0),
...    iaa.Canny(alpha=1),
...    iaa.MedianBlur(13)
...)
```

Create an augmenter that blends a canny edge image with a median-blurred version of the input image. The median blur uses a fixed kernel size of 13x13 pixels.
## Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
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<tbody>
<tr>
<td><code>__call__</code></td>
<td>Alias for <code>augment()</code>.</td>
</tr>
<tr>
<td><code>augment(self[, return_batch, hooks])</code></td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><code>augment_batch(self[, batch[, hooks]])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>augment_batch_(self[, batch[, parents, hooks]])</code></td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><code>augment_batches(self[, batches[, hooks, ...]])</code></td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td><code>augment_bounding_boxes(self[, ...[, parents, ...]])</code></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps(self[, heatmaps[...[, parents, ...]])</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(self[, image[, hooks]])</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images(self[, images[, parents, hooks]])</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints(self[, keypoints_on_images])</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings(self[, ...[, parents, hooks]])</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons(self[, polygons_on_images[, ...]])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(self[, segmaps[, ...]])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(self[, source[, recursive, ...]])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(self[, source[, ...]])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self[, images, rows, cols])</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self[, func[, parents, flat]])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self[, name[, regex, ...]])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(self[, names[, ...]])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self[, func[, copy, ...]])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self[, func[, parents]])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self[, func[, parents]])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
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<tbody>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**get_parameters(self)**

See `get_parameters()`.

**class imgaug.augmenters.edges.IBinaryImageColorizer**

Bases: object

Interface for classes that convert binary masks to color images.

**Methods**

**colorize**(self, image_binary, image_original, ...)  
Convert a binary image to a colorized one.

**colorize**(self, image_binary, image_original, nth_image, random_state)

Convert a binary image to a colorized one.

**Parameters**

- `nth_image` (*int*) – Index of the image in the batch.
- `random_state` (*imgaug.random.RNG*) – Random state to use.

**Returns** Colorized form of `image_binary`.

**Return type** *ndarray*

**class imgaug.augmenters.edges.RandomColorsBinaryImageColorizer**

(color_true=(0, 255),
 color_false=(0, 255))

Bases: `imgaug.augmenters.edges.IBinaryImageColorizer`

Colorizer using two randomly sampled foreground/background colors.

**Parameters**

- `color_true` (*int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional*) – Color of the foreground, i.e. all pixels in binary images that are True. This parameter will be queried once per image to generate \((3,)\) samples denoting the color. (Note that even for grayscale images three values will be sampled and converted to grayscale according to \(0.299*R + 0.587*G + 0.114*B\). This is the same equation that is also used by OpenCV.)
  - If an int, exactly that value will always be used, i.e. every color will be \((v, v, v)\) for value \(v\).
  - If a tuple \((a, b)\), three random values from the range \(a \leq x \leq b\) will be sampled per image.
  - If a list, then three random values will be sampled from that list per image.
– If a StochasticParameter, three values will be sampled from the parameter per image.

• **color_false** *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)* – Analogous to **color_true**, but denotes the color for all pixels that are False in the binary input image.

### Methods

```python
colorize(self, image_binary, image_original, ...)  # Convert a binary image to a colorized one.
```

```python
colorize(self, image_binary, image_original, nth_image, random_state)  # Convert a binary image to a colorized one.
```

**Parameters**

- **image_binary** *(ndarray)* – Boolean (H, W) image.
- **image_original** *(ndarray)* – Original (H, W, C) input image.
- **nth_image** *(int)* – Index of the image in the batch.
- **random_state** *(imgaug.random.RNG)* – Random state to use.

**Returns** Colorized form of `image_binary`.

**Return type** ndarray

### 13.28 imgaug.augmenters.flip

Augmenters that apply mirroring/flipping operations to images.

List of augmenters:

- **Fliplr**
- **Flipud**

```python
class imgaug.augmenters.flip.Fliplr(p=1, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.meta.Augmenter`

Flip/mirror input images horizontally.

**Note:** The default value for the probability is 0.0. So, to flip all input images use `Fliplr(1.0)` and not just `Fliplr()`.

**Supported dtypes:**

See `fliplr()`.

**Parameters**

- **p** *(number or imgaug.parameters.StochasticParameter, optional)* – Probability of each image to get flipped.
- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.
• **name** *(None or str, optional)* – See `__init__()`.  

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator  
  or numpy.random.BitGenerator or numpy.random.SeedSequence or  
  numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage  
  will not yet cause a deprecation warning, but it is still recommended to use `seed` now.  
  Outdated since 0.4.0.  

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method  
  `to_deterministic()` for an alternative and for details about what the “deterministic  
  mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Fliplr(0.5)
```

Flip 50 percent of all images horizontally.

```python
>>> aug = iaa.Fliplr(1.0)
```

Flip all images horizontally.

### Methods

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
</table>
| `__call__` | Alias for `augment()`.
| `augment` | Augment a batch.
| `augment_batch` | Augment a single batch in-place. (Deprecated.)
| `augment_batches` | Augment multiple batches.
| `augment_bounding_boxes` | Augment a batch of bounding boxes.
| `augment_heatmaps` | Augment a batch of heatmaps.
| `augment_image` | Augment a single image.
| `augment_images` | Augment a batch of images.
| `augment_keypoints` | Augment a batch of keypoints/landmarks.
| `augment_line_strings` | Augment a batch of line strings.
| `augment_polygons` | Augment a batch of polygons.
| `augment_segmentation_maps` | Augment a batch of segmentation maps.
| `copy` | Create a shallow copy of this Augmenter instance.
| `copy_random_state` | Copy the RNGs from a source augmenter sequence.
| `deepcopy` | Create a deep copy of this Augmenter instance.

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<tr>
<th>Method</th>
<th>Description</th>
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<tbody>
<tr>
<td><code>draw_grid</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name</code></td>
<td>Find augmenter(s) by name.</td>
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<td><code>get_all_children</code></td>
<td>Get all children of this augmenter as a list.</td>
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<td>Get a list of lists of children of this augmenter.</td>
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<tr>
<td><code>get_parameters</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
get_parameters(self)

See `get_parameters()`.
```

```python
class imgaug.augmenters.flip.Flipud(p=1, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Class: `imgaug.augmenters.meta.Augmenter`

Flip/mirror input images vertically.

**Note:** The default value for the probability is 0.0. So, to flip all input images use `Flipud(1.0)` and not just `Flipud()`.

**Supported dtypes:**

See `flipud()`.

**Parameters**

- **p** *(number or imgaug.parameters.StochasticParameter, optional)* – Probability of each image to get flipped.
- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.
- **name** *(None or str, optional)* – See `__init__()`.
• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter **seed**. Its usage will not yet cause a deprecation warning, but it is still recommended to use **seed** now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa

>>> aug = iaa.Flipud(0.5)
```

Flip 50 percent of all images vertically.

```python
>>> aug = iaa.Flipud(1.0)
```

Flip all images vertically.

### Methods

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<tr>
<td><strong>call</strong></td>
<td>Alias for <strong>augment()</strong>.</td>
</tr>
<tr>
<td>augment(self, return_batch, hooks)</td>
<td>Augment a batch.</td>
</tr>
<tr>
<td>augment_batch(self, batch[, hooks])</td>
<td><strong>Deprecated</strong>.</td>
</tr>
<tr>
<td>augment_batch_(self, batch[, parents, hooks])</td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td>augment_batches(self, batches[, hooks])</td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td>augment_bounding_boxes(self, ...[, parents, ...])</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td>augment_heatmaps(self, heatmaps[, parents, ...])</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td>augment_image(self, image[, hooks])</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td>augment_images(self, images[, parents, hooks])</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td>augment_keypoints(self, keypoints_on_images)</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings(self, ...[, parents, hooks])</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td>augment_polygons(self, polygons_on_images[, ...])</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation_maps(self, segmaps[, ...])</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state(self, source[, recursive, ...])</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
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<td>deepcopy(self)</td>
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<tr>
<td>find_augmenters(self, func[, parents, flat])</td>
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<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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**get_parameters (self)**

See `get_parameters()`.

`imgaug.augmenters.flip.HorizontalFlip (*args, **kwargs)`

Alias for Fliplr.

`imgaug.augmenters.flip.VerticalFlip (*args, **kwargs)`

Alias for Flipud.

`imgaug.augmenters.flip.fliplr (arr)`

Flip an image-like array horizontally.

**Supported dtypes:**

- uint8: yes; fully tested
- uint16: yes; fully tested
- uint32: yes; fully tested
- uint64: yes; fully tested
- int8: yes; fully tested
- int16: yes; fully tested
- int32: yes; fully tested
- int64: yes; fully tested
- float16: yes; fully tested
- float32: yes; fully tested
- float64: yes; fully tested
• float128: yes; fully tested
• bool: yes; fully tested

Parameters arr (ndarray) – A 2D/3D (H, W, [C]) image array.

Returns Horizontally flipped array.

Return type ndarray

Examples

```python
>>> import numpy as np
>>> import imgaug.augmenters.flip as flip
>>> arr = np.arange(16).reshape((4, 4))
>>> arr_flipped = flip.fliplr(arr)
```

Create a 4x4 array and flip it horizontally.

**imgaug.augmenters.flip.flipud(arr)**

Flip an image-like array vertically.

Supported dtypes:

• uint8: yes; fully tested
• uint16: yes; fully tested
• uint32: yes; fully tested
• uint64: yes; fully tested
• int8: yes; fully tested
• int16: yes; fully tested
• int32: yes; fully tested
• int64: yes; fully tested
• float16: yes; fully tested
• float32: yes; fully tested
• float64: yes; fully tested
• float128: yes; fully tested
• bool: yes; fully tested

Parameters arr (ndarray) – A 2D/3D (H, W, [C]) image array.

Returns Vertically flipped array.

Return type ndarray

Examples

```python
>>> import numpy as np
>>> import imgaug.augmenters.flip as flip
>>> arr = np.arange(16).reshape((4, 4))
>>> arr_flipped = flip.flipud(arr)
```
Create a 4×4 array and flip it vertically.

## 13.29 `imgaug.augmenters.geometric`

Augmenters that apply affine or similar transformations.

List of augmenters:

- `Affine`
- `ScaleX`
- `ScaleY`
- `TranslateX`
- `TranslateY`
- `Rotate`
- `ShearX`
- `ShearY`
- `AffineCv2`
- `PiecewiseAffine`
- `PerspectiveTransform`
- `ElasticTransformation`
- `Rot90`
- `WithPolarWarping`
- `Jigsaw`

```python
class imgaug.augmenters.geometric.Affine(scale=None, translate_percent=None, translate_px=None, rotate=None, shear=None, order=1, cval=0, mode='constant', fit_output=False, backend='auto', random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.meta.Augmenter`

Augmenter to apply affine transformations to images.

This is mostly a wrapper around the corresponding classes and functions in OpenCV and skimage.

Affine transformations involve:

- Translation (“move” image on the x-/y-axis)
- Rotation
- Scaling (“zoom” in/out)
- Shear (move one side of the image, turning a square into a trapezoid)

All such transformations can create “new” pixels in the image without a defined content, e.g. if the image is translated to the left, pixels are created on the right. A method has to be defined to deal with these pixel values.

The parameters `cval` and `mode` of this class deal with this.
Some transformations involve interpolations between several pixels of the input image to generate output pixel values. The parameter order deals with the method of interpolation used for this.

**Note:** While this augmenter supports segmentation maps and heatmaps that have a different size than the corresponding image, it is strongly recommended to use the same aspect ratios. E.g. for an image of shape (200, 100, 3), good segmap/heatmap array shapes also follow a 2:1 ratio and ideally are (200, 100, C), (100, 50, C) or (50, 25, C). Otherwise, transformations involving rotations or shearing will produce unaligned outputs. For performance reasons, there is no explicit validation of whether the aspect ratios are similar.

**Supported dtypes:**

if (backend="skimage", order in [0, 1]):
  - uint8: yes; tested
  - uint16: yes; tested
  - uint32: yes; tested (1)
  - uint64: no (2)
  - int8: yes; tested
  - int16: yes; tested
  - int32: yes; tested (1)
  - int64: no (2)
  - float16: yes; tested
  - float32: yes; tested
  - float64: yes; tested
  - float128: no (2)
  - bool: yes; tested

  - (1) scikit-image converts internally to float64, which might affect the accuracy of large integers. In tests this seemed to not be an issue.
  - (2) results too inaccurate

if (backend="skimage", order in [3, 4]):
  - uint8: yes; tested
  - uint16: yes; tested
  - uint32: yes; tested (1)
  - uint64: no (2)
  - int8: yes; tested
  - int16: yes; tested
  - int32: yes; tested (1)
  - int64: no (2)
  - float16: yes; tested
• float32: yes; tested
• float64: limited; tested (3)
• float128: no (2)
• bool: yes; tested

• (1) scikit-image converts internally to float64, which might affect the accuracy of large integers. In tests this seemed to not be an issue.
• (2) results too inaccurate
• (3) NaN around minimum and maximum of float64 value range

if (backend="skimage", order=5):
• uint8: yes; tested
• uint16: yes; tested
• uint32: yes; tested (1)
• uint64: no (2)
• int8: yes; tested
• int16: yes; tested
• int32: yes; tested (1)
• int64: no (2)
• float16: yes; tested
• float32: yes; tested
• float64: limited; not tested (3)
• float128: no (2)
• bool: yes; tested

• (1) scikit-image converts internally to float64, which might affect the accuracy of large integers. In tests this seemed to not be an issue.
• (2) results too inaccurate
• (3) NaN around minimum and maximum of float64 value range

if (backend="cv2", order=0):
• uint8: yes; tested
• uint16: yes; tested
• uint32: no (1)
• uint64: no (2)
• int8: yes; tested
• int16: yes; tested
• int32: yes; tested
• int64: no (2)
• float16: yes; tested (3)
• float32: yes; tested
• float64: yes; tested
• float128: no (1)
• bool: yes; tested (3)

• (1) rejected by cv2
• (2) changed to int32 by cv2
• (3) mapped internally to float32

if (backend="cv2", order=1):
    • uint8: yes; fully tested
    • uint16: yes; tested
    • uint32: no (1)
    • uint64: no (2)
    • int8: yes; tested (3)
    • int16: yes; tested
    • int32: no (2)
    • int64: no (2)
    • float16: yes; tested (4)
    • float32: yes; tested
    • float64: yes; tested
    • float128: no (1)
    • bool: yes; tested (4)

• (1) rejected by cv2
• (2) causes cv2 error: cv2.error: OpenCV(3.4.4) (...)imgwarp.cpp:1805:
  error: (-215:Assertion failed) ifunc != 0 in function 'remap'
• (3) mapped internally to int16
• (4) mapped internally to float32

if (backend="cv2", order=3):
    • uint8: yes; tested
    • uint16: yes; tested
    • uint32: no (1)
    • uint64: no (2)
    • int8: yes; tested (3)
    • int16: yes; tested
• int32: no (2)
• int64: no (2)
• float16: yes; tested (4)
• float32: yes; tested
• float64: yes; tested
• float128: no (1)
• bool: yes; tested (4)

• (1) rejected by cv2
• (2) causes cv2 error: cv2.error: OpenCV(3.4.4) (...)imgwarp.cpp:1805:
  error: (-215:Assertion failed) ifunc != 0 in function
  'remap'
• (3) mapped internally to int16
• (4) mapped internally to float32

Parameters

• scale  (number or tuple of number or list of number or
  imgaug.parameters.StochasticParameter or dict {"x": number/tuple/list/StochasticParameter,
  "y": number/tuple/list/StochasticParameter}, optional) – Scaling factor to use, where 1.0
  denotes “no change” and 0.5 is zoomed out to 50 percent of the original size.
  – If a single number, then that value will be used for all images.
  – If a tuple (a, b), then a value will be uniformly sampled per image from the interval
    [a, b]. That value will be used identically for both x- and y-axis.
  – If a list, then a random value will be sampled from that list per image (again, used for
    both x- and y-axis).
  – If a StochasticParameter, then from that parameter a value will be sampled per
    image (again, used for both x- and y-axis).
  – If a dictionary, then it is expected to have the keys x and/or y. Each of these keys can have
    the same values as described above. Using a dictionary allows to set different values for
    the two axis and sampling will then happen independently per axis, resulting in samples
    that differ between the axes.

• translate_percent  (None or number or tuple of number or list of number or
  imgaug.parameters.StochasticParameter or dict {"x": number/tuple/list/StochasticParameter,
  "y": number/tuple/list/StochasticParameter}, optional) – Translation as a fraction of the
  image height/width (x-translation, y-translation), where 0 denotes “no change” and 0.5
  denotes “half of the axis size”.
  – If None then equivalent to 0.0 unless translate_px has a value other than None.
  – If a single number, then that value will be used for all images.
  – If a tuple (a, b), then a value will be uniformly sampled per image from the interval
    [a, b]. That sampled fraction value will be used identically for both x- and y-axis.
  – If a list, then a random value will be sampled from that list per image (again, used for
    both x- and y-axis).
- If a StochasticParameter, then from that parameter a value will be sampled per image (again, used for both x- and y-axis).
- If a dictionary, then it is expected to have the keys x and/or y. Each of these keys can have the same values as described above. Using a dictionary allows to set different values for the two axes and sampling will then happen independently per axis, resulting in samples that differ between the axes.

**translate_px** *(None or int or tuple of int or list of int or imgaug.parameters.StochasticParameter or dict {"x": int/tuple/list/StochasticParameter, "y": int/tuple/list/StochasticParameter}, optional)* – Translation in pixels.

- If None then equivalent to 0 unless translate_percent has a value other than None.
- If a single int, then that value will be used for all images.
- If a tuple (a, b), then a value will be uniformly sampled per image from the discrete interval [a..b]. That number will be used identically for both x- and y-axis.
- If a list, then a random value will be sampled from that list per image (again, used for both x- and y-axis).
- If a StochasticParameter, then from that parameter a value will be sampled per image (again, used for both x- and y-axis).
- If a dictionary, then it is expected to have the keys x and/or y. Each of these keys can have the same values as described above. Using a dictionary allows to set different values for the two axes and sampling will then happen independently per axis, resulting in samples that differ between the axes.

**rotate** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Rotation in degrees (NOT radians), i.e. expected value range is around [-360, 360]. Rotation happens around the center of the image, not the top left corner as in some other frameworks.

- If a number, then that value will be used for all images.
- If a tuple (a, b), then a value will be uniformly sampled per image from the interval [a, b] and used as the rotation value.
- If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, then this parameter will be used to sample the rotation value per image.

**shear** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter or dict {"x": int/tuple/list/StochasticParameter, "y": int/tuple/list/StochasticParameter}, optional)* – Shear in degrees (NOT radians), i.e. expected value range is around [-360, 360], with reasonable values being in the range of [-45, 45].

- If a number, then that value will be used for all images as the shear on the x-axis (no shear on the y-axis will be done).
- If a tuple (a, b), then two value will be uniformly sampled per image from the interval [a, b] and be used as the x- and y-shear value.
- If a list, then two random values will be sampled from that list per image, denoting x- and y-shear.
- If a StochasticParameter, then this parameter will be used to sample the x- and y-shear values per image.
- If a dictionary, then similar to translate_percent, i.e. one x key and/or one y key are expected, denoting the shearing on the x- and y-axis respectively. The allowed datatypes are again number, tuple (a, b), list or StochasticParameter.

**order** *(int or iterable of int or imgaug.ALL or imgaug.parameters.StochasticParameter, optional)*

Interpolation order to use. Same meaning as in skimage:
- 0: Nearest-neighbor
- 1: Bi-linear (default)
- 2: Bi-quadratic (not recommended by skimage)
- 3: Bi-cubic
- 4: Bi-quartic
- 5: Bi-quintic

Method 0 and 1 are fast, 3 is a bit slower, 4 and 5 are very slow. If the backend is cv2, the mapping to OpenCV’s interpolation modes is as follows:
- 0 -> cv2.INTER_NEAREST
- 1 -> cv2.INTER_LINEAR
- 2 -> cv2.INTER_CUBIC
- 3 -> cv2.INTER_CUBIC
- 4 -> cv2.INTER_CUBIC

As datatypes this parameter accepts:
- If a single int, then that order will be used for all images.
- If a list, then a random value will be sampled from that list per image.
- If imgaug.ALL, then equivalent to list [0, 1, 3, 4, 5] in case of backend=skimage and otherwise [0, 1, 3].
- If StochasticParameter, then that parameter is queried per image to sample the order value to use.

**cval** *(number or tuple of number or list of number or imgaug.ALL or imgaug.parameters.StochasticParameter, optional)*
The constant value to use when filling in newly created pixels. (E.g. translating by 1px to the right will create a new 1px-wide column of pixels on the left of the image). The value is only used when mode=constant. The expected value range is [0, 255] for uint8 images. It may be a float value.
- If this is a single number, then that value will be used (e.g. 0 results in black pixels).
- If a tuple (a, b), then three values (for three image channels) will be uniformly sampled per image from the interval [a, b].
- If a list, then a random value will be sampled from that list per image.
- If imgaug.ALL then equivalent to tuple ‘(0, 255)’.
- If a StochasticParameter, a new value will be sampled from the parameter per image.
• **mode** *(str or list of str or imgaug.ALL or imgaug.parameters.StochasticParameter, optional)*
  – Method to use when filling in newly created pixels. Same meaning as in `skimage` (and `numpy.pad()`):
    - `constant`: Pads with a constant value
    - `edge`: Pads with the edge values of array
    - `symmetric`: Pads with the reflection of the vector mirrored along the edge of the array.
    - `reflect`: Pads with the reflection of the vector mirrored on the first and last values of the vector along each axis.
    - `wrap`: Pads with the wrap of the vector along the axis. The first values are used to pad the end and the end values are used to pad the beginning.

  If `cv2` is chosen as the backend the mapping is as follows:
    - `constant` -> `cv2.BORDER_CONSTANT`
    - `edge` -> `cv2.BORDER_REPLICATE`
    - `symmetric` -> `cv2.BORDER_REFLECT`
    - `reflect` -> `cv2.BORDER_REFLECT_101`
    - `wrap` -> `cv2.BORDER_WRAP`

  The datatype of the parameter may be:
    - If a single string, then that mode will be used for all images.
    - If a list of strings, then a random mode will be picked from that list per image.
    - If `imgaug.ALL`, then a random mode from all possible modes will be picked.
    - If `StochasticParameter`, then the mode will be sampled from that parameter per image, i.e. it must return only the above mentioned strings.

• **fit_output** *(bool, optional)* – Whether to modify the affine transformation so that the whole output image is always contained in the image plane (True) or accept parts of the image being outside the image plane (False). This can be thought of as first applying the affine transformation and then applying a second transformation to “zoom in” on the new image so that it fits the image plane. This is useful to avoid corners of the image being outside of the image plane after applying rotations. It will however negate translation and scaling. Note also that activating this may lead to image sizes differing from the input image sizes. To avoid this, wrap `Affine` in `KeepSizeByResize`, e.g. `KeepSizeByResize(Affine(...))`.

• **backend** *(str, optional)* – Framework to use as a backend. Valid values are `auto`, `skimage` (scikit-image’s warp) and `cv2` (OpenCV’s warp). If `auto` is used, the augmenter will automatically try to use `cv2` whenever possible (order must be in `[0, 1, 3]`). It will silently fall back to `skimage` if `order/dtype` is not supported by `cv2`. `cv2` is generally faster than `skimage`. It also supports RGB `cvals`, while `skimage` will resort to intensity `cvals` (i.e. 3x the same value as RGB). If `cv2` is chosen and order is 2 or 4, it will automatically fall back to order 3.

• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.  

• **name** *(None or str, optional)* – See `__init__()`.  

---

**13.29. imgaug.augmenters.geometric**
• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Affine(scale=2.0)
```

Zoom in on all images by a factor of 2.

```python
>>> aug = iaa.Affine(translate_px=16)
```

Translate all images on the x- and y-axis by 16 pixels (towards the bottom right) and fill up any new pixels with zero (black values).

```python
>>> aug = iaa.Affine(translate_percent=0.1)
```

Translate all images on the x- and y-axis by 10 percent of their width/height (towards the bottom right). The pixel values are computed per axis based on that axis’ size. Fill up any new pixels with zero (black values).

```python
>>> aug = iaa.Affine(rotate=35)
```

Rotate all images by 35 degrees. Fill up any new pixels with zero (black values).

```python
>>> aug = iaa.Affine(shear=15)
```

Shear all images by 15 degrees. Fill up any new pixels with zero (black values).

```python
>>> aug = iaa.Affine(translate_px=(-16, 16))
```

Translate all images on the x- and y-axis by a random value between −16 and 16 pixels (to the bottom right) and fill up any new pixels with zero (black values). The translation value is sampled once per image and is the same for both axis.

```python
>>> aug = iaa.Affine(translate_px={"x": (-16, 16), "y": (-4, 4)})
```

Translate all images on the x-axis by a random value between −16 and 16 pixels (to the right) and on the y-axis by a random value between −4 and 4 pixels to the bottom. The sampling happens independently per axis, so even if both intervals were identical, the sampled axis-wise values would likely be different. This also fills up any new pixels with zero (black values).

```python
>>> aug = iaa.Affine(translate_px={"x": (-16, 16), "y": (-4, 4)})
```

Same as in the above `scale` example, but uses (randomly) either nearest neighbour interpolation or linear interpolation. If `order` is not specified, `order=1` would be used by default.

```python
>>> aug = iaa.Affine(translate_px=16, cval=(0, 255))
```
Same as in the `translate_px` example above, but newly created pixels are now filled with a random color (sampled once per image and the same for all newly created pixels within that image).

```python
>>> aug = iaa.Affine(translate_px=16, mode=["constant", "edge"])
```

Similar to the previous example, but the newly created pixels are filled with black pixels in half of all images (mode `constant` with default `cval` being 0) and in the other half of all images using `edge` mode, which repeats the color of the spatially closest pixel of the corresponding image edge.

```python
>>> aug = iaa.Affine(shear={"y": (-45, 45)})
```

Shear images only on the y-axis. Set `shear` to `shear=(-45, 45)` to shear randomly on both axes, using for each image the same sample for both the x- and y-axis. Use `shear={"x": (-45, 45), "y": (-45, 45)}` to get independent samples per axis.

**Methods**

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
</table>
| `__call__` | Alias for `augment()`.
| `augment(self, *args, **kwargs)` | Augment a single image.
| `augment_batch(self, batch[, hooks])` | Augment a single batch.
| `augment_batches(self, batch[, hooks])` | Augment multiple batches.
| `augment_bounding_boxes(self, batch[, parents, hooks])` | Augment a batch of bounding boxes.
| `augment_heatmaps(self, heatmaps[, parents, ...])` | Augment a batch of heatmaps.
| `augment_image(self, image[, hooks])` | Augment a single image.
| `augment_images(self, images[, hooks])` | Augment a batch of images.
| `augment_keypoints(self, keypoints_on_images)` | Augment a batch of keypoints/landmarks.
| `augment_line_strings(self, batch[, parents, hooks])` | Augment a batch of line strings.
| `augment_polygons(self, polygons_on_images[, ...])` | Augment a batch of polygons.
| `augment_segmentation_maps(self, segmaps[, ...])` | Augment a batch of segmentation maps.
| `copy(self)` | Create a shallow copy of this Augmenter instance.
| `copy_random_state(self, source[, recursive, ...])` | Copy the RNGs from a source augmenter sequence.
| `copy_random_state_(self, source[, ...])` | Copy the RNGs from a source augmenter sequence (in-place).
| `deepcopy(self)` | Create a deep copy of this Augmenter instance.
| `draw_grid(self, images, rows, cols)` | Augment images and draw the results as a single grid-like image.
| `find_augmenters(self, func[, parents, flat])` | Find augmenters that match a condition.
| `find_augmenters_by_name(self, name[, regex, ...])` | Find augmenter(s) by name.
| `find_augmenters_by_names(self, names[, ...])` | Find augmenter(s) by names.
| `get_all_children(self[, flat])` | Get all children of this augmenter as a list.
| `get_children_lists(self)` | Get a list of lists of children of this augmenter.

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<table>
<thead>
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<td><code>get_parameters(self)</code></td>
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<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self[, parents])</code></td>
<td>Removed.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
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<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**get_parameters (self)**
See `get_parameters()`.

**class** `imgaug.augmenters.geometric.AffineCv2(scale=1.0, translate_percent=None, translate_px=None, rotate=0.0, shear=0.0, order=<MagicMock id='140084674614104'>, cval=0, mode=<MagicMock id='140084674585152'>, seed=None, name=None, random_state='deprecated', deterministic='deprecated')`

**Bases:** `imgaug.augmenters.meta.Augmenter`

**Deprecated.** Augmenter to apply affine transformations to images using cv2 (i.e. opencv) backend.

**Warning:** This augmenter is deprecated since 0.4.0. Use `Affine(..., backend='cv2')` instead.

Affine transformations involve:
- Translation (“move” image on the x-/y-axis)
- Rotation
- Scaling (“zoom” in/out)
- Shear (move one side of the image, turning a square into a trapezoid)

All such transformations can create “new” pixels in the image without a defined content, e.g. if the image is translated to the left, pixels are created on the right. A method has to be defined to deal with these pixel values. The parameters `cval` and `mode` of this class deal with this.

Some transformations involve interpolations between several pixels of the input image to generate output pixel values. The parameter `order` deals with the method of interpolation used for this.

Deprecated since 0.4.0.

**Supported dtypes:**
- `uint8`: yes; fully tested
- `uint16`: ?
- `uint32`: ?
- `uint64`: ?
- `int8`: ?
- `int16`: ?
- `int32`: ?
- `int64`: ?
- `float16`: ?
- `float32`: ?
- `float64`: ?
- `float128`: ?
- `bool`: ?

**Parameters**

- `scale` *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter or dict {“x”: number/tuple/list/StochasticParameter, “y”: number/tuple/list/StochasticParameter}, optional)* – Scaling factor to use, where 1.0 denotes “no change” and 0.5 is zoomed out to 50 percent of the original size.
  - If a single number, then that value will be used for all images.
  - If a tuple `(a, b)`, then a value will be uniformly sampled per image from the interval `[a, b]`. That value will be used identically for both x- and y-axis.
  - If a list, then a random value will be sampled from that list per image (again, used for both x- and y-axis).
  - If a StochasticParameter, then from that parameter a value will be sampled per image (again, used for both x- and y-axis).
  - If a dictionary, then it is expected to have the keys `x` and/or `y`. Each of these keys can have the same values as described above. Using a dictionary allows to set different values for the two axis and sampling will then happen *independently* per axis, resulting in samples that differ between the axes.

- `translate_percent` *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter or dict {“x”: number/tuple/list/StochasticParameter, “y”: number/tuple/list/StochasticParameter}, optional)* – Translation as a fraction of the image height/width (x-translation, y-translation), where 0 denotes “no change” and 0.5 denotes “half of the axis size”.
  - If None then equivalent to 0.0 unless `translate_px` has a value other than None.
  - If a single number, then that value will be used for all images.
  - If a tuple `(a, b)`, then a value will be uniformly sampled per image from the interval `[a, b]`. That sampled fraction value will be used identically for both x- and y-axis.
  - If a list, then a random fraction value will be sampled from that list per image (again, used for both x- and y-axis).
– If a StochasticParameter, then from that parameter a value will be sampled per image (again, used for both x- and y-axis).

– If a dictionary, then it is expected to have the keys x and/or y. Each of these keys can have the same values as described above. Using a dictionary allows to set different values for the two axis and sampling will then happen independently per axis, resulting in samples that differ between the axes.

• translate_px (int or tuple of int or list of int or imgaug.parameters.StochasticParameter or dict {"x": int/tuple/list/StochasticParameter, "y": int/tuple/list/StochasticParameter}, optional) –

Translation in pixels.

– If None then equivalent to 0 unless translate_percent has a value other than None.

– If a single int, then that value will be used for all images.

– If a tuple (a, b), then a value will be uniformly sampled per image from the discrete interval [a..b]. That number will be used identically for both x- and y-axis.

– If a list, then a random value will be sampled from that list per image (again, used for both x- and y-axis).

– If a StochasticParameter, then from that parameter a value will be sampled per image (again, used for both x- and y-axis).

– If a dictionary, then it is expected to have the keys x and/or y. Each of these keys can have the same values as described above. Using a dictionary allows to set different values for the two axis and sampling will then happen independently per axis, resulting in samples that differ between the axes.

• rotate (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Rotation in degrees (NOT radians), i.e. expected value range is around [-360, 360]. Rotation happens around the center of the image, not the top left corner as in some other frameworks.

– If a number, then that value will be used for all images.

– If a tuple (a, b), then a value will be uniformly sampled per image from the interval [a, b] and used as the rotation value.

– If a list, then a random value will be sampled from that list per image.

– If a StochasticParameter, then this parameter will be used to sample the rotation value per image.

• shear (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Shear in degrees (NOT radians), i.e. expected value range is around [-360, 360].

– If a number, then that value will be used for all images.

– If a tuple (a, b), then a value will be uniformly sampled per image from the interval [a, b] and be used as the rotation value.

– If a list, then a random value will be sampled from that list per image.

– If a StochasticParameter, then this parameter will be used to sample the shear value per image.

• order (int or list of int or str or list of str or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) –
Interpolation order to use. Allowed are:

- `cv2.INTER_NEAREST` (nearest-neighbor interpolation)
- `cv2.INTER_LINEAR` (bilinear interpolation, used by default)
- `cv2.INTER_CUBIC` (bicubic interpolation over 4x4 pixel neighborhood)
- `cv2.INTER_LANCZOS4`
- `string nearest` (same as `cv2.INTER_NEAREST`)
- `string linear` (same as `cv2.INTER_LINEAR`)
- `string cubic` (same as `cv2.INTER_CUBIC`)
- `string lanczos4` (same as `cv2.INTER_LANCZOS4`)

`INTER_NEAREST` (nearest neighbour interpolation) and `INTER_NEAREST` (linear interpolation) are the fastest.

- If a single `int`, then that order will be used for all images.
- If a string, then it must be one of: nearest, linear, cubic, lanczos4.
- If an iterable of `int/str`, then for each image a random value will be sampled from that iterable (i.e. list of allowed order values).
- If `imgaug.ALL`, then equivalent to list `[cv2.INTER_NEAREST, cv2.INTER_LINEAR, cv2.INTER_CUBIC, cv2.INTER_LANCZOS4]`.
- If a `StochasticParameter`, then that parameter is queried per image to sample the order value to use.

- **cval** *(number or tuple of number or list of number or `imgaug.ALL` or `imgaug.parameters.StochasticParameter`, optional)* – The constant value to use when filling in newly created pixels. (E.g. translating by 1px to the right will create a new 1px-wide column of pixels on the left of the image). The value is only used when `mode=constant`. The expected value range is $[0, 255]$ for `uint8` images. It may be a float value.

  - If this is a single number, then that value will be used (e.g. 0 results in black pixels).
  - If a tuple $(a, b)$, then three values (for three image channels) will be uniformly sampled per image from the interval $[a, b]$.
  - If a list, then a random value will be sampled from that list per image.
  - If `imgaug.ALL` then equivalent to tuple `"(0, 255)`.
  - If a `StochasticParameter`, a new value will be sampled from the parameter per image.

- **mode** *(int or str or list of str or list of int or `imgaug.ALL` or `imgaug.parameters.StochasticParameter`, optional)* – optional Method to use when filling when filling in newly created pixels. Same meaning as in OpenCV’s border mode. Let `abcdefg` be an image’s content and `|` be an image boundary after which new pixels are filled in, then the valid modes and their behaviour are the following:

  - `cv2.BORDER_REPLICATE`:
    - `aaaaaa|abcdefg|hhhhhhh`
  - `cv2.BORDER_REFLECT`:
    - `fedcba|abcdefg|hgfedcb`
  - `cv2.BORDER_REFLECT_101`:
    - `gfedcb|abcdefg|gfedcba`
  - `cv2.BORDER_WRAP`:
    - `cdefgh|abcdefg|abcdefg`
- `cv2.BORDER_CONSTANT`: `iiiiii|abcdefgh|iiiiiii`, where `i` is the defined `cval`.
- `replicate`: Same as `cv2.BORDER_REPLICATE`.
- `reflect`: Same as `cv2.BORDER_REFLECT`.
- `reflect_101`: Same as `cv2.BORDER_REFLECT_101`.
- `wrap`: Same as `cv2.BORDER_WRAP`.
- `constant`: Same as `cv2.BORDER_CONSTANT`.

The datatype of the parameter may be:

- If a single `int`, then it must be one of the `cv2.BORDER_*` constants.
- If a single string, then it must be one of: `replicate`, `reflect`, `reflect_101`, `wrap`, `constant`.
- If a list of `int/str`, then per image a random mode will be picked from that list.
- If `imgaug.ALL`, then a random mode from all possible modes will be picked.
- If `StochasticParameter`, then the mode will be sampled from that parameter per image, i.e. it must return only the above mentioned strings.

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.

- **name** *(None or str, optional)* – See `__init__()`.

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
g = import imgaug.augmenters as iaa
g = iaa.AffineCv2(scale=2.0)
```

Zoom in on all images by a factor of 2.

```python
g = iaa.AffineCv2(translate_px=16)
```

Translate all images on the x- and y-axis by 16 pixels (towards the bottom right) and fill up any new pixels with zero (black values).

```python
g = iaa.AffineCv2(translate_percent=0.1)
```

Translate all images on the x- and y-axis by 10 percent of their width/height (towards the bottom right). The pixel values are computed per axis based on that axis’ size. Fill up any new pixels with zero (black values).
>>> aug = iaa.AffineCv2(rotate=35)

Rotate all images by 35 degrees. Fill up any new pixels with zero (black values).

>>> aug = iaa.AffineCv2(shear=15)

Shear all images by 15 degrees. Fill up any new pixels with zero (black values).

>>> aug = iaa.AffineCv2(translate_px=(-16, 16))

Translate all images on the x- and y-axis by a random value between -16 and 16 pixels (to the bottom right) and fill up any new pixels with zero (black values). The translation value is sampled once per image and is the same for both axis.

>>> aug = iaa.AffineCv2(translate_px=16, cval=(0, 255))

Same as in the translate_px example above, but newly created pixels are now filled with a random color (sampled once per image and the same for all newly created pixels within that image).

>>> aug = iaa.AffineCv2(translate_px=16, mode=["constant", "replicate"])

Similar to the previous example, but the newly created pixels are filled with black pixels in half of all images (mode constant with default cval being 0) and in the other half of all images using replicate mode, which repeats the color of the spatially closest pixel of the corresponding image edge.

Methods

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<td><strong>call</strong></td>
<td>Alias for augment().</td>
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<tr>
<td>augment</td>
<td>Augment a batch.</td>
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<tr>
<td>augment_batch</td>
<td>Augment a single batch in-place.</td>
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<tr>
<td>augment_bounding_boxes</td>
<td>Augment a batch of bounding boxes.</td>
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<tr>
<td>augment_heatmaps</td>
<td>Augment a batch of heatmaps.</td>
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<tr>
<td>augment_image</td>
<td>Augment a single image.</td>
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<tr>
<td>augment_images</td>
<td>Augment a batch of images.</td>
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<tr>
<td>augment_keypoints</td>
<td>Augment a batch of keypoints/landmarks.</td>
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<td><code>augment_line_strings(self, ..., [parents, hooks])</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons(self, polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(self, segmaps[, ...])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(self, source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self[, func[, copy, ...]])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self[, func[, parents]])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a determi-</td>
</tr>
</tbody>
</table>

**get_parameters(self)**

See `get_parameters()`.  

**class** `imgaug.augmenters.geometric.ElasticTransformation(alpha=(0.0, 40.0), sigma=(4.0, 8.0), order=3, cval=0, mode='constant', polygon_recoverer='auto', seed=None, name=None, random_state='deprecated', deterministic='deprecated')`
Bases: `imgaug.augmenters.meta.Augmenter`

Transform images by moving pixels locally around using displacement fields.

The augmenter has the parameters `alpha` and `sigma`. `alpha` controls the strength of the displacement: higher values mean that pixels are moved further. `sigma` controls the smoothness of the displacement: higher values lead to smoother patterns – as if the image was below water – while low values will cause individual pixels to be moved very differently from their neighbours, leading to noisy and pixelated images.

A relation of 10:1 seems to be good for `alpha` and `sigma`, e.g. `alpha=10` and `sigma=1` or `alpha=50`, `sigma=5`. For 128x128 a setting of `alpha=(0, 70.0), sigma=(4.0, 6.0)` may be a good choice and will lead to a water-like effect.

Code here was initially inspired by https://gist.github.com/chsasank/4d8f68caf01f041a6453e67fb30f8f5a

For a detailed explanation, see

Simard, Steinkraus and Platt
Best Practices for Convolutional Neural Networks applied to Visual Document Analysis
in Proc. of the International Conference on Document Analysis and Recognition, 2003

**Note:** For coordinate-based inputs (keypoints, bounding boxes, polygons, ...), this augmenter still has to perform an image-based augmentation, which will make it significantly slower for such inputs than other augmenters. See *Performance*.

**Supported dtypes:**

- `uint8`: yes; fully tested (1)
- `uint16`: yes; tested (1)
- `uint32`: yes; tested (2)
- `uint64`: limited; tested (3)
- `int8`: yes; tested (1) (4) (5)
- `int16`: yes; tested (4) (6)
- `int32`: yes; tested (4) (6)
- `int64`: limited; tested (3)
- `float16`: yes; tested (1)
- `float32`: yes; tested (1)
- `float64`: yes; tested (1)
- `float128`: no
- `bool`: yes; tested (1) (7)

  - (1) Always handled by cv2.
  - (2) Always handled by scipy.
  - (3) Only supported for `order != 0`. Will fail for `order=0`.
  - (4) Mapped internally to float64 when `order=1`.
  - (5) Mapped internally to int16 when `order>=2`.
• (6) Handled by \texttt{cv2} when order=0 or order=1, otherwise by \texttt{scipy}.

• (7) Mapped internally to \texttt{float32}.

Parameters

• **alpha** (number or tuple of number or list of number or \texttt{imgaug.parameters.StochasticParameter}, optional) – Strength of the distortion field. Higher values mean that pixels are moved further with respect to the distortion field’s direction. Set this to around 10 times the value of \texttt{sigma} for visible effects.
  - If number, then that value will be used for all images.
  - If tuple \((a, b)\), then a random value will be uniformly sampled per image from the interval \([a, b]\).
  - If a list, then for each image a random value will be sampled from that list.
  - If \texttt{StochasticParameter}, then that parameter will be used to sample a value per image.

• **sigma** (number or tuple of number or list of number or \texttt{imgaug.parameters.StochasticParameter}, optional) – Standard deviation of the gaussian kernel used to smooth the distortion fields. Higher values (for 128x128 images around 5.0) lead to more water-like effects, while lower values (for 128x128 images around 1.0 and lower) lead to more noisy, pixelated images. Set this to around 1/10th of \texttt{alpha} for visible effects.
  - If number, then that value will be used for all images.
  - If tuple \((a, b)\), then a random value will be uniformly sampled per image from the interval \([a, b]\).
  - If a list, then for each image a random value will be sampled from that list.
  - If \texttt{StochasticParameter}, then that parameter will be used to sample a value per image.

• **order** (int or list of int or \texttt{imgaug.ALL} or \texttt{imgaug.parameters.StochasticParameter}, optional) – Interpolation order to use. Same meaning as in \texttt{scipy.ndimage.map_coordinates()} and may take any integer value in the range 0 to 5, where orders close to 0 are faster.
  - If a single int, then that order will be used for all images.
  - If a tuple \((a, b)\), then a random value will be uniformly sampled per image from the interval \([a, b]\).
  - If a list, then for each image a random value will be sampled from that list.
  - If \texttt{imgaug.ALL}, then equivalent to list \([0, 1, 2, 3, 4, 5]\).
  - If \texttt{StochasticParameter}, then that parameter is queried per image to sample the order value to use.

• **cval** (number or tuple of number or list of number or \texttt{imgaug.ALL} or \texttt{imgaug.parameters.StochasticParameter}, optional) – The constant intensity value used to fill in new pixels. This value is only used if \texttt{mode} is set to \texttt{constant}. For standard uint8 images (value range 0 to 255), this value may also should also be in the range 0 to 255. It may be a \texttt{float} value, even for images with integer dtypes.
  - If this is a single number, then that value will be used (e.g. 0 results in black pixels).
- If a tuple \((a, b)\), then a random value will be uniformly sampled per image from the interval \([a, b]\).

- If a list, then a random value will be picked from that list per image.

- If \texttt{imgaug.ALL}, a value from the discrete range \([0..255]\) will be sampled per image.

- If a \texttt{StochasticParameter}, a new value will be sampled from the parameter per image.

- \textbf{mode} (\texttt{str or list of str or imgaug.ALL or imgaug.parameters.StochasticParameter, optional})
  - Parameter that defines the handling of newly created pixels. May take the same values as \texttt{scipy.ndimage.map_coordinates()}, i.e. \texttt{constant, nearest, reflect} or \texttt{wrap}.
  - If a single string, then that mode will be used for all images.
  - If a list of strings, then per image a random mode will be picked from that list.
  - If \texttt{imgaug.ALL}, then a random mode from all possible modes will be picked.
  - If \texttt{StochasticParameter}, then the mode will be sampled from that parameter per image, i.e. it must return only the above mentioned strings.

- \textbf{polygon_recoverer} (\texttt{‘auto’ or None or imgaug.augmentables.polygons._ConcavePolygonRecoverer, optional}) – The class to use to repair invalid polygons. If \texttt{‘auto’}, a new instance of \texttt{imgaug.augmentables.polygons._ConcavePolygonRecoverer} will be created. If \texttt{None}, no polygon recoverer will be used. If an object, then that object will be used and must provide a \texttt{recover_from()} method, similar to \texttt{_ConcavePolygonRecoverer}.

- \textbf{seed} (\texttt{None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional}) – See \texttt{__init__}().

- \textbf{name} (\texttt{None or str, optional}) – See \texttt{__init__}().

- \textbf{random_state} (\texttt{None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional}) – Old name for parameter \texttt{seed}. Its usage will not yet cause a deprecation warning, but it is still recommended to use \texttt{seed} now. Outdated since 0.4.0.

- \textbf{deterministic} (\texttt{bool, optional}) – Deprecated since 0.4.0. See method \texttt{to_deterministic()} for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.ElasticTransformation(alpha=50.0, sigma=5.0)
```

Apply elastic transformations with a strength/alpha of 50.0 and smoothness of 5.0 to all images.

```python
>>> aug = iaa.ElasticTransformation(alpha=(0.0, 70.0), sigma=5.0)
```

Apply elastic transformations with a strength/alpha that comes from the interval \([0.0, 70.0]\) (randomly picked per image) and with a smoothness of 5.0.
## Methods

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<td>augment</td>
<td>Augment a batch.</td>
</tr>
<tr>
<td>augment_batch</td>
<td>Augment a single batch in-place.</td>
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<td>Remove this augmenter or children that match a condition.</td>
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<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>reseed</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>seed_</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><strong>Deprecated</strong></td>
<td></td>
</tr>
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<table>
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<tbody>
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<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>

```
KEYPOINT_AUG_ALPHA_THRESH = 0.05
KEYPOINT_AUG_SIGMA_THRESH = 1.0
NB_NEIGHBOURING_KEYPOINTS = 3
NEIGHBOURING_KEYPOINTS_DISTANCE = 1.0
```

```python
def get_parameters(self):
    See get_parameters().
```

```python
class imgaug.augmenters.geometric.Jigsaw(nb_rows=(3, 10), nb_cols=(3, 10), max_steps=1, allow_pad=True, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.meta.Augmenter`

Move cells within images similar to jigsaw patterns.

**Note:** This augmenter will by default pad images until their height is a multiple of `nb_rows`. Analogous for `nb_cols`.

**Note:** This augmenter will resize heatmaps and segmentation maps to the image size, then apply similar padding as for the corresponding images and resize back to the original map size. That also means that images may change in shape (due to padding), but heatmaps/segmaps will not change. For heatmaps/segmaps, this deviates from pad augmenters that will change images and heatmaps/segmaps in corresponding ways and then keep the heatmaps/segmaps at the new size.

**Warning:** This augmenter currently only supports augmentation of images, heatmaps, segmentation maps and keypoints. Other augmentables, i.e. bounding boxes, polygons and line strings, will result in errors.

Added in 0.4.0.

**Supported dtypes:**

See `apply_jigsaw()`.

**Parameters**

- **`nb_rows`** *(int or list of int or tuple of int or imgaug.parameters.StochasticParameter, optional)*

  How many rows the jigsaw pattern should have.

  - If a single `int`, then that value will be used for all images.
  - If a tuple `(a, b)`, then a random value will be uniformly sampled per image from the discrete interval `[a..b]`.
  - If a list, then for each image a random value will be sampled from that list.
- If \texttt{StochasticParameter}, then that parameter is queried per image to sample the value to use.

- **\texttt{nb\_cols}** (\texttt{int} or list of \texttt{int} or tuple of \texttt{int} or \texttt{imgaug.parameters.StochasticParameter}, optional) –
  How many cols the jigsaw pattern should have.
  - If a single \texttt{int}, then that value will be used for all images.
  - If a tuple \texttt{(a, b)}, then a random value will be uniformly sampled per image from the discrete interval \texttt{[a..b]}.
  - If a list, then for each image a random value will be sampled from that list.
  - If \texttt{StochasticParameter}, then that parameter is queried per image to sample the value to use.

- **\texttt{max\_steps}** (\texttt{int} or list of \texttt{int} or tuple of \texttt{int} or \texttt{imgaug.parameters.StochasticParameter}, optional) –
  How many steps each jigsaw cell may be moved.
  - If a single \texttt{int}, then that value will be used for all images.
  - If a tuple \texttt{(a, b)}, then a random value will be uniformly sampled per image from the discrete interval \texttt{[a..b]}.
  - If a list, then for each image a random value will be sampled from that list.
  - If \texttt{StochasticParameter}, then that parameter is queried per image to sample the value to use.

- **\texttt{allow\_pad}** (\texttt{bool}, optional) – Whether to allow automatically padding images until they are evenly divisible by \texttt{nb\_rows} and \texttt{nb\_cols}.

- **\texttt{seed}** (None or \texttt{int} or \texttt{imgaug.random.RNG} or \texttt{numpy.random.Generator} or \texttt{numpy.random.BitGenerator} or \texttt{numpy.random.SeedSequence} or \texttt{numpy.random.RandomState}, optional) – See \texttt{__init__()}.  

- **\texttt{name}** (None or \texttt{str}, optional) – See \texttt{__init__()}.  

- **\texttt{random\_state}** (None or \texttt{int} or \texttt{imgaug.random.RNG} or \texttt{numpy.random.Generator} or \texttt{numpy.random.BitGenerator} or \texttt{numpy.random.SeedSequence} or \texttt{numpy.random.RandomState}, optional) – Old name for parameter \texttt{seed}. Its usage will not yet cause a deprecation warning, but it is still recommended to use \texttt{seed} now. Outdated since 0.4.0.

- **\texttt{deterministic}** (\texttt{bool}, optional) – Deprecated since 0.4.0. See method \texttt{to\_deterministic()} for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Jigsaw(nb_rows=10, nb_cols=10)
```

Create a jigsaw augmenter that splits images into 10x10 cells and shifts them around by 0 to 2 steps (default setting).

```python
>>> aug = iaa.Jigsaw(nb_rows=(1, 4), nb_cols=(1, 4))
```
Create a jigsaw augmenter that splits each image into 1 to 4 cells along each axis.

```python
>>> aug = iaa.Jigsaw(nb_rows=10, nb_cols=10, max_steps=(1, 5))
```

Create a jigsaw augmenter that moves the cells in each image by a random amount between 1 and 5 times (decided per image). Some images will be barely changed, some will be fairly distorted.

**Methods**

- `__call__`(self, *args, **kwargs) Alias for `augment()`.
- `augment`(self, return_batch, hooks) Augment a batch.
- `augment_batch`(self, batch[, hooks]) Deprecated.
- `augment_batch_(self, batch[, parents, hooks])` Augment a single batch in-place.
- `augment_batches`(self, batches[, hooks]) Augment multiple batches.
- `augment_bounding_boxes`(self, ...[, parents, ...]) Augment a batch of bounding boxes.
- `augment_heatmaps`(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
- `augment_image`(self, image[, hooks]) Augment a single image.
- `augment_images`(self, images[, parents, hooks]) Augment a batch of images.
- `augment_keypoints`(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
- `augment_line_strings`(self, ...[, parents, hooks]) Augment a batch of line strings.
- `augment_polygons`(self, polygons_on_images[, ...]) Augment a batch of polygons.
- `augment_segmentation_maps`(self, segmaps[, ...]) Augment a batch of segmentation maps.
- `copy`(self) Create a shallow copy of this Augmenter instance.
- `copy_random_state`(self, source[, recursive, ...]) Copy the RNGs from a source augmenter sequence.
- `copy_random_state_`(self[, recursive]) Copy the RNGs from a source augmenter sequence (in-place).
- `deepcopy`(self) Create a deep copy of this Augmenter instance.
- `draw_grid`(self, images, rows, cols) Augment images and draw the results as a single grid-like image.
- `find_augmenters`(self, func[, parents, flat]) Find augmenters that match a condition.
- `find_augmenters_by_name`(self, name[, regex,...]) Find augmenter(s) by name.
- `find_augmenters_by_names`(self, names[, ...]) Find augmenter(s) by names.
- `get_all_children`(self[, flat]) Get all children of this augmenter as a list.
- `get_children_lists`(self) Get a list of lists of children of this augmenter.
- `get_parameters`(self) Get the parameters of this augmenter.
- `localize_random_state`(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
- `localize_random_state_`(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
- `pool`(self[, processes, maxtasksperchild, seed]) Create a pool used for multicore augmentation.
- `remove_augmenters`(self, func[, copy,...]) Remove this augmenter or children that match a condition.
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<table>
<thead>
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</tr>
<tr>
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<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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**get_parameters(self)**
Get the parameters of this augmenter.

**Returns** List of parameters of arbitrary types (usually child class of StochasticParameter, but not guaranteed to be).

**Return type** list

```python
class imgaug.augmenters.geometric.PerspectiveTransform(scale=(0.0, 0.06), cval=0, mode='constant', keep_size=True, fit_output=False, polygon_recoverer='auto', seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases:** imgaug.augmenters.meta.Augmenter

Apply random four point perspective transformations to images.

Each of the four points is placed on the image using a random distance from its respective corner. The distance is sampled from a normal distribution. As a result, most transformations don’t change the image very much, while some “focus” on polygons far inside the image.

The results of this augmenter have some similarity with Crop.

**Code partially from** http://www.pyimagesearch.com/2014/08/25/4-point-opencv-getperspective-transform-example/

**Supported dtypes:**

if (keep_size=False):

- uint8: yes; fully tested
- uint16: yes; tested
- uint32: no (1)
- uint64: no (2)
- int8: yes; tested (3)
- int16: yes; tested
- int32: no (2)
- int64: no (2)
- float16: yes; tested (4)
- float32: yes; tested
- float64: yes; tested
- float128: no (1)
- bool: yes; tested (4)
  
  (1) rejected by opencv
  
  (2) leads to opencv error: cv2.error: OpenCV(3.4.4) (...)imgwarp.cpp:1805: error: (-215:Assertion failed) ifunc != 0 in function 'remap'.

  (3) mapped internally to int16.

  (4) mapped internally to float32.

if (keep_size=True):

    minimum of ( imgaug.augmenters.geometric.PerspectiveTransform(keep_size=False),
                imresize_many_images() )

Parameters

- scale (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Standard deviation of the normal distributions. These are used to sample the random distances of the subimage’s corners from the full image’s corners. The sampled values reflect percentage values (with respect to image height/width). Recommended values are in the range 0.0 to 0.1.
  
  - If a single number, then that value will always be used as the scale.
  
  - If a tuple (a, b) of numbers, then a random value will be uniformly sampled per image from the interval (a, b).

  - If a list, then a random value will be picked from the list per image.

  - If a StochasticParameter, then that parameter will be queried to draw one value per image.

- keep_size (bool, optional) – Whether to resize image’s back to their original size after applying the perspective transform. If set to False, the resulting images may end up having different shapes and will always be a list, never an array.

- cval (number or tuple of number or list of number or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – The constant value used to fill up pixels in the result image that didn’t exist in the input image (e.g. when translating to the left, some new pixels are created at the right). Such a fill-up with a constant value only happens, when mode is constant. The expected value range is [0, 255] for uint8 images. It may be a float value.
  
  - If this is a single int or float, then that value will be used (e.g. 0 results in black pixels).
  
  - If a tuple (a, b), then a random value is uniformly sampled per image from the interval [a, b].

  - If a list, then a random value will be sampled from that list per image.

  - If imgaug.ALL, then equivalent to tuple (0, 255).
- If a StochasticParameter, a new value will be sampled from the parameter per image.

- **mode** *(int or str or list of str or list of int or imgaug.ALL or imgaug.parameters.StochasticParameter, optional)* – Parameter that defines the handling of newly created pixels. Same meaning as in OpenCV’s border mode. Let abcdefgh be an image’s content and | be an image boundary, then:
  - cv2.BORDER_REPLICATE: aaaaa|abcdefgh|hhhhhhh
  - cv2.BORDER_CONSTANT: iiiiii|abcdefgh|iiiiiii, where i is the defined cval.

- replicate: Same as cv2.BORDER_REPLICATE.
- constant: Same as cv2.BORDER_CONSTANT.

  The datatype of the parameter may be:
  - If a single int, then it must be one of cv2.BORDER_.*.
  - If a single string, then it must be one of: replicate, reflect, reflect_101, wrap, constant.
  - If a list of ints/strings, then per image a random mode will be picked from that list.
  - If imgaug.ALL, then a random mode from all possible modes will be picked per image.
  - If StochasticParameter, then the mode will be sampled only the above mentioned strings.

- **fit_output** *(bool, optional)* – If True, the image plane size and position will be adjusted to still capture the whole image after perspective transformation. (Followed by image resizing if keep_size is set to True.) Otherwise, parts of the transformed image may be outside of the image plane. This setting should not be set to True when using large scale values as it could lead to very large images.

  Added in 0.4.0.

- **polygon_recoverer** *(‘auto’ or None or imgaug.augmentables.polygons._ConcavePolygonRecoverer, optional)* – The class to use to repair invalid polygons. If "auto", a new instance of :class:`imgaug.augmentables.polygons._ConcavePolygonRecoverer` will be created. If None, no polygon recoverer will be used. If an object, then that object will be used and must provide a recover_from() method, similar to _ConcavePolygonRecoverer.

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.
Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.PerspectiveTransform(scale=(0.01, 0.15))
```

Apply perspective transformations using a random scale between 0.01 and 0.15 per image, where the scale is roughly a measure of how far the perspective transformation’s corner points may be distanced from the image’s corner points. Higher scale values lead to stronger “zoom-in” effects (and thereby stronger distortions).

```python
>>> aug = iaa.PerspectiveTransform(scale=(0.01, 0.15), keep_size=False)
```

Same as in the previous example, but images are not resized back to the input image size after augmentation. This will lead to smaller output images.

Methods

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<td>augment_batch (self, batch[, parents, hooks])</td>
<td>Augment a single batch in-place.</td>
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<tr>
<td>augment_batches (self, batches[, hooks, ...])</td>
<td>Augment multiple batches.</td>
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<td>augment_bounding_boxes (self, ...[, parents, ...])</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
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<td>Remove this augmenter or children that match a condition.</td>
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<tr>
<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
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<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
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<td>show_grid(self, images, rows, cols)</td>
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**get_parameters**(self)

See `get_parameters()`.

```python
class imgaug.augmenters.geometric.PiecewiseAffine(scale=(0.0, 0.04), nb_rows=(2, 4), nb_cols=(2, 4), order=1, cval=0, mode='constant', absolute_scale=False, polygon_recoverer=None, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.meta.Augmenter`

Apply affine transformations that differ between local neighbourhoods.

This augmenter places a regular grid of points on an image and randomly moves the neighbourhood of these points around via affine transformations. This leads to local distortions.

This is mostly a wrapper around scikit-image’s `PiecewiseAffine`. See also `Affine` for a similar technique.

**Note:** This augmenter is very slow. See `Performance`. Try to use `ElasticTransformation` instead, which is at least 10x faster.

**Note:** For coordinate-based inputs (keypoints, bounding boxes, polygons, ...), this augmenter still has to perform an image-based augmentation, which will make it significantly slower for such inputs than other augmenters. See `Performance`.

**Supported dtypes:**

- `uint8`: yes; fully tested
- `uint16`: yes; tested (1)
- `uint32`: yes; tested (1) (2)
- `uint64`: no (3)
- int8: yes; tested (1)
- int16: yes; tested (1)
- int32: yes; tested (1) (2)
- int64: no (3)
- float16: yes; tested (1)
- float32: yes; tested (1)
- float64: yes; tested (1)
- float128: no (3)
- bool: yes; tested (1) (4)

(1) Only tested with order set to 0.
(2) scikit-image converts internally to float64, which might introduce inaccuracies. Tests showed that these inaccuracies seemed to not be an issue.
(3) Results too inaccurate.
(4) Mapped internally to float64.

Parameters

- **scale** *(float or tuple of float or imgaug.parameters.StochasticParameter, optional)* – Each point on the regular grid is moved around via a normal distribution. This scale factor is equivalent to the normal distribution’s sigma. Note that the jitter (how far each point is moved in which direction) is multiplied by the height/width of the image if `absolute_scale=False` (default), so this scale can be the same for different sized images. Recommended values are in the range 0.01 to 0.05 (weak to strong augmentations).
  - If a single float, then that value will always be used as the scale.
  - If a tuple (a, b) of floats, then a random value will be uniformly sampled per image from the interval [a, b].
  - If a list, then a random value will be picked from that list per image.
  - If a StochasticParameter, then that parameter will be queried to draw one value per image.

- **nb_rows** *(int or tuple of int or imgaug.parameters.StochasticParameter, optional)* – Number of rows of points that the regular grid should have. Must be at least 2. For large images, you might want to pick a higher value than 4. You might have to then adjust scale to lower values.
  - If a single int, then that value will always be used as the number of rows.
  - If a tuple (a, b), then a value from the discrete interval [a..b] will be uniformly sampled per image.
  - If a list, then a random value will be picked from that list per image.
  - If a StochasticParameter, then that parameter will be queried to draw one value per image.

- **nb_cols** *(int or tuple of int or imgaug.parameters.StochasticParameter, optional)* – Number of columns. Analogous to `nb_rows`. 
• **order** (int or list of int or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See `__init__()`.

• **cval** (int or float or tuple of float or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See `__init__()`.

• **mode** (str or list of str or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See `__init__()`.

• **absolute_scale** (bool, optional) – Take `scale` as an absolute value rather than a relative value.

• **polygon_recoverer** ('auto' or None or imgaug.augmentables.polygons._ConcavePolygonRecoverer, optional) – The class to use to repair invalid polygons. If "auto", a new instance of :class:`imgaug.augmentables.polygons._ConcavePolygonRecoverer` will be created. If None, no polygon recoverer will be used. If an object, then that object will be used and must provide a `recover_from()` method, similar to `_ConcavePolygonRecoverer`.

• **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See `__init__()`.

• **name** (None or str, optional) – See `__init__()`.

• **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

• **deterministic** (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.PiecewiseAffine(scale=(0.01, 0.05))
```

Place a regular grid of points on each image and then randomly move each point around by 1 to 5 percent (with respect to the image height/width). Pixels between these points will be moved accordingly.

```python
>>> aug = iaa.PiecewiseAffine(scale=(0.01, 0.05), nb_rows=8, nb_cols=8)
```

Same as the previous example, but uses a denser grid of 8x8 points (default is 4x4). This can be useful for large images.

### Methods

```python
__call__(self, *args, **kwargs) Alias for `augment()`.
```  
```python
augment(self[, return_batch, hooks]) Augment a batch.
```  
```python
augment_batch(self[, batch[, hooks]]) Deprecated.
```  
```python
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
```  
```python
augment_batches(self[, batches[, parents, ...]]) Augment multiple batches.
```  
```python
augment_bounding_boxes(self, ...[, parents, ...]) Augment a batch of bounding boxes.
```  
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<th>Description</th>
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<td>Augment a batch of heatmaps.</td>
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<tr>
<td>augment_image</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td>augment_images</td>
<td>Augment a batch of images.</td>
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<tr>
<td>augment_keypoints</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td>augment_polygons</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation_maps</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>copy</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state</td>
<td>Copy the RNGs from a source Augmenter sequence.</td>
</tr>
<tr>
<td>copy_random_state_</td>
<td>Copy the RNGs from a source Augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy</td>
<td>Create a deep copy of this Augmenter instance.</td>
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<tr>
<td>draw_grid</td>
<td>Augment images and draw the results as a single grid-like image.</td>
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<tr>
<td>find_augmenters</td>
<td>Find augmenters that match a condition.</td>
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<tr>
<td>find_augmenters_by_name</td>
<td>Find augmenter(s) by name.</td>
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<tr>
<td>find_augmenters_by_names</td>
<td>Find augmenter(s) by names.</td>
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<tr>
<td>get_all_children</td>
<td>Get all children of this Augmenter as a list.</td>
</tr>
<tr>
<td>get_children_lists</td>
<td>Get a list of lists of children of this Augmenter.</td>
</tr>
<tr>
<td>get_parameters</td>
<td>See get_parameters().</td>
</tr>
<tr>
<td>localize_random_state</td>
<td>Assign augmenter-specific RNGs to this Augmenter and its children.</td>
</tr>
<tr>
<td>localize_random_state_</td>
<td>Assign augmenter-specific RNGs to this Augmenter and its children.</td>
</tr>
<tr>
<td>pool</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters</td>
<td>Remove this Augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace</td>
<td>Remove in-place children of this Augmenter that match a condition.</td>
</tr>
<tr>
<td>reseed</td>
<td>Deprecated.</td>
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<tr>
<td>seed</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>show_grid</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic</td>
<td>Convert this Augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

get_parameters (self)
See get_parameters().

class imgaug.augmenters.geometric.Rot90 (k=1, keep_size=True, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.meta.Augmenter
Rotate images clockwise by multiples of 90 degrees.

This could also be achieved using Affine, but Rot90 is significantly more efficient.

**Supported dtypes:**

```
if (keep_size=False):
  • uint8: yes; fully tested
  • uint16: yes; tested
  • uint32: yes; tested
  • uint64: yes; tested
  • int8: yes; tested
  • int16: yes; tested
  • int32: yes; tested
  • int64: yes; tested
  • float16: yes; tested
  • float32: yes; tested
  • float64: yes; tested
  • float128: yes; tested
  • bool: yes; tested

if (keep_size=True):
  minimum of ( imgaug.augmenters.geometric.Rot90(keep_size=False),
                imresize_many_images() )
```

**Parameters**

- **k** (int or list of int or tuple of int or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) –
  How often to rotate clockwise by 90 degrees.
  - If a single int, then that value will be used for all images.
  - If a tuple (a, b), then a random value will be uniformly sampled per image from the discrete interval [a..b].
  - If a list, then for each image a random value will be sampled from that list.
  - If imgaug.ALL, then equivalent to list [0, 1, 2, 3].
  - If StochasticParameter, then that parameter is queried per image to sample the value to use.

- **keep_size** (bool, optional) – After rotation by an odd-valued k (e.g. 1 or 3), the resulting image may have a different height/width than the original image. If this parameter is set to True, then the rotated image will be resized to the input image’s size. Note that this might also cause the augmented image to look distorted.

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().
• **name** *(None or str, optional)* – See *__init__()__.

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Rot90(1)
```

Rotate all images by 90 degrees. Resize these images afterwards to keep the size that they had before augmentation. This may cause the images to look distorted.

```python
>>> aug = iaa.Rot90([1, 3])
```

Rotate all images by 90 or 270 degrees. Resize these images afterwards to keep the size that they had before augmentation. This may cause the images to look distorted.

```python
>>> aug = iaa.Rot90((1, 3))
```

Rotate all images by 90, 180 or 270 degrees. Resize these images afterwards to keep the size that they had before augmentation. This may cause the images to look distorted.

```python
>>> aug = iaa.Rot90((1, 3), keep_size=False)
```

Rotate all images by 90, 180 or 270 degrees. Does not resize to the original image size afterwards, i.e. each image’s size may change.

### Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
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<tbody>
<tr>
<td><code>__call__</code></td>
<td>Alias for <code>augment()</code></td>
</tr>
<tr>
<td><code>augment(self[, return_batch, hooks])</code></td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><code>augment_batch(self[, batch[, hooks]])</code></td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><code>augment_bounding_boxes(self[, ...[, parents, ...]])</code></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps(self[, heatmaps[, parents, ...]])</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(self[, image[, hooks]])</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images(self[, parents, hooks])</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints(self[, ...[, parents, ...]])</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings(self[, ...[, parents, hooks]])</code></td>
<td>Augment a batch of line strings.</td>
</tr>
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<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>augment_polygons(self, polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(self, segmaps[, ...])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(self, source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(self, source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence</td>
</tr>
<tr>
<td></td>
<td>(in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single</td>
</tr>
<tr>
<td></td>
<td>grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[, name[, regex,...]])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code></td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter</td>
</tr>
<tr>
<td></td>
<td>and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter</td>
</tr>
<tr>
<td></td>
<td>and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy,...])</code></td>
<td>Remove this augmenter or children that match a</td>
</tr>
<tr>
<td></td>
<td>condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that</td>
</tr>
<tr>
<td></td>
<td>match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single</td>
</tr>
<tr>
<td></td>
<td>grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a</td>
</tr>
<tr>
<td></td>
<td>deterministic one.</td>
</tr>
</tbody>
</table>

**get_parameters**

See `get_parameters()`.

**class** `imgaug.augmenters.geometric.Rotate`

```
(imgaug.augmenters.geometric.Rotate(rotate=(-30, 30), order=1, cval=0, mode='constant', fit_output=False, backend='auto', seed=None, name=None, random_state='deprecated', deterministic='deprecated'))
```

**Bases:** `imgaug.augmenters.geometric.Affine`

Apply affine rotation on the y-axis to input data.

This is a wrapper around `Affine`. It is the same as `Affine(rotate=<value>)`.

Added in 0.4.0.

**Supported dtypes:**
See Affine.

Parameters

- **rotate** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See Affine.
- **order** (int or iterable of int or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See Affine.
- **cval** (number or tuple of number or list of number or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See Affine.
- **mode** (str or list of str or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See Affine.
- **fit_output** (bool, optional) – See Affine.
- **backend** (str, optional) – See Affine.
- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().
- **name** (None or str, optional) – See __init__().
- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Rotate((-45, 45))
```

Create an augmenter that rotates images by a random value between -45 and 45 degrees.

Methods

```python
__call__(self, *args, **kwargs)  # Alias for augment().
augment(self[, return_batch, hooks])  # Augment a batch.
augment_batch(self[, batch[, hooks]])  # Deprecated.
augment_batch_(self, batch[, parents, hooks])  # Augment a single batch in-place.
augment_batches(self, batches[, parents,...])  # Augment multiple batches.
augment_bounding_boxes(self, ...[, parents,...])  # Augment a batch of bounding boxes.
augment_heatmaps(self, heatmaps[, parents, ...])  # Augment a batch of heatmaps.
augment_image(self, image[, hooks])  # Augment a single image.
augment_images(self, images[, parents, hooks])  # Augment a batch of images.
```
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<th>Method</th>
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<td>augment_keypoints</td>
<td>Augment a batch of keypoints/landmarks.</td>
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<tr>
<td>augment_line_strings</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td>augment_polygons</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation_maps</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>copy</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td>copy_random_state_</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy</td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td>draw_grid</td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td>find_augmenters</td>
<td>Find augmenters that match a condition.</td>
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<tr>
<td>find_augmenters_by_name</td>
<td>Find augmenter(s) by name.</td>
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<tr>
<td>find_augmenters_by_names</td>
<td>Find augmenter(s) by names.</td>
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<tr>
<td>get_all_children</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td>get_children_lists</td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td>get_parameters</td>
<td>See get_parameters().</td>
</tr>
<tr>
<td>localize_random_state</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>localize_random_state_</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>pool</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>reseed</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>show_grid</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**class** imgaug.augmenters.geometric.ScaleX

```
class imgaug.augmenters.geometric.ScaleX(scale=(0.5, 1.5), order=1, cval=0,
mode='constant', fit_output=False, backend='auto', seed=None, name=None,
random_state='deprecated', deterministic='deprecated')
```

**Bases:** imgaug.augmenters.geometric.Affine

Apply affine scaling on the x-axis to input data.

This is a wrapper around Affine.

Added in 0.4.0.
Supported dtypes:

See Affine.

Parameters

- **scale** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Analogous to scale in Affine, except that this scale value only affects the x-axis. No dictionary input is allowed.

- **order** *(int or iterable of int or imgaug.ALL or imgaug.parameters.StochasticParameter, optional)* – See Affine.

- **cval** *(number or tuple of number or list of number or imgaug.ALL or imgaug.parameters.StochasticParameter, optional)* – See Affine.

- **mode** *(str or list of str or imgaug.ALL or imgaug.parameters.StochasticParameter, optional)* – See Affine.

- **fit_output** *(bool, optional)* – See Affine.

- **backend** *(str, optional)* – See Affine.

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See __init__().

- **name** *(None or str, optional)* – See __init__().

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.ScaleX((0.5, 1.5))

Create an augmenter that scales images along the width to sizes between 50% and 150%. This does not change the image shape (i.e. height and width), only the pixels within the image are remapped and potentially new ones are filled in.

Methods

<table>
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<tr>
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<tr>
<td><strong>call</strong></td>
<td>Alias for augment().</td>
</tr>
<tr>
<td>augment(self[, return_batch, hooks])</td>
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<tr>
<td>augment_batch(self[, batch[, hooks]])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>augment_batch__(self, batch[, parents, hooks])</td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td>augment_batches(self, batch[, hooks,...])</td>
<td>Augment multiple batches.</td>
</tr>
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<td>augment_heatmaps</td>
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<td>augment_image</td>
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<td>augment_segmentation_maps</td>
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<tr>
<td>copy</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td>copy_random_state_(in-place)</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
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<td>Augment images and draw the results as a single grid-like image.</td>
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<tr>
<td>localize_random_state</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td>localize_random_state_(in-place)</td>
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<td>Create a pool used for multicore augmentation.</td>
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<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
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<td>reseed</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>
class imgaug.augmenters.geometric.ScaleY(scale=(0.5, 1.5), order=1, cval=0, mode='constant', fit_output=False, backend='auto', seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.geometric.Affine

Apply affine scaling on the y-axis to input data.

This is a wrapper around Affine.

Added in 0.4.0.

Supported dtypes:

See Affine.

Parameters

- **scale** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Analogous to scale in Affine, except that this scale value only affects the y-axis. No dictionary input is allowed.

- **order** (int or iterable of int or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See Affine.

- **cval** (number or tuple of number or list of number or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See Affine.

- **mode** (str or list of str or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See Affine.

- **fit_output** (bool, optional) – See Affine.

- **backend** (str, optional) – See Affine.

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- **name** (None or str, optional) – See __init__().

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.ScaleY((0.5, 1.5))
```

Create an augmenter that scales images along the height to sizes between 50% and 150%. This does not change the image shape (i.e. height and width), only the pixels within the image are remapped and potentially new ones are filled in.
### Methods

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<td><code>augment_heatmaps(self[, heatmaps[, parents, ...]])</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(self[, image[, hooks]])</code></td>
<td>Augment a single image.</td>
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<td><code>augment_images(self[, images[, parents, hooks]])</code></td>
<td>Augment a batch of images.</td>
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<td>Augment a batch of line strings.</td>
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<td><code>augment_polygons(self[, polygons_on_images[, ...]])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
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<td><code>augment_segmentation_maps(self[, segmaps[, ...]])</code></td>
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<td><code>copy(self)</code></td>
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Continued on next page
show_grid(self, images, rows, cols) Augment images and plot the results as a single grid-like image.

to_deterministic(self[, n]) Convert this augmenter from a stochastic to a deterministic one.

**class** imgaug.augmenters.geometric.ShearX(shear=(-30, 30), order=1, cval=0, mode='constant', fit_output=False, backend='auto', seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.geometric.Affine

Apply affine shear on the x-axis to input data.

This is a wrapper around Affine.

Added in 0.4.0.

**Supported dtypes:**

See Affine.

**Parameters**

- **shear** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Analogous to shear in Affine, except that this shear value only affects the x-axis. No dictionary input is allowed.

- **order** *(int or iterable of int or imgaug.ALL or imgaug.parameters.StochasticParameter, optional)* – See Affine.

- **cval** *(number or tuple of number or list of number or imgaug.ALL or imgaug.parameters.StochasticParameter, optional)* – See Affine.

- **mode** *(str or list of str or imgaug.ALL or imgaug.parameters.StochasticParameter, optional)* – See Affine.

- **fit_output** *(bool, optional)* – See Affine.

- **backend** *(str, optional)* – See Affine.

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See **init**().

- **name** *(None or str, optional)* – See **init**().

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.
### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.ShearX((-20, 20))
```

Create an augmenter that shears images along the x-axis by random amounts between −20 and 20 degrees.

### Methods

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remove_augmenters(self, func[, copy,...]) Remove this augmenter or children that match a condition.

remove_augmenters_(self, func[, parents]) Remove in-place children of this augmenter that match a condition.

remove_augmenters_inplace(self, func[, parents]) Deprecated.

reseed(self[, random_state, deterministic_too]) Deprecated.

seed_(self[, entropy, deterministic_too]) Seed this augmenter and all of its children.

show_grid(self, images, rows, cols) Augment images and plot the results as a single grid-like image.

to_deterministic(self[, n]) Convert this augmenter from a stochastic to a deterministic one.

class imgaug.augmenters.geometric.ShearY(shear=(-30, 30), order=1, cval=0, mode='constant', fit_output=False, backend='auto', seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.geometric.Affine

Apply affine shear on the y-axis to input data.

This is a wrapper around Affine.

Added in 0.4.0.

Supported dtypes:

See Affine.

Parameters

- shear (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Analogous to shear in Affine, except that this shear value only affects the y-axis. No dictionary input is allowed.

- order (int or iterable of int or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See Affine.

- cval (number or tuple of number or list of number or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See Affine.

- mode (str or list of str or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See Affine.

- fit_output (bool, optional) – See Affine.

- backend (str, optional) – See Affine.

- seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- name (None or str, optional) – See __init__().

- random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. It’s usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.ShearY((-20, 20))
```

Create an augmenter that shears images along the y-axis by random amounts between \(-20\) and \(20\) degrees.

### Methods

- `__call__` *(self, *args, **kwargs)* – Alias for `augment()`.
- `augment(self, return_batch, hooks)` – Augment a batch.
- `augment_batch(self, batch, hooks)` – Deprecated.
- `augment_batch_(self, batch, parents, hooks)` – Augment a single batch in-place.
- `augment_bounding_boxes(self, ...[, parents, ...])` – Augment a batch of bounding boxes.
- `augment_heatmaps(self, heatmaps, parents, ...)` – Augment a batch of heatmaps.
- `augment_image(self, image, hooks)` – Augment a single image.
- `augment_images(self, images, parents, hooks)` – Augment a batch of images.
- `augment_keypoints(self, keypoints_on_images)` – Augment a batch of keypoints/landmarks.
- `augment_line_strings(self, ...[, parents, hooks])` – Augment a batch of line strings.
- `augment_polygons(self, polygons_on_images)` – Augment a batch of polygons.
- `augment_segmentation_maps(self, segmaps)` – Augment a batch of segmentation maps.
- `copy(self)` – Create a shallow copy of this Augmenter instance.
- `copy_random_state(source[, recursive, ...])` – Copy the RNGs from a source augmenter sequence.
- `copy_random_state_(self, source[, ...])` – Copy the RNGs from a source augmenter sequence (in-place).
- `deepcopy(self)` – Create a deep copy of this Augmenter instance.
- `draw_grid(self, images, rows, cols)` – Augment images and draw the results as a single grid-like image.
- `find_augmenters(self, func[, parents, flat])` – Find augmenters that match a condition.
- `find_augmenters_by_name(self, name[, regex, ...])` – Find augmenter(s) by name.
- `find_augmenters_by_names(self, names[, ...])` – Find augmenter(s) by names.
- `get_all_children(self[, flat])` – Get all children of this augmenter as a list.
- `get_children_lists(self)` – Get a list of lists of children of this augmenter.
- `get_parameters(self)` – See `get_parameters()`.
- `localize_random_state(self[, recursive])` – Assign augmenter-specific RNGs to this augmenter and its children.
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```python
class imgaug.augmenters.geometric.TranslateX(percent=None, px=None, order=1, cval=0, mode='constant', fit_output=False, backend='auto', seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases:** `imgaug.augmenters.geometric.Affine`

Apply affine translation on the x-axis to input data.

This is a wrapper around `Affine`.

Added in 0.4.0.

**Supported dtypes:**

See `Affine`.

**Parameters**

- **percent** (None or number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Analogous to `translate_percent` in `Affine`, except that this translation value only affects the x-axis. No dictionary input is allowed.

- **px** (None or int or tuple of int or list of int or imgaug.parameters.StochasticParameter or dict {"x": int/tuple/list/StochasticParameter, "y": int/tuple/list/StochasticParameter}, optional) – Analogous to `translate_px` in `Affine`, except that this translation value only affects the x-axis. No dictionary input is allowed.

- **order** (int or iterable of int or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See `Affine`.

- **cval** (number or tuple of number or list of number or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See `Affine`.

- **mode** (str or list of str or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See `Affine`.

- **fit_output** (bool, optional) – See `Affine`.

- **backend** (str, optional) – See `Affine`.
• **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See `__init__()`.

• **name** (None or str, optional) – See `__init__()`.

• **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

• **deterministic** (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.TranslateX(px=(-20, 20))
Create an augmenter that translates images along the x-axis by -20 to 20 pixels.

>>> aug = iaa.TranslateX(percent=(-0.1, 0.1))
Create an augmenter that translates images along the x-axis by -10% to 10% (relative to the x-axis size).
```

### Methods

- `__call__(self, *args, **kwargs)` Alias for `augment()`.
- `augment(self[, return_batch, hooks])` Augment a batch.
- `augment_batch(self[, batch[, hooks]])` Deprecated.
- `augment_batch_(self, batch[, parents, hooks])` Augment a single batch in-place.
- `augment_batches(self, batches[, hooks])` Augment multiple batches.
- `augment_bounding_boxes(self, ...[, parents, ...])` Augment a batch of bounding boxes.
- `augment_heatmaps(self, heatmaps[, parents, ...])` Augment a batch of heatmaps.
- `augment_image(self, image[, hooks])` Augment a single image.
- `augment_images(self, images[, parents, hooks])` Augment a batch of images.
- `augment_keypoints(self, keypoints_on_images)` Augment a batch of keypoints/landmarks.
- `augment_line_strings(self, ...[, parents, hooks])` Augment a batch of line strings.
- `augment_polygons(self, polygons_on_images[, ...])` Augment a batch of polygons.
- `augment_segmentation_maps(self, segmaps[, ...])` Augment a batch of segmentation maps.
- `copy(self)` Create a shallow copy of this Augmenter instance.
- `copy_random_state(self, source[, recursive, ...])` Copy the RNGs from a source augmenter sequence.

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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>copy_random_state_(self, source[, …])</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy(self)</td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td>draw_grid(self, images, rows, cols)</td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td>find_augmenters(self, func[, parents, flat])</td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td>find_augmenters_by_name(self, name[, regex, …])</td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td>find_augmenters_by_names(self, names[, …])</td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td>get_all_children(self[, flat])</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td>get_children_lists(self)</td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td>localize_random_state_(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>pool(self[, processes, maxtasksperchild, seed])</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters_(self, func[, copy, …])</td>
<td>Remove this augmentor or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self[, func[, parents]])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>reseed_(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic_(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**class** `imgaug.augmenters.geometric.TranslateY`  
(\texttt{percent=\text{None}, \text{px=\text{None}, order=1, cva}l=0, \text{mode=’constant’, fit_output=False, back-end=’auto’, seed=}\text{None, \text{name=}\text{None, random_state=’\text{deprecated’}, deterministic=’\text{deprecated’)}})

**Bases:** `imgaug.augmenters.geometric.Affine`

Apply affine translation on the y-axis to input data.

This is a wrapper around `Affine`.

Added in 0.4.0.

**Supported dtypes:**

See `Affine`.

**Parameters**

- **percent** (\text{None or number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional}) – Analogous to \text{translate_percent} in `Affine`, except that this translation value only affects the y-axis. No dictionary input is allowed.

- **px** (\text{None or int or tuple of int or list of int or imgaug.parameters.StochasticParameter or})
dict {“x”: int/tuple/list/StochasticParameter, “y”: int/tuple/list/StochasticParameter, optional} – Analogous to translate_px in Affine, except that this translation value only affects the y-axis. No dictionary input is allowed.

• order (int or iterable of int or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See Affine.

• cval (number or tuple of number or list of number or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See Affine.

• mode (str or list of str or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See Affine.

• fit_output (bool, optional) – See Affine.

• backend (str, optional) – See Affine.

• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__.

• name (None or str, optional) – See __init__.

• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.TranslateY(px=(-20, 20))
```

Create an augmenter that translates images along the y-axis by -20 to 20 pixels.

```python
>>> aug = iaa.TranslateY(percent=(-0.1, 0.1))
```

Create an augmenter that translates images along the y-axis by -10% to 10% (relative to the y-axis size).

Methods

```python
__call__ (self, *args, **kwargs) Alias for augment().
augment (self, return_batch, hooks) Augment a batch.
augment_batch (self, batch[, hooks]) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches (self, batch[, hooks, …]) Augment multiple batches.
augment_bounding_boxes (self, …[, parents, …]) Augment a batch of bounding boxes.
augment_heatmaps (self, heatmaps[, parents, …]) Augment a batch of heatmaps.
```

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<table>
<thead>
<tr>
<th>Method (self, [parents, hooks])</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>augment_image(image)</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td>augment_images(images)</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td>augment_keypoints(kepoints_on_images)</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings()</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td>augment_polygons(polygons_on_images)</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation_maps()</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>copy()</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state()</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td>copy_random_state_(source)</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy()</td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td>draw_grid(images, rows, cols)</td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td>find_augmenters(func, [parents, flat])</td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td>find_augmenters_by_name(name, [regex, ...])</td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td>find_augmenters_by_names(names, [flat])</td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td>get_all_children([flat])</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td>get_children_lists()</td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td>get_parameters()</td>
<td>See get_parameters().</td>
</tr>
<tr>
<td>localize_random_state(recursive)</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>localize_random_state_(recursive)</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>pool([processes, maxtasksperchild, seed])</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters(func, [copy, ...])</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_(func, [parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(func, [parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(random_state, deterministic_too)</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed([entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(n)</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**class** imgaug.augmenters.geometric.WithPolarWarping (children, seed=None, name=None, random_state=’deprecated’, deterministic=’deprecated’)

**Bases:** imgaug.augmenters.meta.Augmenter

Augmenter that applies other augmenters in a polar-transformed space.

This augmenter first transforms an image into a polar representation, then applies its child augmenter, then
transforms back to cartesian space. The polar representation is still in the image’s input dtype (i.e. \texttt{uint8} stays \texttt{uint8}) and can be visualized. It can be thought of as an “unrolled” version of the image, where previously circular lines appear straight. Hence, applying child augmenters in that space can lead to circular effects. E.g. replacing rectangular pixel areas in the polar representation with black pixels will lead to curved black areas in the cartesian result.

This augmenter can create new pixels in the image. It will fill these with black pixels. For segmentation maps it will fill with class id \texttt{0}. For heatmaps it will fill with \texttt{0.0}.

This augmenter is limited to arrays with a height and/or width of \texttt{32767} or less.

**Warning:** When augmenting coordinates in polar representation, it is possible that these are shifted outside of the polar image, but are inside the image plane after transforming back to cartesian representation, usually on newly created pixels (i.e. black backgrounds). These coordinates are currently not removed. It is recommended to not use very strong child transformations when also augmenting coordinate-based augmentables.

**Warning:** For bounding boxes, this augmenter suffers from the same problem as affine rotations applied to bounding boxes, i.e. the resulting bounding boxes can have unintuitive (seemingly wrong) appearance. This is due to coordinates being “rotated” that are inside the bounding box, but do not fall on the object and actually are background. It is recommended to use this augmenter with caution when augmenting bounding boxes.

**Warning:** For polygons, this augmenter should not be combined with augmenters that perform automatic polygon recovery for invalid polygons, as the polygons will frequently appear broken in polar representation and their “fixed” version will be very broken in cartesian representation. Augmenters that perform such polygon recovery are currently \texttt{PerspectiveTransform}, \texttt{PiecewiseAffine} and \texttt{ElasticTransformation}.

Added in 0.4.0.

**Supported dtypes:**

- \texttt{uint8}: yes; fully tested
- \texttt{uint16}: yes; tested
- \texttt{uint32}: no (1)
- \texttt{uint64}: no (2)
- \texttt{int8}: yes; tested
- \texttt{int16}: yes; tested
- \texttt{int32}: yes; tested
- \texttt{int64}: no (2)
- \texttt{float16}: yes; tested (3)
- \texttt{float32}: yes; tested
- \texttt{float64}: yes; tested
- \texttt{float128}: no (1)
- \texttt{bool}: yes; tested (4)
• (1) OpenCV produces error TypeError: Expected cv::UMat for argument 'src'
• (2) OpenCV produces array of nothing but zeros.
• (3) Mapped to float32.
• (4) Mapped to uint8.

Parameters

• children (imgaug.augmenters.meta.Augmenter or list of imgaug.augmenters.meta.Augmenter or None, optional) – One or more augmenters to apply to images after they were transformed to polar representation.

• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

• name (None or str, optional) – See __init__().

• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.WithPolarWarping(iaa.CropAndPad(percent=(-0.1, 0.1)))
```

Apply cropping and padding in polar representation, then warp back to cartesian representation.

```python
>>> aug = iaa.WithPolarWarping(
>>>     iaa.Affine(
>>>         translate_percent={"x": (-0.2, 0.2), "y": (-0.2, 0.2)},
>>>         rotate=(-35, 35),
>>>         scale=(0.8, 1.2),
>>>         shear={"x": (-15, 15), "y": (-15, 15)}
>>>     )
>>> )
```

Apply affine transformations in polar representation.

```python
>>> aug = iaa.WithPolarWarping(iaa.AveragePooling((2, 8)))
```

Apply average pooling in polar representation. This leads to circular bins.

Methods
<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>__call__</code></td>
<td>Alias for <code>augment()</code>.</td>
</tr>
<tr>
<td><code>augment(self[, return_batch, hooks])</code></td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><code>augment_batch(self[, batch[, hooks]])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>augment_batch(self[, batch[, parents, hooks]])</code></td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><code>augment_batches(self[, batches[, hooks]])</code></td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td><code>augment_bounding_boxes(self[, ...[, parents, ...]])</code></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps(self[, heatmaps[, parents, ...]])</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(self[, image[, hooks]])</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images(self[, images[, parents, hooks]])</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints(self[, keypoints_on_images])</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings(self[, ...[, parents, hooks]])</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons(self[, polygons_on_images[, ...]])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(self[, segmats[, ...]])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(self[, source[, recursive[, ...]])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(self[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self[, images, rows, cols])</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self[, func[, parents[, flat]]])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self[, name[, regex, ...]])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(self[, names[, ...]])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_childern_lists(self)</code></td>
<td>See <code>get_children_lists()</code>.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self[, func[, copy[, ...]])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self[, func[, parents]])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self[, func[, parents]])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self[, images, rows, cols])</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
<tr>
<td><code>warpPolarCoords(src, dsize, center, ...)</code></td>
<td></td>
</tr>
</tbody>
</table>

```python
get_children_lists(self)
    See get_children_lists().

get_parameters(self)
    See get_parameters().
```

```python
classmethod warpPolarCoords(src, dsize, center, maxRadius, flags)
```

```python
imgaug.augmenters.geometric.apply_jigsaw(arr, destinations)
```

Move cells of an image similar to a jigsaw puzzle.

This function will split the image into rows x cols cells and move each cell to the target index given in destinations.

Added in 0.4.0.

**Supported dtypes:**

- uint8: yes; fully tested
- uint16: yes; fully tested
- uint32: yes; fully tested
- uint64: yes; fully tested
- int8: yes; fully tested
- int16: yes; fully tested
- int32: yes; fully tested
- int64: yes; fully tested
- float16: yes; fully tested
- float32: yes; fully tested
- float64: yes; fully tested
- float128: yes; fully tested
- bool: yes; fully tested

**Parameters**

- `arr (ndarray)` – Array with at least two dimensions denoting height and width.
- `destinations (ndarray)` – 2-dimensional array containing for each cell the id of the destination cell. The order is expected to be flattened c-order, i.e. row by row. The height of the image must be evenly divisible by the number of rows in this array. Analogous for the width and columns.

**Returns** Modified image with cells moved according to destinations.

**Return type** ndarray

```python
imgaug.augmenters.geometric.apply_jigsaw_to_coords(coords, destinations, image_shape)
```

Move coordinates on an image similar to a jigsaw puzzle.
This is the same as `apply_jigsaw()`, but moves coordinates within the cells.

Added in 0.4.0.

**Parameters**

- `coords (ndarray)` – \((N, 2)\) array denoting xy-coordinates.
- `destinations (ndarray)` – See `apply_jigsaw()`.
- `image_shape (tuple of int)` – \((\text{height, width, } \ldots)\) shape of the image on which the coordinates are placed. Only height and width are required.

**Returns** Moved coordinates.

**Return type** ndarray

```python
imgaug.augmenters.geometric.generate_jigsaw_destinations(nb_rows, nb_cols, max_steps, seed, connectivity=4)
```

Generate a destination pattern for `apply_jigsaw()`.

Added in 0.4.0.

**Parameters**

- `nb_rows (int)` – Number of rows to split the image into.
- `nb_cols (int)` – Number of columns to split the image into.
- `max_steps (int)` – Maximum number of cells that each cell may be moved.
- `seed` (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState) – Seed value or alternatively RNG to use. If None the global RNG will be used.
- `connectivity (int, optional)` – Whether a diagonal move of a cell counts as one step (connectivity=8) or two steps (connectivity=4).

**Returns** 2-dimensional array containing for each cell the id of the target cell.

**Return type** ndarray

### 13.30 `imgaug.augmenters.imgcorruptlike`

Augmenters that wrap methods from `imagecorruptions` package.


The package is derived from [‘https://github.com/hendrycks/robustness’](https://github.com/hendrycks/robustness). The corresponding paper is:

Hendrycks, Dan and Dietterich, Thomas G.
Benchmarking Neural Network Robustness to Common Corruptions and Perturbations

with the newer version being:

Hendrycks, Dan and Dietterich, Thomas G.
Benchmarking Neural Network Robustness to Common Corruptions and Perturbations

List of augmenters:
- GaussianNoise
- ShotNoise
- ImpulseNoise
- SpeckleNoise
- GaussianBlur
- GlassBlur
- DefocusBlur
- MotionBlur
- ZoomBlur
- Fog
- Frost
- Snow
- Spatter
- Contrast
- Brightness
- Saturate
- JpegCompression
- Pixelate
- ElasticTransform

**Note:** The functions provided here have identical outputs to the ones in `imagecorruptions` when called using the `corrupt()` function of that package. E.g. the outputs are always `uint8` and not `float32` or `float64`.

Example usage:

```python
>>> # Skip the doctests in this file as the imagecorruptions package is
>>> # not available in all python versions that are otherwise supported
>>> # by imgaug.
>>> import imgaug as ia
>>> import imgaug.augmenters as iaa
>>> import numpy as np

>>> image = np.zeros((64, 64, 3), dtype=np.uint8)
>>> names, funcs = iaa.imgcorruptlike.get_corruption_names("validation")
>>> for name, func in zip(names, funcs):
...     image_aug = func(image, severity=5, seed=1)
...     image_aug = ia.draw_text(image_aug, x=20, y=20, text=name)
...     ia.imshow(image_aug)
```

Use e.g. `'iaa.imgcorruptlike.GaussianNoise(severity=2)(images=...)` to create and apply a specific augmenter.

Added in 0.4.0.
class imgaug.augmenters.imgcorruptlike.Brightness(severity=(1, 5), seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase

Wrapper around imagecorruptions.corruptions.brightness.

Note: This augmenter only affects images. Other data is not changed.

Added in 0.4.0.

Supported dtypes:

See apply_brightness()

Parameters

- severity (int, optional) – Strength of the corruption, with valid values being 1 <= severity <= 5.
- seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().
- name (None or str, optional) – See __init__().
- random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
- deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.Brightness(severity=2)

Create an augmenter around imagecorruptions.corruptions.brightness. Apply it to images using e.g. aug(images=[image1, image2, ...]).

Methods

__call__(self, *args, **kwargs) Alias for augment().

augment(self, return_batch, hooks) Augment a batch.

augment_batch(self, batch[, hooks]) Deprecated.

augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.

augment_batches(self, batches[, hooks, ...]) Augment multiple batches.

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<td>Augment a batch of keypoints/landmarks.</td>
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<td><code>augment_line_strings</code></td>
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<td><code>augment_segmentation_maps</code></td>
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<tr>
<td><code>copy</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
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<tr>
<td><code>copy_random_state</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
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<td><code>copy_random_state_(in-place)</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters</code></td>
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<tr>
<td><code>get_all_children</code></td>
<td>Get all children of this augmenter as a list.</td>
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<td>Get a list of lists of children of this augmenter.</td>
</tr>
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<td><code>get_parameters</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(in-place)</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(in-place)</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>reseed</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**Previously Available:**
- `remove_augmenters_inplace` (now `remove_augmenters_(in-place)`)
- `to_deterministic` (now `convert_to_deterministic`)
- `pool` (now `create_pool`)
- `localize_random_state` (now `assign_random_state`)
- `deepcopy` (now `create_deep_copy`)
- `copy` (now `create_shallow_copy`)
- `localize_random_state_(in-place)` (now `assign_random_state_(in-place)`)
- `copy_random_state_(in-place)` (now `assign_random_state_(in-place)`)
- `copy_random_state` (now `assign_random_state`)
- `pool` (now `create_pool`)
- `get_children_lists` (now `get_cildren_lists`)
- `get_all_children` (now `get_all_children`)
- `reseed` (now `convert_to_deterministic`)
- `get_parameters` (now `get_parameters()`)
- `find_augmenters_by_name` (now `find_augmenters_by_name(s)`)
- `find_augmenters` (now `find_augmenters(s)`)
class imgaug.augmenters.imgcorruptlike.Contrast(severity=(1, 5), seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase

Wrapper around imagecorruptions.corruptions.contrast.

**Note:** This augmenter only affects images. Other data is not changed.

Added in 0.4.0.

**Supported dtypes:**

See apply_contrast().

**Parameters**

- **severity** *(int, optional)* – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See __init__().

- **name** *(None or str, optional)* – See __init__().

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.Contrast(severity=2)
```

Create an augmenter around imagecorruptions.corruptions.contrast. Apply it to images using e.g. `aug(images=[image1, image2, ...])`.

**Methods**

- **__call__(self, *args, **kwargs)** — Alias for augment().

- **augment(self[, return_batch, hooks])** — Augment a batch.

- **augment_batch(self[, batch[, parents, hooks]])** — Deprecated.

- **augment_batch_(self[, batch[, parents, hooks]])** — Augment a single batch in-place.

- **augment_batches(self[, batches[, hooks, ...]])** — Augment multiple batches.

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<td><code>copy_random_state_inplace</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
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<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>resseed</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>
class `imgaug.augmenters.imgcorruptlike.DefocusBlur`(`severity=(1, 5)`, `seed=None`, `name=None`, `random_state='deprecated'`, `deterministic='deprecated'`)

Bases: `imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase`

Wrapper around `imagecorruptions.corruptions.defocus_blur`.

Note: This augmenter only affects images. Other data is not changed.

Added in 0.4.0.

Supported dtypes:

See `apply_defocus_blur()`.

Parameters

- `severity` (*int*, *optional*) – Strength of the corruption, with valid values being `1 <= severity <= 5`.
- `seed` (*None* or *int* or *imgaug.random.RNG* or *numpy.random.Generator* or *numpy.random.BitGenerator* or *numpy.random.SeedSequence* or *numpy.random.RandomState*, *optional*) – See `__init__()`.  
- `name` (*None* or *str*, *optional*) – See `__init__()`.  
- `random_state` (*None* or *int* or *imgaug.random.RNG* or *numpy.random.Generator* or *numpy.random.BitGenerator* or *numpy.random.SeedSequence* or *numpy.random.RandomState*, *optional*) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
- `deterministic` (*bool*, *optional*) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.DefocusBlur(severity=2)
```

Create an augmenter around `imagecorruptions.corruptions.defocus_blur`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`.

Methods

- `__call__`(self, *args, **kwargs) – Alias for `augment()`.
- `augment`(self, return_batch, hooks) – Augment a batch.
- `augment_batch`(self, batch[, hooks]) – Deprecated.
- `augment_batch_`(self, batch[, parents, hooks]) – Augment a single batch in-place.
- `augment_batches`(self, batches[, hooks, ...]) – Augment multiple batches.
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<td>Augment a batch of bounding boxes.</td>
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<td>augment_heatmaps(self, heatmaps[...])</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td>augment_image(self, image[, hooks])</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td>augment_images(self, images[, parents, hooks])</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td>augment_keypoints(self, keypoints_on_images)</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings(self, ...)</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td>augment_polygons(self, polygons_on_images[, ...])</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation_maps(self, segmaps[...])</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state(self, source[, recursive, ...])</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td>copy_random_state_(self, source[, ...])</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy(self)</td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td>draw_grid(self, images, rows, cols)</td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td>find_augmenters(self, func[, parents, flat])</td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td>find_augmenters_by_name(self, name[, regex, ...])</td>
<td>Find augmenter(s) by name.</td>
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<tr>
<td>find_augmenters_by_names(self, names[, ...])</td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td>get_all_children(self[, flat])</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td>get_children_lists(self)</td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td>get_parameters(self)</td>
<td>See get_parameters().</td>
</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>localize_random_state_(self[, recursive])</td>
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<td>pool(self[, processes, maxtasksperchild, seed])</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters(self, func[, copy, ...])</td>
<td>Remove this augmentor or children that match a condition.</td>
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<tr>
<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>
class imgaug.augmenters.imgcorruptlike.ElasticTransform(severity=(1, 5), seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase

Wrapper around imagecorruptions.corruptions.elastic_transform.

Warning: This augmenter can currently only transform image-data. Batches containing heatmaps, segmentation maps and coordinate-based augmentables will be rejected with an error. Use ElasticTransformation if you have to transform such inputs.

Added in 0.4.0.

Supported dtypes:

See apply_elastic_transform().

Parameters

- severity (int, optional) – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).
- seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().
- name (None or str, optional) – See __init__().
- random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
- deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.ElasticTransform(severity=2)
```

Create an augmenter around imagecorruptions.corruptions.elastic_transform. Apply it to images using e.g. `aug(images=[image1, image2, ...])`.

Methods

- __call__(self, *args, **kwargs) Alias for augment().
- augment(self[, return_batch, hooks]) Augment a batch.

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<td><strong>augment_batch</strong> (self, batch[, hooks])</td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><strong>augment_bounding_boxes</strong> (self, ...[, parents, ...])</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><strong>augment_heatmaps</strong> (self, heatmaps[, parents, ...])</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><strong>augment_image</strong> (self, image[, hooks])</td>
<td>Augment a single image.</td>
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<tr>
<td><strong>augment_images</strong> (self, images[, parents, hooks])</td>
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<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><strong>augment_line_strings</strong> (self, ...[, parents, hooks])</td>
<td>Augment a batch of line strings.</td>
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<tr>
<td><strong>augment_polygons</strong> (self, polygons_on_images[, ...])</td>
<td>Augment a batch of polygons.</td>
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<td>Augment a batch of segmentation maps.</td>
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<td><strong>deepcopy</strong> (self)</td>
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<td><strong>draw_grid</strong> (self, images, rows, cols)</td>
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<td>Find augmenters that match a condition.</td>
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<tr>
<td><strong>find_augmenters_by_name</strong> (self, name[, regex, ...])</td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><strong>find_augmenters_by_names</strong> (self, names[, ...])</td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><strong>get_all_children</strong> (self[, flat])</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><strong>get_children_lists</strong> (self)</td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><strong>get_parameters</strong> (self)</td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><strong>localize_random_state</strong> (self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><strong>localize_random_state_ (self[, recursive])</strong></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><strong>pool</strong> (self, processes, maxtasksperchild, seed)</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><strong>remove_augmenters</strong> (self, func[, copy, ...])</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><strong>remove_augmenters_inplace</strong> (self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><strong>reseed</strong> (self[, random_state, deterministic_too])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
<tr>
<td><strong>seed</strong> (self, entropy, deterministic_too)</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><strong>show_grid</strong> (self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><strong>to_deterministic</strong> (self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>
class imgaug.augmenters.imgcorruptlike.Fog(severity=(1, 5), seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase

Wrapper around imagecorruptions.corruptions.fog.

Note: This augmenter only affects images. Other data is not changed.

Added in 0.4.0.

Supported dtypes:

See apply_fog().

Parameters

- severity (int, optional) – Strength of the corruption, with valid values being $1 \leq \text{severity} \leq 5$.

- seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- name (None or str, optional) – See __init__().

- random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.Fog(severity=2)
```

Create an augmenter around imagecorruptions.corruptions.fog. Apply it to images using e.g. `aug(images=[image1, image2, ...])`.

Methods

__call__ (self, *args, **kwargs)

Alias for augment().

augment(self, return_batch, hooks)

Augment a batch.

augment_batch(self, batch[, hooks])

Deprecated.

augment_batch(self, batch[, parents, hooks])

Augment a single batch in-place.

augment_batches(self, batch[, hooks, ...])

Augment multiple batches.

augment_bounding_boxes(self, ...[, parents, ...])

Augment a batch of bounding boxes.

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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>augment_heatmaps(self, heatmaps[, parents, ...])</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(self, image[, hooks])</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images(self, images[, hooks])</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints(self, keypoints_on_images)</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings(self, ...[, parents, hooks])</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons(self, polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(self, segmaps[, ...])</code></td>
<td>Augment a batch of segmentation maps.</td>
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<tr>
<td><code>copy(self)</code></td>
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</tr>
<tr>
<td><code>copy_random_state(self, source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(self[, recursive])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
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<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
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<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed(self[, entropy, deterministic_too])</code></td>
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<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.imgcorruptlike.Frost(severity=(1, 5), seed=None, name=None,
    random_state='deprecated', deterministic='deprecated')
```

**Bases:** `imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase`

Wrapper around `imagecorruptions.corruptions.frost`. 

13.30. `imgaug.augmenters.imgcorruptlike`
Note: This augmenter only affects images. Other data is not changed.

Added in 0.4.0.

Supported dtypes:
See apply_frost().

Parameters

- **severity** (int, optional) – Strength of the corruption, with valid values being $1 \leq \text{severity} \leq 5$.

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- **name** (None or str, optional) – See __init__().

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.Frost(severity=2)
```

Create an augmenter around imagecorruptions.corruptions.frost. Apply it to images using e.g. `aug(images=[image1, image2, ...])`.

Methods

```python
__call__(self, *args, **kwargs)  # Alias for augment().
augment(self[, return_batch, hooks])  # Augment a batch.
augment_batch(self[, batch[, hooks]])  # Deprecated.
augment_batch_(self, batch[, parents, hooks])  # Augment a single batch in-place.
augment_batches(self[, batches[, hooks, ...]])  # Augment multiple batches.
augment_bounding_boxes(self[, bounding_boxes[, parents, ...]])  # Augment a batch of bounding boxes.
augment_heatmaps(self[, heatmaps[, parents, ...]])  # Augment a batch of heatmaps.
augment_image(self[, image[, hooks]])  # Augment a single image.
augment_images(self[, images[, parents, hooks]])  # Augment a batch of images.
augment_keypoints(self[, keypoints_on_images[, parents, hooks]])  # Augment a batch of keypoints/landmarks.
```

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<table>
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</tr>
</thead>
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<tr>
<td><code>augment_line_strings(self, ..., parents, hooks)</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons(self, polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
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<td><code>copy_random_state_(self, source[, ...])</code></td>
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<td><code>draw_grid(self, images, rows, cols)</code></td>
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<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
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</tr>
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<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td><code>localize_random_state_(self[, recursive])</code></td>
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<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
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<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
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<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td><strong>Deprecated.</strong></td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td><strong>Deprecated.</strong></td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**class** `imgaug.augmenters.imgcorruptlike.GaussianBlur( severity=(1, 5), seed=None, name=None, random_state='deprecated', deterministic='deprecated' )`

**Bases:** `imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase`

**Wrapper around** `imagecorruptions.corruptions.gaussian_blur`.

**Note:** This augmenter only affects images. Other data is not changed.

Added in 0.4.0.
Supported dtypes:

See `apply_gaussian_blur()`.

Parameters

- **severity** *(int, optional)* – Strength of the corruption, with valid values being \( 1 \leq \text{severity} \leq 5 \).

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.

- **name** *(None or str, optional)* – See `__init__()`.

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.GaussianBlur(severity=2)
```

Create an augmenter around `imagecorruptions.corruptions.gaussian_blur`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`.

Methods

```python
__call__(self, *args, **kwargs) 
**Aliases for augment().**
```

```python
augment(self[, return_batch, hooks]) 
Augment a batch.
```

```python
augment_batch(self[, return_batch, hooks]) 
**Deprecated.**
```

```python
augment_batch_(self, batch[, parents, hooks]) 
Augment a single batch in-place.
```

```python
augment_batches(self, batch[, parents, hooks]) 
Augment multiple batches.
```

```python
augment_bounding_boxes(self[, parents, hooks]) 
Augment a batch of bounding boxes.
```

```python
augment_heatmaps(self[, parents, hooks]) 
Augment a batch of heatmaps.
```

```python
augment_image(self[, image[, hooks]]) 
Augment a single image.
```

```python
augment_images(self[, image[, parents, hooks]]) 
Augment a batch of images.
```

```python
augment_keypoints(self[, parents, hooks]) 
Augment a batch of keypoints/landmarks.
```

```python
augment_line_strings(self[, parents, hooks]) 
Augment a batch of line strings.
```

```python
augment_polygons(self[, polygons_on_images[, parents, hooks]]) 
Augment a batch of polygons.
```

Continued on next page
class imgaug.augmenters.imgcorruptlike.GaussianNoise(severity=(1, 5), seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase

Wrapper around imagecorruptions.corruptions.gaussian_noise.

**Note:** This augmenter only affects images. Other data is not changed.

Added in 0.4.0.

**Supported dtypes:**

See apply_gaussian_noise().

**Parameters**
• **severity** (*int*, optional) – Strength of the corruption, with valid values being $1 \leq \text{severity} \leq 5$.

• **seed** (*None* or *int* or *imgaug.random.RNG* or *numpy.random.Generator* or *numpy.random.BitGenerator* or *numpy.random.SeedSequence* or *numpy.random.RandomState*, optional) – See **__init__()**.

• **name** (*None* or *str*, optional) – See **__init__()**.

• **random_state** (*None* or *int* or *imgaug.random.RNG* or *numpy.random.Generator* or *numpy.random.BitGenerator* or *numpy.random.SeedSequence* or *numpy.random.RandomState*, optional) – Old name for parameter **seed**. Its usage will not yet cause a deprecation warning, but it is still recommended to use **seed** now. Outdated since 0.4.0.

• **deterministic** (*bool*, optional) – Deprecated since 0.4.0. See method **to_deterministic()** for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.GaussianNoise(severity=2)
```

Create an augmenter around `imagecorruptions.corruptions.gaussian_noise`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`.

Methods

```python
__call__(self, *args, **kwargs)  # Alias for augment().

augment(self[, return_batch, hooks])  # Augment a batch.

augment_batch(self[, batch[, hooks]])  # Deprecated.

augment_batch_(self, batch[, parents, hooks])  # Augment a single batch in-place.

augment_batches(self, batches[, hooks, ...])  # Augment multiple batches.

augment_bounding_boxes(self, ...[, parents, ...])  # Augment a batch of bounding boxes.

augment_heatmaps(self, heatmaps[, parents, ...])  # Augment a batch of heatmaps.

augment_image(self, image[, hooks])  # Augment a single image.

augment_images(self, images[, parents, hooks])  # Augment a batch of images.

augment_keypoints(self, keypoints_on_images)  # Augment a batch of keypoints/landmarks.

augment_line_strings(self, ...[, parents, hooks])  # Augment a batch of line strings.

augment_polygons(self, polygons_on_images[, ...])  # Augment a batch of polygons.

augment_segmentation_maps(self, segmaps [, ...])  # Augment a batch of segmentation maps.

copy(self)  # Create a shallow copy of this Augmenter instance.

copy_random_state(self, source[, recursive, ...])  # Copy the RNGs from a source augmenter sequence.
```

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### Table 165 – continued from previous page

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>copy_random_state_(self, source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
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<tr>
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<td><code>to_deterministic_(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>

#### `class imgaug.augmenters.imgcorruptlike.GlassBlur`

```python
class imgaug.augmenters.imgcorruptlike.GlassBlur (severity=(1, 5), seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase`

Wrapper around `imagecorruptions.corruptions.glass_blur`.

**Note:** This augmenter only affects images. Other data is not changed.

Added in 0.4.0.

**Supported dtypes:**

See `apply_glass_blur()`.

**Parameters**

- `severity` *(int, optional)* – Strength of the corruption, with valid values being $1 \leq \text{severity} \leq 5$.
- `seed` *(None or int or `imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or*
numPy.random.RandomState, optional) – See __init__().

- name (None or str, optional) – See __init__().

- random_state (None or int or imgaug.random.RNG or numPy.random.Generator
  or numPy.random.BitGenerator or numPy.random.SeedSequence or
  numPy.random.RandomState, optional) – Old name for parameter seed. Its usage
  will not yet cause a deprecation warning, but it is still recommended to use seed
  now. Outdated since 0.4.0.

- deterministic (bool, optional) – Deprecated since 0.4.0. See method
  to_deterministic() for an alternative and for details about what the “deterministic
  mode” actually does.

Examples

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.GlassBlur(severity=2)
```

Create an augmenter around imagecorruptions.corruptions.glass_blur. Apply it to images using e.g. `aug(images=[image1, image2, ...])`.

Methods

- __call__ (self, *args, **kwargs) Alias for `augment()`.
- augment(self, return_batch, hooks) Augment a batch.
- augment_batch(self, batch[, hooks]) Deprecated.
- augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
- augment_batches(self, batches[, hooks,...]) Augment multiple batches.
- augmentBoundingBoxes(self, [parents, ...]) Augment a batch of bounding boxes.
- augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
- augment_image(self, image[, hooks]) Augment a single image.
- augment_images(self, images[, parents, hooks]) Augment a batch of images.
- augment_keypoints(self, keypoints_on_images[, parents, ...]) Augment a batch of keypoints/landmarks.
- augment_line_strings(self, ...[, parents, hooks]) Augment a batch of line strings.
- augment_polygons(self, polygons_on_images[, parents, ...]) Augment a batch of polygons.
- augment_segmentation_maps(self, segmaps[, ...]) Augment a batch of segmentation maps.
- copy(self) Create a shallow copy of this Augmenter instance.
- copy_random_state(self, source[, recursive,...]) Copy the RNGs from a source augmenter sequence.
- copy_random_state_(self, source,...) Copy the RNGs from a source augmenter sequence (in-place).
- deepcopy(self) Create a deep copy of this Augmenter instance.
- draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.

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### Table 166 – continued from previous page

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
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<tbody>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
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<tr>
<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td><code>localize_random_state_(self[, recursive])</code></td>
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</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**class** `imgaug.augmenters.imgcorruptlike.ImpulseNoise` *(severity=(1, 5), seed=None, name=None, random_state='deprecated', deterministic='deprecated')*

**Bases:** `imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase`

Wrapper around `imagecorruptions.corruptions.impulse_noise`.

**Note:** This augmenter only affects images. Other data is not changed.

Added in 0.4.0.

**Supported dtypes:**

See `apply_impulse_noise()`.

**Parameters**

- **severity** *(int, optional)* – Strength of the corruption, with valid values being $1 \leq \text{severity} \leq 5$.
- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.  
- **name** *(None or str, optional)* – See `__init__()`.  
- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.  

```
13.30. imgaug.augmenters.imgcorruptlike 829
```
numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.ImpulseNoise(severity=2)
```

Create an augmenter around `imagecorruptions.corruptions.impulse_noise`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`.

### Methods

- `__call__`(self, *args, **kwargs) – Alias for `augment()`.
- `augment`(self, return_batch, hooks) – Augment a batch.
- `augment_batch`(self, batch[, hooks]) – Deprecated.
- `augment_batch_(self, batch[, parents, hooks])` – Augment a single batch in-place.
- `augment_batches`(self, batches[, hooks]) – Augment multiple batches.
- `augment_bounding_boxes`(self, ...[, parents, ...]) – Augment a batch of bounding boxes.
- `augment_heatmaps`(self, heatmaps[, parents, ...]) – Augment a batch of heatmaps.
- `augment_image`(self, image[, hooks]) – Augment a single image.
- `augment_images`(self, images[, parents, hooks]) – Augment a batch of images.
- `augment_keypoints`(self, keypoints_on_images) – Augment a batch of keypoints/landmarks.
- `augment_line_strings`(self, ...[, parents, hooks]) – Augment a batch of line strings.
- `augment_polygons`(self, polygons_on_images[, ...]) – Augment a batch of polygons.
- `augment_segmentation_maps`(self, segmaps[, ...]) – Augment a batch of segmentation maps.
- `copy`(self) – Create a shallow copy of this Augmenter instance.
- `copy_random_state`(self, source[, recursive, ...]) – Copy the RNGs from a source augmenter sequence.
- `copy_random_state_(self, source[, ...])` – Copy the RNGs from a source augmenter sequence (in-place).
- `deepcopy`(self) – Create a deep copy of this Augmenter instance.
- `draw_grid`(self, images, rows, cols) – Augment images and draw the results as a single grid-like image.
- `find_augmenters`(self, func[, parents, flat]) – Find augmenters that match a condition.
- `find_augmenters_by_name`(self, name[, regex, ...]) – Find augmenter(s) by name.
- `find_augmenters_by_names`(self, names[, ...]) – Find augmenter(s) by names.
### get_all_children(self[, flat])
Get all children of this augmenter as a list.

### get_children_lists(self)
Get a list of lists of children of this augmenter.

### get_parameters(self)
See `get_parameters()`.

### localize_random_state(self[, recursive])
Assign augmenter-specific RNGs to this augmenter and its children.

### localize_random_state_(self[, recursive])
Assign augmenter-specific RNGs to this augmenter and its children.

### pool(self[, processes, maxtasksperchild, seed])
Create a pool used for multicore augmentation.

### remove_augmenters(self, func[, copy,...])
Remove this augmenter or children that match a condition.

### remove_augmenters_(self, func[, parents])
Remove in-place children of this augmenter that match a condition.

### remove_augmenters_inplace(self, func[, parents])
Deprecated.

### reseed(self[, random_state, deterministic_too])
Deprecated.

### seed_(self[, entropy, deterministic_too])
Seed this augmenter and all of its children.

### show_grid(self, images, rows, cols)
Augment images and plot the results as a single grid-like image.

### to_deterministic(self[, n])
Convert this augmenter from a stochastic to a deterministic one.

## JpegCompression

### class imgaug.augmenters.imgcorruptlike.JpegCompression(severity=(1, 5), seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase

Wrapper around imagecorruptions.corruptions.jpeg_compression.

**Note:** This augmenter only affects images. Other data is not changed.

Added in 0.4.0.

**Supported dtypes:**

See `apply_jpeg_compression()`.

**Parameters**

- **severity** (`int`, `optional`) – Strength of the corruption, with valid values being `1 <= severity <= 5`.
- **seed** (`None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional`) – See `__init__()`.
- **name** (`None or str, optional`) – See `__init__()`.
- **random_state** (`None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional`) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.JpegCompression(severity=2)
```

Create an augmenter around `imagecorruptions.corruptions.jpeg_compression`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`.

### Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
</table>
| `_call_` | Alias for `augment()`.
| `augment` | Augment a batch.
| `augment_batch` | Augment a single batch in-place. (Deprecated.)
| `augment_batch_(self, batch[, parents, hooks])` | Augment multiple batches.
| `augment_bounding_boxes(self, ...[, parents, ...])` | Augment a batch of bounding boxes.
| `augment_heatmaps` | Augment a batch of heatmaps.
| `augment_image` | Augment a single image.
| `augment_images` | Augment a batch of images.
| `augment_keypoints(self, keypoints_on_images)` | Augment a batch of keypoints/landmarks.
| `augment_line_strings` | Augment a batch of line strings.
| `augment_polygons` | Augment a batch of polygons.
| `augment_segmentation_maps` | Augment a batch of segmentation maps.
| `copy` | Create a shallow copy of this Augmenter instance.
| `copy_random_state` | Copy the RNGs from a source augmenter sequence.
| `copy_random_state_(self, source[, recursive, ...])` | Copy the RNGs from a source augmenter sequence (in-place).
| `deepcopy` | Create a deep copy of this Augmenter instance.
| `draw_grid` | Augment images and draw the results as a single grid-like image.
| `find_augmenters` | Find augmenters that match a condition.
| `find_augmenters_by_name` | Find augmenter(s) by name.
| `find_augmenters_by_names` | Find augmenter(s) by names.
| `get_all_children` | Get all children of this augmenter as a list.
| `get_children_lists` | Get a list of lists of children of this augmenter.
| `get_parameters` | See `get_parameters()`.

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localize_random_state(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.

localize_random_state_(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.

pool(self[, processes, maxtasksperchild, seed]) Create a pool used for multicore augmentation.

remove_augmenters(self, func[, copy, ...]) Remove this augmenter or children that match a condition.

remove_augmenters_(self, func[, parents]) Remove in-place children of this augmenter that match a condition.

remove_augmenters_inplace(self, func[, parents]) Deprecated.

reseed(self[, random_state, deterministic_too]) Deprecated.

seed_(self[, entropy, deterministic_too]) Seed this augmenter and all of its children.

show_grid(self, images, rows, cols) Augment images and plot the results as a single grid-like image.

to_deterministic(self[, n]) Convert this augmenter from a stochastic to a deterministic one.

class imgaug.augmenters.imgcorruptlike.MotionBlur(severity=(1, 5), seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase

Wrapper around imagecorruptions.corruptions.motion_blur.

Note: This augmenter only affects images. Other data is not changed.

Added in 0.4.0.

Supported dtypes:
See apply_motion_blur().

Parameters

• severity (int, optional) – Strength of the corruption, with valid values being 1 <= severity <= 5.

• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

• name (None or str, optional) – See __init__().

• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.
Examples

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.MotionBlur(severity=2)
```

Create an augmenter around `imagecorruptions.corruptions.motion_blur`. Apply it to images using e.g. `aug(images=[image1, image2, ...]).`

Methods

- `__call__`(self, *args, **kwargs) Alias for `augment()`.
- `augment`(self, return_batch, hooks) Augment a batch.
- `augment_batch`(self, batch[, hooks]) Deprecated.
- `augment_batch_(self, batch[, parents, hooks])` Augment a single batch in-place.
- `augment_batches`(self, batches[, hooks]) Augment multiple batches.
- `augment_bounding_boxes`(self, [...[, parents, ...]]) Augment a batch of bounding boxes.
- `augment_heatmaps`(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
- `augment_image`(self, image[, hooks]) Augment a single image.
- `augment_images`(self, images[, parents, hooks]) Augment a batch of images.
- `augment_keypoints`(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
- `augment_line_strings`(self, [...[, parents, hooks]]) Augment a batch of line strings.
- `augment_polygons`(self, polygons_on_images[, ...]) Augment a batch of polygons.
- `augment_segmentation_maps`(self, segmaps[, ...]) Augment a batch of segmentation maps.
- `copy`(self) Create a shallow copy of this Augmenter instance.
- `copy_random_state`(self[, source[, recursive]]) Copy the RNGs from a source augmenter sequence.
- `copy_random_state_(self[, recursive])` Copy the RNGs from a source augmenter sequence (in-place).
- `deepcopy`(self) Create a deep copy of this Augmenter instance.
- `draw_grid`(self, images, rows, cols) Augment images and draw the results as a single grid-like image.
- `find_augmenters`(self, func[, parents, flat]) Find augmenters that match a condition.
- `find_augmenters_by_name`(self, name[, regex, ...]) Find augmenter(s) by name.
- `find_augmenters_by_names`(self, names[, ...]) Find augmenter(s) by names.
- `get_all_children`(self[, flat]) Get all children of this augmenter as a list.
- `get_children_lists`(self) Get a list of lists of children of this augmenter.
- `get_parameters`(self) See `get_parameters()`.
- `localize_random_state`(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
- `localize_random_state_(self[, recursive])` Assign augmenter-specific RNGs to this augmenter and its children.
- `pool`(self, processes, maxtasksperchild, seed) Create a pool used for multicore augmentation.

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<tbody>
<tr>
<td><code>remove_augmenters(self, func[, copy,...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
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</table>

**class** `imgaug.augmenters.imgcorruptlike.Pixelate` *(severity=(1, 5), seed=None, name=None, random_state='deprecated', deterministic='deprecated')*

Bases: `imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase`

Wrapper around `imagecorruptions.corruptions.pixelate`.

**Note:** This augmenter only affects images. Other data is not changed.

Added in 0.4.0.

**Supported dtypes:**

See `apply_pixelate()`.

**Parameters**

- **severity (int, optional)** – Strength of the corruption, with valid values being `1 <= severity <= 5`.
- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.
- **name** *(None or str, optional)* – See `__init__()`.
- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.Pixelate(severity=2)
```
Create an augmenter around `imagecorruptions.corruptions.pixelate`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`.

**Methods**

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<tbody>
<tr>
<td><code>__call__</code></td>
<td>Alias for <code>augment()</code>.</td>
</tr>
<tr>
<td><code>augment(self[, return_batch, hooks])</code></td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><code>augment_batch(self[, batch, hooks])</code></td>
<td><code>Deprecated</code>.</td>
</tr>
<tr>
<td><code>augment_batch_(self, batch[, parents, hooks])</code></td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><code>augment_bounding_boxes(self, ...[, parents, ...])</code></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps(self, heatmaps[, parents, ...])</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(self, image[, hooks])</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images(self, images[, parents, hooks])</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints(self, keypoints_on_images)</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings(self, ...[, parents, hooks])</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons(self, polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(self, segmaps[, ...])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(self[, source[, recursive, ...]])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(self[, recursive])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
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<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
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<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
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</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
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<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmentor or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
</tbody>
</table>
## remove_augmenters_inplace(self, func[, parents])

**Deprecated.**

## reseed(self[, random_state, deterministic_too])

**Deprecated.**

## seed_(self[, entropy, deterministic_too])

Seed this augmenter and all of its children.

## show_grid(self, images, rows, cols)

Augment images and plot the results as a single grid-like image.

## to_deterministic(self[, n])

Convert this augmenter from a stochastic to a deterministic one.

### class imgaug.augmenters.imgcorruptlike.Saturate(severity=(1, 5), seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase

Wrapper around imagecorruptions.corruptions.saturate.

**Note:** This augmenter only affects images. Other data is not changed.

Added in 0.4.0.

**Supported dtypes:**

See `apply_saturate()`.

**Parameters**

- **severity** *(int, optional)* – Strength of the corruption, with valid values being $1 \leq \text{severity} \leq 5$.
- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.
- **name** *(None or str, optional)* – See `__init__()`.
- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.Saturate(severity=2)
```

Create an augmenter around `imagecorruptions.corruptions.saturate`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`. 

---

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## Methods

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<td><code>__call__</code>(self, *args, **kwargs)</td>
<td>Alias for <code>augment()</code></td>
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<tr>
<td><code>augment</code>(self[, return_batch, hooks])</td>
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<td><code>augment_batch</code>(self[, batch[, hooks]])</td>
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<td><code>copy</code>(self)</td>
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<td><code>deepcopy</code>(self)</td>
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<td><code>draw_grid</code>(self, images, rows, cols)</td>
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<td><code>find_augmenters</code>(self[, func[, parents, flat]])</td>
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<td><code>localize_random_state</code>(self[, recursive])</td>
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<td>Remove in-place children of this augmenter that match a condition.</td>
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<td><code>reseed</code>(self[, random_state, deterministic_too])</td>
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<td><code>seed_</code>(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
</tbody>
</table>

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<table>
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<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.imgcorruptlike.ShotNoise(severity=(1, 5), seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase

Wrapper around imagecorruptions.shot_noise.

**Note:** This augmenter only affects images. Other data is not changed.

Added in 0.4.0.

**Supported dtypes:**
See `apply_shot_noise()`.

**Parameters**

- **severity** *(int, optional)* – Strength of the corruption, with valid values being `1 <= severity <= 5`.
- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.
- **name** *(None or str, optional)* – See `__init__()`.
- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.ShotNoise(severity=2)
```

Create an augmenter around `imagecorruptions.corruptions.shot_noise`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`.

**Methods**
__call__ (self, *args, **kwargs) Alias for augment().
augment(self[, return_batch, hooks]) Augment a batch.
augment_batch(self, batch[, hooks]) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self, batches[, hooks, ...]) Augment multiple batches.
augment_bounding_boxes(self, ...[, parents, ...]) Augment a batch of bounding boxes.
augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
augment_image(self, image[, hooks]) Augment a single image.
augment_images(self, images[, parents, hooks]) Augment a batch of images.
augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
augment_line_strings(self, ...[, parents, hooks]) Augment a batch of line strings.
augment_polygons(self, polygons_on_images[, parents, ...]) Augment a batch of polygons.
augment_segmentation_maps(self, segmaps[, ...]) Augment a batch of segmentation maps.
copy(self) Create a shallow copy of this Augmenter instance.
copy_random_state(self[, source[, recursive, ...]]) Copy the RNGs from a source augmenter sequence.
copy_random_state_(self[, source, ...]) Copy the RNGs from a source augmenter sequence (in-place).
deepcopy(self) Create a deep copy of this Augmenter instance.
draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.
find_augmenters(self, func[, parents, flat]) Find augmenters that match a condition.
find_augmenters_by_name(self, name[, regex, ...]) Find augmenter(s) by name.
find_augmenters_by_names(self, names[, ...]) Find augmenter(s) by names.
get_all_children(self[, flat]) Get all children of this augmenter as a list.
get_children_lists(self) Get a list of lists of children of this augmenter.
get_parameters(self) See get_parameters().
localize_random_state(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
localize_random_state_(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
pool(self[, processes, maxtasksperchild, seed]) Create a pool used for multicore augmentation.
remove_augmenters(self, func[, copy, ...]) Remove this augmenter or children that match a condition.
remove_augmenters_(self, func[, parents]) Remove in-place children of this augmenter that match a condition.
remove_augmenters_inplace(self, func[, parents]) Deprecated.
reseed(self[, random_state, deterministic_too]) Deprecated.
seed_(self[, entropy, deterministic_too]) Seed this augmenter and all of its children.
show_grid(self, images, rows, cols) Augment images and plot the results as a single grid-like image.

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to_deterministic(self[, n]) Convert this augmenter from a stochastic to a deterministic one.

class imgaug.augmenters.imgcorruptlike.Snow(severity=(1, 5), seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase

Wrapper around imagecorruptions.corruptions.snow.

Note: This augmenter only affects images. Other data is not changed.

Added in 0.4.0.

Supported dtypes:

See apply_snow().

Parameters

- **severity** *(int, optional)* – Strength of the corruption, with valid values being $1 \leq severity \leq 5$.

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See **__init__()**.

- **name** *(None or str, optional)* – See **__init__()**.

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.Snow(severity=2)
```

Create an augmenter around imagecorruptions.corruptions.snow. Apply it to images using e.g. `aug(images=[image1, image2, ...])`.

Methods

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<td>Alias for <code>augment()</code></td>
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<td><code>augment_batch(self[, batch[, hooks]])</code></td>
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<td><code>seed_(self[, entropy, deterministic_too])</code></td>
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<td><code>show_grid(self, images, rows, cols)</code></td>
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<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>
class imgaug.augmenters.imgcorruptlike.Spatter(severity=(1, 5), seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase

Wrapper around imagecorruptions.corruptions.spatter.

Note: This augmenter only affects images. Other data is not changed.

Added in 0.4.0.

Supported dtypes:
See apply_spatter().

Parameters

• severity (int, optional) – Strength of the corruption, with valid values being 1 <= severity <= 5.

• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

• name (None or str, optional) – See __init__().

• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.Spatter(severity=2)
```

Create an augmenter around imagecorruptions.corruptions.spatter. Apply it to images using e.g. aug(images=[image1, image2, ...]).

Methods

__call__(self, *args, **kwargs)  Alias for augment().

augment(self, return_batch, hooks)  Augment a batch.

augment_batch(self, batch[, hooks])  Deprecated.

augment_batch_(self, batch[, parents, hooks])  Augment a single batch in-place.

augment_batches(self, batches[, hooks, ...])  Augment multiple batches.

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<td>augment_bounding_boxes(self, ...[, parents, ...])</td>
<td>Augment a batch of bounding boxes.</td>
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<td>localize_random_state(self[, recursive])</td>
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<td>show_grid(self, images, rows, cols)</td>
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class imgaug.augmenters.imgcorruptlike.SpeckleNoise(severity=(1, 5), seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase

Wrapper around imagecorruptions.corruptions.speckle_noise.

Note: This augmenter only affects images. Other data is not changed.

Added in 0.4.0.

Supported dtypes:

See apply_speckle_noise().

Parameters

- **severity** (int, optional) – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- **name** (None or str, optional) – See __init__().

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.SpeckleNoise(severity=2)
```

Create an augmenter around imagecorruptions.corruptions.speckle_noise. Apply it to images using e.g. `aug(images=[image1, image2, ...])`.

Methods

- **__call__(self, *args, **kwargs)**  
  Alias for `augment()`.

- **augment(self[, return_batch, hooks])**  
  Augment a batch.

- **augment_batch(self[, batch[, hooks]])**  
  Deprecated.

- **augment_batch(self[, batch[, parents, hooks]])**  
  Augment a single batch in-place.

- **augment_batches(self, batches[, hooks, ...])**  
  Augment multiple batches.

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<table>
<thead>
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<td>get_all_children</td>
<td>Get all children of this augmenter as a list.</td>
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<tr>
<td>reseed</td>
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</tr>
<tr>
<td>seed</td>
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</tr>
<tr>
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<td>Augment images and plot the results as a single grid-like image.</td>
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<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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class `imgaug.augmenters.imgcorruptlike.ZoomBlur`(
  `severity=(1, 5)`, `seed=None`,
  `name=None`, `random_state='deprecated'`,
  `deterministic='deprecated'`
)

Bases: `imgaug.augmenters.imgcorruptlike._ImgcorruptAugmenterBase`

Wrapper around `imagecorruptions.corruptions.zoom_blur`.

**Note:** This augmenter only affects images. Other data is not changed.

Added in 0.4.0.

**Supported dtypes:**

See `apply_zoom_blur()`.

**Parameters**

- `severity` *(int, optional)* – Strength of the corruption, with valid values being `1 <= severity <= 5`.
- `seed` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.
- `name` *(None or str, optional)* – See `__init__()`.
- `random_state` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
- `deterministic` *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> # doctest: +SKIP
>>> import imgaug.augmenters as iaa
>>> aug = iaa.imgcorruptlike.ZoomBlur(severity=2)
```

Create an augmenter around `imagecorruptions.corruptions.zoom_blur`. Apply it to images using e.g. `aug(images=[image1, image2, ...])`.

**Methods**

```python
__call__(self, *args, **kwargs) Alias for `augment()`.
```

```python
augment(self, return_batch, hooks)) Augment a batch.
augment_batch(self, batch[, hooks]) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self, batches[, hooks, ...]) Augment multiple batches.
```

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<td><code>remove_augmenters_(self[, func, copy, ...])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
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<td>Deprecated.</td>
</tr>
<tr>
<td><code>resseed</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid</code></td>
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`imgaug.augmenters.imgcorruptlike.apply_brightness(x, severity=1, seed=None)`
Apply brightness from imagecorruptions.
Added in 0.4.0.
Supported dtypes:
See \_call_imgcorrupt_func().

Parameters
- \(\text{x} (\text{ndarray})\) – Image array. Expected to have shape \((H, W)\), \((H, W, 1)\) or \((H, W, 3)\) with dtype uint8 and a minimum height/width of 32.
- \text{severity} (\text{int}, \text{optional}) – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).
- \text{seed} (\text{None or int}, \text{optional}) – Seed for the random number generation to use.

Returns Corrupted image.

Return type \text{ndarray}

imgaug.augmenters.imgcorruptlike.apply_contrast(\text{x}, \text{severity}=1, \text{seed}=\text{None})
Apply contrast from imagecorruptions.
Added in 0.4.0.

Supported dtypes:
See \_call_imgcorrupt_func().

Parameters
- \(\text{x} (\text{ndarray})\) – Image array. Expected to have shape \((H, W)\), \((H, W, 1)\) or \((H, W, 3)\) with dtype uint8 and a minimum height/width of 32.
- \text{severity} (\text{int}, \text{optional}) – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).
- \text{seed} (\text{None or int}, \text{optional}) – Seed for the random number generation to use.

Returns Corrupted image.

Return type \text{ndarray}

imgaug.augmenters.imgcorruptlike.apply_defocus_blur(\text{x}, \text{severity}=1, \text{seed}=\text{None})
Apply defocus_blur from imagecorruptions.
Added in 0.4.0.

Supported dtypes:
See \_call_imgcorrupt_func().

Parameters
- \(\text{x} (\text{ndarray})\) – Image array. Expected to have shape \((H, W)\), \((H, W, 1)\) or \((H, W, 3)\) with dtype uint8 and a minimum height/width of 32.
- \text{severity} (\text{int}, \text{optional}) – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).
- \text{seed} (\text{None or int}, \text{optional}) – Seed for the random number generation to use.

Returns Corrupted image.

Return type \text{ndarray}

imgaug.augmenters.imgcorruptlike.apply_elastic_transform(\text{image}, \text{severity}=1, \text{seed}=\text{None})
Apply elastic_transform from imagecorruptions.
Added in 0.4.0.
Supported dtypes:

See `_call_imgcorrupt_func()`.

Parameters

- **image (ndarray)** – Image array. Expected to have shape \((H,W)\), \((H,W,1)\) or \((H,W,3)\) with dtype `uint8` and a minimum height/width of 32.
- **severity (int, optional)** – Strength of the corruption, with valid values being \(1 \leq severity \leq 5\).
- **seed (None or int, optional)** – Seed for the random number generation to use.

Returns Corrupted image.

Return type `ndarray`

imgaug.augmenters.imgcorruptlike.apply_fog(x, severity=1, seed=None)

Apply fog from imagecorruptions.

Added in 0.4.0.

Supported dtypes:

See `_call_imgcorrupt_func()`.

Parameters

- **x (ndarray)** – Image array. Expected to have shape \((H,W)\), \((H,W,1)\) or \((H,W,3)\) with dtype `uint8` and a minimum height/width of 32.
- **severity (int, optional)** – Strength of the corruption, with valid values being \(1 \leq severity \leq 5\).
- **seed (None or int, optional)** – Seed for the random number generation to use.

Returns Corrupted image.

Return type `ndarray`

imgaug.augmenters.imgcorruptlike.apply_frost(x, severity=1, seed=None)

Apply frost from imagecorruptions.

Added in 0.4.0.

Supported dtypes:

See `_call_imgcorrupt_func()`.

Parameters

- **x (ndarray)** – Image array. Expected to have shape \((H,W)\), \((H,W,1)\) or \((H,W,3)\) with dtype `uint8` and a minimum height/width of 32.
- **severity (int, optional)** – Strength of the corruption, with valid values being \(1 \leq severity \leq 5\).
- **seed (None or int, optional)** – Seed for the random number generation to use.

Returns Corrupted image.

Return type `ndarray`

imgaug.augmenters.imgcorruptlike.apply_gaussian_blur(x, severity=1, seed=None)

Apply gaussian_blur from imagecorruptions.

Added in 0.4.0.
Supported dtypes:
See `_call_imgcorrupt_func()`.

Parameters
- `x` *(ndarray)* – Image array. Expected to have shape \((H, W)\), \((H, W, 1)\) or \((H, W, 3)\) with dtype `uint8` and a minimum height/width of 32.
- `severity` *(int, optional)* – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).
- `seed` *(None or int, optional)* – Seed for the random number generation to use.

Returns Corrupted image.
Return type *ndarray*

```python
imgaug.augmenters.imgcorruptlike.apply_gaussian_noise(x, severity=1, seed=None)
```
Apply `gaussian_noise` from `imagecorruptions`.
Added in 0.4.0.

Supported dtypes:
See `_call_imgcorrupt_func()`.

Parameters
- `x` *(ndarray)* – Image array. Expected to have shape \((H, W)\), \((H, W, 1)\) or \((H, W, 3)\) with dtype `uint8` and a minimum height/width of 32.
- `severity` *(int, optional)* – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).
- `seed` *(None or int, optional)* – Seed for the random number generation to use.

Returns Corrupted image.
Return type *ndarray*

```python
imgaug.augmenters.imgcorruptlike.apply_glass_blur(x, severity=1, seed=None)
```
Apply `glass_blur` from `imagecorruptions`.
Added in 0.4.0.

Supported dtypes:
See `_call_imgcorrupt_func()`.

Parameters
- `x` *(ndarray)* – Image array. Expected to have shape \((H, W)\), \((H, W, 1)\) or \((H, W, 3)\) with dtype `uint8` and a minimum height/width of 32.
- `severity` *(int, optional)* – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).
- `seed` *(None or int, optional)* – Seed for the random number generation to use.

Returns Corrupted image.
Return type *ndarray*

```python
imgaug.augmenters.imgcorruptlike.apply_impulse_noise(x, severity=1, seed=None)
```
Apply `impulse_noise` from `imagecorruptions`.
Added in 0.4.0.
Supported dtypes:
See \_call\_imgcorrupt\_func().

Parameters

- **x** *(ndarray)* – Image array. Expected to have shape \((H,W)\), \((H,W,1)\) or \((H,W,3)\) with dtype uint8 and a minimum height/width of 32.
- **severity** *(int, optional)* – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).
- **seed** *(None or int, optional)* – Seed for the random number generation to use.

Returns  Corrupted image.

Return type  ndarray

\texttt{imgaug.augmenters.imgcorruptlike.apply\_jpeg\_compression}(x, severity=1, seed=None)

Apply jpeg\_compression from imagecorruptions.

Added in 0.4.0.

Supported dtypes:
See \_call\_imgcorrupt\_func().

Parameters

- **x** *(ndarray)* – Image array. Expected to have shape \((H,W)\), \((H,W,1)\) or \((H,W,3)\) with dtype uint8 and a minimum height/width of 32.
- **severity** *(int, optional)* – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).
- **seed** *(None or int, optional)* – Seed for the random number generation to use.

Returns  Corrupted image.

Return type  ndarray

\texttt{imgaug.augmenters.imgcorruptlike.apply\_motion\_blur}(x, severity=1, seed=None)

Apply motion\_blur from imagecorruptions.

Added in 0.4.0.

Supported dtypes:
See \_call\_imgcorrupt\_func().

Parameters

- **x** *(ndarray)* – Image array. Expected to have shape \((H,W)\), \((H,W,1)\) or \((H,W,3)\) with dtype uint8 and a minimum height/width of 32.
- **severity** *(int, optional)* – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).
- **seed** *(None or int, optional)* – Seed for the random number generation to use.

Returns  Corrupted image.

Return type  ndarray

\texttt{imgaug.augmenters.imgcorruptlike.apply\_pixelate}(x, severity=1, seed=None)

Apply pixelate from imagecorruptions.

Added in 0.4.0.
Supported dtypes:

See `_call_imgcorrupt_func()`.

Parameters

- `x` (*ndarray*) – Image array. Expected to have shape \((H, W), (H, W, 1)\) or \((H, W, 3)\) with dtype `uint8` and a minimum height/width of 32.
- `severity` (*int, optional*) – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).
- `seed` (*None or int, optional*) – Seed for the random number generation to use.

Returns Corrupted image.

Return type `ndarray`

```
imgaug.augmenters.imgcorruptlike.apply_saturate(x, severity=1, seed=None)
```

Apply saturate from `imagecorruptions`.

Added in 0.4.0.

Supported dtypes:

See `_call_imgcorrupt_func()`.

Parameters

- `x` (*ndarray*) – Image array. Expected to have shape \((H, W), (H, W, 1)\) or \((H, W, 3)\) with dtype `uint8` and a minimum height/width of 32.
- `severity` (*int, optional*) – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).
- `seed` (*None or int, optional*) – Seed for the random number generation to use.

Returns Corrupted image.

Return type `ndarray`

```
imgaug.augmenters.imgcorruptlike.apply_shot_noise(x, severity=1, seed=None)
```

Apply shot_noise from `imagecorruptions`.

Added in 0.4.0.

Supported dtypes:

See `_call_imgcorrupt_func()`.

Parameters

- `x` (*ndarray*) – Image array. Expected to have shape \((H, W), (H, W, 1)\) or \((H, W, 3)\) with dtype `uint8` and a minimum height/width of 32.
- `severity` (*int, optional*) – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).
- `seed` (*None or int, optional*) – Seed for the random number generation to use.

Returns Corrupted image.

Return type `ndarray`

```
imgaug.augmenters.imgcorruptlike.apply_snow(x, severity=1, seed=None)
```

Apply snow from `imagecorruptions`.

Added in 0.4.0.
Supported dtypes:
See \_call_imgcorrupt_func().

Parameters
- x (ndarray) – Image array. Expected to have shape \((H, W)\), \((H, W, 1)\) or \((H, W, 3)\) with dtype \texttt{uint8} and a minimum height/width of 32.
- severity \((\text{int, optional})\) – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).
- seed \((\text{None or int, optional})\) – Seed for the random number generation to use.

Returns Corrupted image.

Return type ndarray

\texttt{imgaug.augmenters.imgcorruptlike.apply\_spatter}(x, severity=1, seed=None)
Apply spatter from \texttt{imagecorruptions}.
Added in 0.4.0.

Supported dtypes:
See \_call_imgcorrupt_func().

Parameters
- x (ndarray) – Image array. Expected to have shape \((H, W)\), \((H, W, 1)\) or \((H, W, 3)\) with dtype \texttt{uint8} and a minimum height/width of 32.
- severity \((\text{int, optional})\) – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).
- seed \((\text{None or int, optional})\) – Seed for the random number generation to use.

Returns Corrupted image.

Return type ndarray

\texttt{imgaug.augmenters.imgcorruptlike.apply\_speckle\_noise}(x, severity=1, seed=None)
Apply speckle_noise from \texttt{imagecorruptions}.
Added in 0.4.0.

Supported dtypes:
See \_call_imgcorrupt_func().

Parameters
- x (ndarray) – Image array. Expected to have shape \((H, W)\), \((H, W, 1)\) or \((H, W, 3)\) with dtype \texttt{uint8} and a minimum height/width of 32.
- severity \((\text{int, optional})\) – Strength of the corruption, with valid values being \(1 \leq \text{severity} \leq 5\).
- seed \((\text{None or int, optional})\) – Seed for the random number generation to use.

Returns Corrupted image.

Return type ndarray

\texttt{imgaug.augmenters.imgcorruptlike.apply\_zoom\_blur}(x, severity=1, seed=None)
Apply zoom_blur from \texttt{imagecorruptions}.
Added in 0.4.0.
**Supported dtypes:**

See `_call_imgcorrupt_func()`.

**Parameters**

- `x` *(ndarray)* – Image array. Expected to have shape `(H,W)`, `(H,W,1)` or `(H,W,3)` with dtype `uint8` and a minimum height/width of 32.
- `severity` *(int, optional)* – Strength of the corruption, with valid values being `1 <= severity <= 5`.
- `seed` *(None or int, optional)* – Seed for the random number generation to use.

**Returns** Corrupted image.

**Return type** ndarray

`imgaug.augmenters.imgcorruptlike.get_corruption_names(subset='common')`

Get a named subset of image corruption functions.

**Note:** This function returns the augmentation names (as strings) and the corresponding augmentation functions, while `get_corruption_names()` in `imagecorruptions` only returns the augmentation names.

Added in 0.4.0.

**Parameters** `subset` *(‘common’, ‘validation’, ‘all’, optional.)* – Name of the subset of image corruption functions.

**Returns**

- `list of str` – Names of the corruption methods, e.g. “gaussian_noise”.
- `list of callable` – Function corresponding to the name. Is one of the `apply_*()` functions in this module. Apply e.g. via `func(image, severity=2, seed=123)`.

### 13.31 `imgaug.augmenters.meta`  

Augmenters that don’t apply augmentations themselves, but are needed for meta usage.

List of augmenters:

- `Augmenter` *(base class for all augmenters)*
- `Sequential`
- `SomeOf`
- `OneOf`
- `Sometimes`
- `WithChannels`
- `Identity`
- `Noop`
- `Lambda`
- `AssertLambda`
- `AssertShape`
• ChannelShuffle

Note: `WithColorspace` is in `color.py`.

class imgaug.augmenters.meta.AssertLambda(func_images=None, func_heatmaps=None, func_segmentation_maps=None, func_keypoints=None, func_bounding_boxes=None, func_polygons=None, func_line_strings=None, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: `imgaug.augmenters.meta.Lambda`

Assert conditions based on lambda-function to be the case for input data.

This augmenter applies a lambda function to each image or other input. The lambda function must return `True` or `False`. If `False` is returned, an assertion error is produced.

This is useful to ensure that generic assumption about the input data are actually the case and error out early otherwise.

**Supported dtypes:**
- `uint8`: yes; fully tested
- `uint16`: yes; tested
- `uint32`: yes; tested
- `uint64`: yes; tested
- `int8`: yes; tested
- `int16`: yes; tested
- `int32`: yes; tested
- `int64`: yes; tested
- `float16`: yes; tested
- `float32`: yes; tested
- `float64`: yes; tested
- `float128`: yes; tested
- `bool`: yes; tested

**Parameters**
- `func_images` (*None or callable, optional*) – The function to call for each batch of images. It must follow the form:

  ```python
  function(images, random_state, parents, hooks)
  ```

  and return either `True` (valid input) or `False` (invalid input). It essentially re-uses the interface of `_augment_images()`.

- `func_heatmaps` (*None or callable, optional*) – The function to call for each batch of heatmaps. It must follow the form:

  ```python
  function(heatmaps, random_state, parents, hooks)
  ```
and return either True (valid input) or False (invalid input). It essentially re-uses the interface of _augment_heatmaps().

- **func_segmentation_maps** *(None or callable, optional)* – The function to call for each batch of segmentation maps. It must follow the form:

  ```python
  function(segmaps, random_state, parents, hooks)
  ```

  and return either True (valid input) or False (invalid input). It essentially re-uses the interface of _augment_segmentation_maps().

- **func_keypoints** *(None or callable, optional)* – The function to call for each batch of keypoints. It must follow the form:

  ```python
  function(keypoints_on_images, random_state, parents, hooks)
  ```

  and return either True (valid input) or False (invalid input). It essentially re-uses the interface of _augment_keypoints().

- **func_bounding_boxes** *(None or callable, optional)* – The function to call for each batch of bounding boxes. It must follow the form:

  ```python
  function(bounding_boxes_on_images, random_state, parents, hooks)
  ```

  and return either True (valid input) or False (invalid input). It essentially re-uses the interface of _augment_bounding_boxes().

  Added in 0.4.0.

- **func_polygons** *(None or callable, optional)* – The function to call for each batch of polygons. It must follow the form:

  ```python
  function(polygons_on_images, random_state, parents, hooks)
  ```

  and return either True (valid input) or False (invalid input). It essentially re-uses the interface of _augment_polygons().

- **func_line_strings** *(None or callable, optional)* – The function to call for each batch of line strings. It must follow the form:

  ```python
  function(line_strings_on_images, random_state, parents, hooks)
  ```

  and return either True (valid input) or False (invalid input). It essentially re-uses the interface of _augment_line_strings().

  Added in 0.4.0.

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- **name** *(None or str, optional)* – See `__init__()`.

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Methods

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<thead>
<tr>
<th>Method</th>
<th>Description</th>
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</table>
| `__call__`(self, *args, **kwargs) | Alias for `augment()`.
| `augment`(self[, return_batch, hooks]) | Augment a batch.
| `augment_batch`(self[, batch[, hooks]]) | Augment a single batch in-place. <br>**Deprecated**.
| `augment_batch_(self[, batch[, parents, hooks]])` | Augment multiple batches.
| `augment_bounding_boxes`(self[, ...[, parents, ...]]) | Augment a batch of bounding boxes.
| `augment_heatmaps`(self[, heatmaps[, parents, ...]]) | Augment a batch of heatmaps.
| `augment_image`(self[, image[, hooks]]) | Augment a single image.
| `augment_images`(self[, images[, parents, hooks]]) | Augment a batch of images.
| `augment_keypoints`(self[, key-points_on_images]) | Augment a batch of keypoints/landmarks.
| `augment_line_strings`(self[, ...[, parents, hooks]]) | Augment a batch of line strings.
| `augment_polygons`(self[, polygons_on_images[, ...]]) | Augment a batch of polygons.
| `augment_segmentation_maps`(self[, segmaps[, ...]]) | Augment a batch of segmentation maps.
| `copy`(self) | Create a shallow copy of this Augmenter instance.
| `copy_random_state`(self[, source[, recursive, ...]]) | Copy the RNGs from a source augmenter sequence.
| `copy_random_state_(self[, source[, ...]])` | Copy the RNGs from a source augmenter sequence in-place.
| `deepcopy`(self) | Create a deep copy of this Augmenter instance.
| `draw_grid`(self[, images, rows, cols]) | Augment images and draw the results as a single grid-like image.
| `find_augmenters`(self[, func[, parents, flat]]) | Find augmenters that match a condition.
| `find_augmenters_by_name`(self[, name[, regex, ...]]) | Find augmenter(s) by name.
| `find_augmenters_by_names`(self[, names[, ...]]) | Find augmenter(s) by names.
| `get_all_children`(self[, flat]) | Get all children of this augmenter as a list.
| `get_children_lists`(self) | Get a list of lists of children of this augmenter.
| `get_parameters`(self) | See `get_parameters()`.
| `localize_random_state`(self[, recursive]) | Assign augmenter-specific RNGs to this augmenter and its children.
| `localize_random_state_(self[, recursive])` | Assign augmenter-specific RNGs to this augmenter and its children.
| `pool`(self[, processes, maxtasksperchild, seed]) | Create a pool used for multicore augmentation.
| `remove_augmenters`(self[, func[, copy, ...]]) | Remove this augmenter or children that match a condition.
| `remove_augmenters_(self[, func[, parents]])` | Remove in-place children of this augmenter that match a condition. 

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<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a determinstic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.meta.AssertShape(shape, check_images=True, check_heatmaps=True, check_segmentation_maps=True, check_keypoints=True, check_bounding_boxes=True, check_polygons=True, check_line_strings=True, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases:** `imgaug.augmenters.meta.Lambda`

Assert that inputs have a specified shape.

**Supported dtypes:**

- `uint8`: yes; fully tested
- `uint16`: yes; tested
- `uint32`: yes; tested
- `uint64`: yes; tested
- `int8`: yes; tested
- `int16`: yes; tested
- `int32`: yes; tested
- `int64`: yes; tested
- `float16`: yes; tested
- `float32`: yes; tested
- `float64`: yes; tested
- `float128`: yes; tested
- `bool`: yes; tested

**Parameters**

- `shape (tuple)` – The expected shape, given as a `tuple`. The number of entries in the `tuple` must match the number of dimensions, i.e. it must contain four entries for `(N, H, W, C)`. If only a single entity is augmented, e.g. via `augment_image()`, then `N` is 1 in the input to this augmenter. Images that don’t have a channel axis will automatically have one assigned, i.e. `C` is at least 1. For each component of the `tuple` one of the following datatypes may be used:
  - If a component is `None`, any value for that dimensions is accepted.
– If a component is int, exactly that value (and no other one) will be accepted for that dimension.
– If a component is a tuple of two int s with values a and b, only a value within the interval [a, b) will be accepted for that dimension.
– If an entry is a list of int s, only a value from that list will be accepted for that dimension.

• **check_images** (bool, optional) – Whether to validate input images via the given shape.
• **check_heatmaps** (bool, optional) – Whether to validate input heatmaps via the given shape. The number of heatmaps will be verified as N. For each HeatmapsOnImage instance its array’s height and width will be verified as H and W, but not the channel count.
• **check_segmentation_maps** (bool, optional) – Whether to validate input segmentation maps via the given shape. The number of segmentation maps will be verified as N. For each SegmentationMapOnImage instance its array’s height and width will be verified as H and W, but not the channel count.
• **check_keypoints** (bool, optional) – Whether to validate input keypoints via the given shape. This will check (a) the number of keypoints and (b) for each KeypointsOnImage instance the .shape attribute, i.e. the shape of the corresponding image.
• **check_bounding_boxes** (bool, optional) – Whether to validate input bounding boxes via the given shape. This will check (a) the number of bounding boxes and (b) for each BoundingBoxesOnImage instance the .shape attribute, i.e. the shape of the corresponding image.
  Added in 0.4.0.
• **check_polygons** (bool, optional) – Whether to validate input polygons via the given shape. This will check (a) the number of polygons and (b) for each PolygonsOnImage instance the .shape attribute, i.e. the shape of the corresponding image.
• **check_line_strings** (bool, optional) – Whether to validate input line strings via the given shape. This will check (a) the number of line strings and (b) for each LineStringsOnImage instance the .shape attribute, i.e. the shape of the corresponding image.
  Added in 0.4.0.
• **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().
• **name** (None or str, optional) – See __init__().
• **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
• **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.
Examples

```python
>>> import imgaug.augmenters as iaa
>>> seq = iaa.Sequential([
>>>     iaa.AssertShape((None, 32, 32, 3)),
>>>     iaa.Fliplr(0.5)
>>> ])
```

Verify first for each image batch if it contains a variable number of 32x32 images with 3 channels each. Only if that check succeeds, the horizontal flip will be executed. Otherwise an assertion error will be raised.

```python
>>> seq = iaa.Sequential([
>>>     iaa.AssertShape((None, (32, 64), 32, [1, 3])),
>>>     iaa.Fliplr(0.5)
>>> ])
```

Similar to the above example, but now the height may be in the interval \([32, 64)\) and the number of channels may be either 1 or 3.

Methods

```python
__call__(self, *args, **kwargs) Alias for augment().
augment(self[, return_batch, hooks]) Augment a batch.
augment_batch(self[, batch[, hooks]]) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self[, batches[, hooks]]) Augment multiple batches.
augment_bounding_boxes(self[, ...[, parents, ...]]) Augment a batch of bounding boxes.
augment_heatmaps(self[, heatmaps[, parents, ...]]) Augment a batch of heatmaps.
augment_image(self[, image[, hooks]]) Augment a single image.
augment_images(self[, images[, parents, hooks]]) Augment a batch of images.
augment_keypoints(self[, keypoints_on_images[, parents, hooks]]) Augment a batch of keypoints/landmarks.
augment_line_strings(self[, ...[, parents, hooks]]) Augment a batch of line strings.
augment_polygons(self[, polygons_on_images[, ...]]) Augment a batch of polygons.
augment_segmentation_maps(self[, segmaps[, ...]]) Augment a batch of segmentation maps.
copy(self) Create a shallow copy of this Augmenter instance.
copy_random_state(self[, source[, recursive, ...]]) Copy the RNGs from a source augmenter sequence.
copy_random_state_(self[, source, ...]) Copy the RNGs from a source augmenter sequence (in-place).
deepcopy(self) Create a deep copy of this Augmenter instance.
draw_grid(self[, images, rows, cols]) Augment images and draw the results as a single grid-like image.
find_augmenters(self[, func[, parents, flat]]) Find augmenters that match a condition.
find_augmenters_by_name(self[, name[, regex, ...]]) Find augmenter(s) by name.
```
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<table>
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<tr>
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<tbody>
<tr>
<td><code>find_augmenters_by_names</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**class imgaug.augmenters.meta.Augmenter**

```python
class imgaug.augmenters.meta.Augmenter (seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases:** `object`

Base class for Augmenter objects. All augmenters derive from this class.

**Parameters**

- `seed` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Seed to use for this augmenter’s random number generator (RNG) or alternatively an RNG itself. Setting this parameter allows to control/influence the random number sampling of this specific augmenter without affecting other augmenters. Usually, there is no need to set this parameter.
  - If `None`: The global RNG is used (shared by all augmenters).
  - If `int`: The value will be used as a seed for a new `RNG` instance.
  - If `RNG`: The RNG instance will be used without changes.
  - If `Generator`: A new RNG instance will be created, containing that generator.
  - If `BitGenerator`: Will be wrapped in a `Generator`. Then similar behaviour to `Generator` parameters.
  - If `SeedSequence`: Will be wrapped in a new bit generator and `Generator`. Then similar behaviour to `Generator` parameters.
  - If `RandomState`: Similar behaviour to `Generator`. Outdated in `numpy 1.17+`. If a new bit generator has to be created, it will be an instance of `numpy.random.SFC64`. Added in 0.4.0.
• **name** *(None or str, optional)* – Name given to the Augmenter instance. This name is used when converting the instance to a string, e.g. for print statements. It is also used for find, remove or similar operations on augmenters with children. If None, UnnamedX will be used as the name, where X is the Augmenter’s class name.

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

### Methods

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| **__call__**(self, *args, **kwargs) | Alias for `augment()`.
| **augment**(self[, return_batch, hooks]) | Augment a batch.
| **augment_batch**(self[, batch[, hooks]]) | Augment a single batch.
| **augment_batch_(self, batch[, parents, hooks])** | Augment a single batch in-place.
| **augment_batches**(self[, batch[, hooks[, ...]]) | Augment multiple batches.
| **augment_bounding_boxes**(self[, ...[, parents, ...]]) | Augment a batch of bounding boxes.
| **augment_heatmaps**(self[, heatmaps[, parents,...]]) | Augment a batch of heatmaps.
| **augment_image**(self[, image[, hooks]]) | Augment a single image.
| **augment_images**(self[, images[, parents, hooks]]) | Augment a batch of images.
| **augment_keypoints**(self[, key-points_on_images]) | Augment a batch of keypoints/landmarks.
| **augment_line_strings**(self[, ...[, parents, hooks]]) | Augment a batch of line strings.
| **augment_polygons**(self[, polygons_on_images[, ...]]) | Augment a batch of polygons.
| **augment_segmentation_maps**(self[, segmaps[, ...]]) | Augment a batch of segmentation maps.
| **copy**(self) | Create a shallow copy of this Augmenter instance.
| **copy_random_state**(self[, source[, recursive,...]]) | Copy the RNGs from a source augmenter sequence.
| **copy_random_state_(self[, source[, ...]])** | Copy the RNGs from a source augmenter sequence (in-place).
| **deepcopy**(self) | Create a deep copy of this Augmenter instance.
| **draw_grid**(self[, images, rows, cols]) | Augment images and draw the results as a single grid-like image.
| **find_augmenters**(self[, func[, parents, flat]]) | Find augmenters that match a condition.
| **find_augmenters_by_name**(self[, name[, regex,...]]) | Find augmenter(s) by name.
| **find_augmenters_by_names**(self[, names[, ...]]) | Find augmenter(s) by names.
| **get_all_children**(self[, flat]) | Get all children of this augmenter as a list.
| **get_children_lists**(self) | Get a list of lists of children of this augmenter.
| **get_parameters**(self) | Get the parameters of this augmenter.

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<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
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<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self, processes, maxtasksperchild, seed)[]</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy,...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
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<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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**augment** *(self, return_batch=False, hooks=None, **kwargs)*

Augment a batch.

This method is a wrapper around `UnnormalizedBatch` and `augment_batch()`. Hence, it supports the same datatypes as `UnnormalizedBatch`.

If `return_batch` was set to False (the default), the method will return a tuple of augmentables. It will return the same types of augmentables (but in augmented form) as input into the method. This behaviour is partly specific to the python version:

- **In python 3.6+** (if `return_batch=False`):
  - Any number of augmentables may be provided as input.
  - None of the provided named arguments *has to be image or images* (but of coarse you *may* provide them).
  - The return order matches the order of the named arguments, e.g. `x_aug, y_aug, z_aug = augment(X=x, Y=y, Z=z)`.

- **In python <3.6** (if `return_batch=False`):
  - One or two augmentables may be used as input, not more than that.
  - One of the input arguments has to be *image or images*.
  - The augmented images are *always* returned first, independent of the input argument order, e.g. `a_aug, b_aug = augment(b=b, images=a)`. This also means that the output of the function can only be one of the following three cases: a batch, list/array of images, tuple of images and something (like images + segmentation maps).

If `return_batch` was set to True, an instance of `UnnormalizedBatch` will be returned. The output is the same for all python version and any number or combination of augmentables may be provided.

So, to keep code downward compatible for python <3.6, use one of the following three options:

- Use `batch = augment(images=X, ..., return_batch=True)`.
- Call `images = augment(images=X)`.
- Call `images, other = augment(images=X, <something_else>=Y)`. 
All augmentables must be provided as named arguments. E.g. `augment(<array>)` will crash, but `augment(images=<array>)` will work.

**Parameters**

- **image** *(None or (H,W,C) ndarray or (H,W) ndarray, optional)* – The image to augment. Only this or `images` can be set, not both. If `return_batch` is `False` and the python version is below 3.6, either this or `images` must be provided.

- **images** *(None or (N,H,W,C) ndarray or (N,H,W) ndarray or iterable of (H,W,C) ndarray or iterable of (H,W) ndarray, optional)* – The images to augment. Only this or `image` can be set, not both. If `return_batch` is `False` and the python version is below 3.6, either this or `image` must be provided.

- **heatmaps** *(None or (N,H,W,C) ndarray or imgaug.augmentables.heatmaps.HeatmapsOnImage or iterable of (H,W,C) ndarray or iterable of imgaug.augmentables.heatmaps.HeatmapsOnImage, optional)* – The heatmaps to augment. If anything else than `HeatmapsOnImage`, then the number of heatmaps must match the number of images provided via parameter `images`. The number is contained either in `N` or the first iterable’s size.

- **segmentation_maps** *(None or (N,H,W) ndarray or imgaug.augmentables.segmaps.SegmentationMapsOnImage or iterable of (H,W) ndarray or iterable of imgaug.augmentables.segmaps.SegmentationMapsOnImage, optional)* – The segmentation maps to augment. If anything else than `SegmentationMapsOnImage`, then the number of segmaps must match the number of images provided via parameter `images`. The number is contained either in `N` or the first iterable’s size.

- **keypoints** *(None or list of (N,K,2) ndarray or tuple of number or imgaug.augmentables.kps.Keypoint or iterable of (K,2) ndarray or iterable of tuple of number or iterable of imgaug.augmentables.kps.Keypoint, optional)* – The keypoints to augment. If a tuple (or iterable(s) of tuple), then interpreted as \((x,y)\) coordinates and must hence contain two numbers. A single tuple represents a single coordinate on one image, an iterable of tuples the coordinates on one image and an iterable of iterable of tuples the coordinates on several images. Analogous if `Keypoint` instances are used instead of tuples. If an `ndarray`, then `N` denotes the number of images and `K` the number of keypoints on each image. If anything else than `KeypointsOnImage` is provided, then the number of keypoint groups must match the number of images provided via parameter `images`. The number is contained e.g. in `N` or in case of “iterable of iterable of tuples” in the first iterable’s size.

- **bounding_boxes** *(None or (N,B,4) ndarray or tuple of number or imgaug.augmentables.bbs.BoundingBox or imgaug.augmentables.bbs.BoundingBoxesOnImage or iterable of (B,4) ndarray or iterable of tuple of number or iterable of imgaug.augmentables.bbs.BoundingBox or iterable of imgaug.augmentables.bbs.BoundingBoxesOnImage, optional)* – The bounding boxes to augment. This is analogous to the `keypoints` parameter. However, each tuple and also the last index in case of arrays has size 4, denoting the bounding box coordinates \(x_1, y_1, x_2\) and \(y_2\).

- **polygons** *(None or (N,#polys,#points,2) ndarray or imgaug.augmentables.polys.Polygon or imgaug.augmentables.polys.PolygonsOnImage or iterable of (#polys,#points,2) ndarray or iterable of tuple of number or iterable of imgaug.augmentables.polys.Polygon or iterable of iterable of number or iterable of imgaug.augmentables.polys.PolygonsOnImage or iterable of iterable of (#points,2) ndarray or iterable of tuple of number or iterable of imgaug.augmentables.polys.PolygonsOnImage, optional)* – The polygons to augment.
ndarray or iterable of iterable of tuple of number or iterable of iterable of imgaug.augmentables.kps.Keypoint or iterable of iterable of imgaug.augmentables.polys.Polygon or iterable of iterable of iterable of tuple of number or iterable of iterable of iterable of tuple of imgaug.augmentables.kps.Keypoint, optional

- The polygons to augment. This is similar to the keypoints parameter. However, each polygon may be made up of several "(x,y)" coordinates (three or more are required for valid polygons). The following datatypes will be interpreted as a single polygon on a single image:
  - imgaug.augmentables.polys.Polygon
  - iterable of tuple of number
  - iterable of imgaug.augmentables.kps.Keypoint

The following datatypes will be interpreted as multiple polygons on a single image:
  - imgaug.augmentables.polys.PolygonsOnImage
  - iterable of imgaug.augmentables.polys.Polygon
  - iterable of iterable of tuple of number
  - iterable of iterable of imgaug.augmentables.kps.Keypoint
  - iterable of iterable of imgaug.augmentables.polys.Polygon

The following datatypes will be interpreted as multiple polygons on multiple images:
  - (N,#polys,#points,2) ndarray
  - iterable of (#polys,#points,2) ndarray
  - iterable of iterable of (#points,2) ndarray
  - iterable of iterable of iterable of tuple of number
  - iterable of iterable of iterable of tuple of imgaug.augmentables.kps.Keypoint

- line_strings (None or (N,#lines,#points,2) ndarray or imgaug.augmentables.lines.LineString or imgaug.augmentables.lines.LineStringOnImage or iterable of (#polys,#points,2) ndarray or iterable of tuple of number or iterable of imgaug.augmentables.kps.Keypoint or iterable of imgaug.augmentables.lines.LineString or iterable of iterable of imgaug.augmentables.lines.LineStringOnImage or iterable of iterable of (#points,2) ndarray or iterable of iterable of tuple of number or iterable of iterable of imgaug.augmentables.kps.Keypoint or iterable of iterable of iterable of imgaug.augmentables.lines.LineString or iterable of iterable of iterable of tuple of number or iterable of iterable of iterable of tuple of imgaug.augmentables.kps.Keypoint, optional) – The line strings to augment. See polygons, which behaves similarly.

- return_batch (bool, optional) – Whether to return an instance of UnnormalizedBatch. If the python version is below 3.6 and more than two augmentables were provided (e.g. images, keypoints and polygons), then this must be set to True. Otherwise an error will be raised.

- hooks (None or imgaug.imgaug.HooksImages, optional) – Hooks object to dynamically interfere with the augmentation process.

Returns If return_batch was set to True, a instance of UnnormalizedBatch will be returned. If return_batch was set to False, a tuple of augmentables will be returned, e.g. (augmented images, augmented keypoints). The datatypes match the input datatypes of the corresponding named argument. In python <3.6, augmented images are
always the first entry in the returned tuple. In python 3.6+ the order matches the order of the
named arguments.

**Return type** tuple or `imgaug.augmentables.batches.UnnormalizedBatch`

**Examples**

```python
>>> import numpy as np
>>> import imgaug as ia
>>> import imgaug.augmenters as iaa

>>> aug = iaa.Affine(rotate=(-25, 25))
>>> image = np.zeros((64, 64, 3), dtype=np.uint8)
>>> keypoints = [(10, 20), (30, 32)]  # (x,y) coordinates
>>> images_aug, keypoints_aug = aug.augment(

>>> image=image, keypoints=keypoints)
```

Create a single image and a set of two keypoints on it, then augment both by applying a random ro-
tation between -25 deg and +25 deg. The sampled rotation value is automatically aligned between
image and keypoints. Note that in python <3.6, augmented images will always be returned first, inde-
pendent of the order of the named input arguments. So `keypoints_aug, images_aug = aug.augment(
keypoints=keypoints, image=image)` would not be correct (but in python 3.6+ it would be).

```python
>>> import numpy as np
>>> import imgaug as ia
>>> from imgaug.augmentables.bbs import BoundingBox

>>> aug = iaa.Affine(rotate=(-25, 25))

>>> images = [np.zeros((64, 64, 3), dtype=np.uint8),

>>> np.zeros((32, 32, 3), dtype=np.uint8)]

>>> keypoints = [[(10, 20), (30, 32)],  # KPs on first image

>>> [(22, 10), (12, 14)]]  # KPs on second image

>>> bbs = [

>>> [BoundingBox(x1=5, y1=5, x2=50, y2=45)],

>>> [BoundingBox(x1=4, y1=6, x2=10, y2=15),

>>> BoundingBox(x1=8, y1=9, x2=16, y2=30)]

>>> ]  # one BB on first image, two BBs on second image

>>> batch_aug = aug.augment(

>>> images=images, keypoints=keypoints, bounding_boxes=bbs,

>>> return_batch=True)
```

Create two images of size 64×64 and 32×32, two sets of keypoints (each containing two keypoints)
and two sets of bounding boxes (the first containing one bounding box, the second two bounding boxes).
These augmentables are then augmented by applying random rotations between -25 deg and +25 deg
to them. The rotation values are sampled by image and aligned between all augmentables on the same
image. The method finally returns an instance of `UnnormalizedBatch` from which the augmented data
can be retrieved via `batch_aug.images_aug, batch_aug.keypoints_aug, and batch_aug.
bounding_boxes_aug`. In python 3.6+, `return_batch` can be kept at False and the augmented data
can be retrieved as `images_aug, keypoints_aug, bbs_aug = augment(...)`.

**augment_batch**(self, batch, hooks=None)

*Deprecated.* Use `augment_batch()` instead. `augment_batch()` was renamed to `augment_batch()`
as it changes all *unaug* attributes of batches in-place. Note that `augment_batch()` has now a parents
parameter. Calls of the style `augment_batch(batch, hooks)` must be changed to `augment_batch(batch, hooks=hooks)`.

Augment a single batch.
Deprecated since 0.4.0.

**augment_batch**(self, batch, parents=None, hooks=None)

Augment a single batch in-place.

Added in 0.4.0.

**Parameters**

- **batch** *(imgaug.augmentables.batches.Batch or imgaug.augmentables.batches.UnnormalizedBatch or imgaug.augmentables.batches._BatchInAugmentation)* – A single batch to augment.

  If `imgaug.augmentables.batches.UnnormalizedBatch` or `imgaug.augmentables.batches.Batch`, then the *-* attributes may be modified in-place, while the *-* attributes will not be modified. If `imgaug.augmentables.batches._BatchInAugmentation`, then all attributes may be modified in-place.

- **parents** *(None or list of imgaug.augmenters.Augmenter, optional)* – Parent augmenters that have previously been called before the call to this function. Usually you can leave this parameter as `None`. It is set automatically for child augmenters.

- **hooks** *(None or imgaug.HooksImages, optional)* – HooksImages object to dynamically interfere with the augmentation process.

**Returns** Augmented batch.

**Return type** `imgaug.augmentables.batches.Batch` or `imgaug.augmentables.batches.UnnormalizedBatch`

**augment_batches**(self, batches, hooks=None, background=False)

Augment multiple batches.

In contrast to other `augment_*` method, this one **yields** batches instead of returning a full list. This is more suited for most training loops.

This method also also supports augmentation on multiple cpu cores, activated via the `background` flag. If the `background` flag is activated, an instance of `Pool` will be spawned using all available logical CPU cores and an `output_buffer_size` of `C*10`, where `C` is the number of logical CPU cores. I.e. a maximum of `C*10` batches will be somewhere in the augmentation pipeline (or waiting to be retrieved by downstream functions) before this method temporarily stops the loading of new batches from `batches`.

**Parameters**

- **batches** *(imgaug.augmentables.batches.Batch or imgaug.augmentables.batches.UnnormalizedBatch or iterable of imgaug.augmentables.batches.Batch or iterable of imgaug.augmentables.batches.UnnormalizedBatch)* – A single batch or a list of batches to augment.

- **hooks** *(None or imgaug.HooksImages, optional)* – HooksImages object to dynamically interfere with the augmentation process.

- **background** *(bool, optional)* – Whether to augment the batches in background processes. If True, hooks can currently not be used as that would require pickling functions. Note that multicore augmentation distributes the batches onto different CPU cores. It does not split the data within batches. It is therefore not sensible to use `background=True` to augment a single batch. Only use it for multiple batches. Note also that multicore augmentation needs some time to start. It is therefore not recommended to use it for very few batches.
augment_bounding_boxes (self, bounding_boxes_on_images, parents=None, hooks=None)
Augment a batch of bounding boxes.

This is the corresponding function to Augmenter.augment_images(), just for bounding boxes. Usually you will want to call Augmenter.augment_images() with a list of images, e.g. augment_images([A, B, C]) and then augment_bounding_boxes() with the corresponding list of bounding boxes on these images, e.g. augment_bounding_boxes([Abb, Bbb, Cbb]), where Abb are the bounding boxes on image A.

Make sure to first convert the augmenter(s) to deterministic states before augmenting images and their corresponding bounding boxes, e.g. by

```python
>>> import imgaug.augmenters as iaa
>>> from imgaug.augmentables.bbs import BoundingBox
>>> from imgaug.augmentables.bbs import BoundingBoxesOnImage
>>> A = B = C = np.ones((10, 10), dtype=np.uint8)
>>> Abb = Bbb = Cbb = BoundingBoxesOnImage([BoundingBox(1, 1, 9, 9)], (10, 10))
>>> seq = iaa.Fliplr(0.5)
>>> seq_det = seq.to_deterministic()
>>> imgs_aug = seq_det.augment_images([A, B, C])
>>> bbs_aug = seq_det.augment_bounding_boxes([Abb, Bbb, Cbb])
```

Otherwise, different random values will be sampled for the image and bounding box augmentations, resulting in different augmentations (e.g. images might be rotated by 30deg and bounding boxes by -10deg).

Also make sure to call Augmenter.to_deterministic() again for each new batch, otherwise you would augment all batches in the same way.

Note that there is also Augmenter.augment(), which automatically handles the random state alignment.

Parameters

- **bounding_boxes_on_images** (imgaug.augmentables.bbs.BoundingBoxesOnImage or list of imgaug.augmentables.bbs.BoundingBoxesOnImage) – The bounding boxes to augment. Either a single instance of BoundingBoxesOnImage or a list of such instances, with each one of them containing the bounding boxes of a single image.

- **parents** (None or list of imgaug.augmenters.meta.Augmenter, optional) – Parent augmenters that have previously been called before the call to this function. Usually you can leave this parameter as None. It is set automatically for child augmenters.

- **hooks** (None or imgaug.imgaug.HooksKeypoints, optional) – HooksKeypoints object to dynamically interfere with the augmentation process.

Returns Augmented bounding boxes.

Return type imgaug.augmentables.bbs.BoundingBoxesOnImage or list of imgaug.augmentables.bbs.BoundingBoxesOnImage

augment_heatmaps (self, heatmaps, parents=None, hooks=None)
Augment a batch of heatmaps.

Parameters

- **heatmaps** (imgaug.augmentables.heatmaps.HeatmapsOnImage or list of imgaug.augmentables.heatmaps.HeatmapsOnImage) – Heatmap(s) to augment. Either
a single heatmap or a list of heatmaps.

- **parents** *(None or list of imgaug.augmenters.meta.Augmenter, optional)* – Parent augmenters that have previously been called before the call to this function. Usually you can leave this parameter as `None`. It is set automatically for child augmenters.

- **hooks** *(None or imgaug.imgaug.HooksHeatmaps, optional)* – *HooksHeatmaps* object to dynamically interfere with the augmentation process.

**Returns** Corresponding augmented heatmap(s).

**Return type** `imgaug.augmentables.heatmaps.HeatmapsOnImage` or list of `imgaug.augmentables.heatmaps.HeatmapsOnImage`

### `augment_image(self, image, hooks=None)`

Augment a single image.

**Parameters**

- **image** *(ndarray or (H, W) ndarray)* – The image to augment. Channel-axis is optional, but expected to be the last axis if present. In most cases, this array should be of dtype `uint8`, which is supported by all augmenters. Support for other dtypes varies by augmenter – see the respective augmenter-specific documentation for more details.

- **hooks** *(None or imgaug.HooksImages, optional)* – *HooksImages* object to dynamically interfere with the augmentation process.

**Returns** The corresponding augmented image.

**Return type** `ndarray`

### `augment_images(self, images, parents=None, hooks=None)`

Augment a batch of images.

**Parameters**

- **images** *(ndarray or (N,H,W,C) ndarray or (N,H,W) ndarray or list of (H,W,C) ndarray or list of (H,W) ndarray)* – Images to augment. The input can be a list of numpy arrays or a single array. Each array is expected to have shape `(H, W, C)` or `(H, W)`, where `H` is the height, `W` is the width and `C` are the channels. The number of channels may differ between images. If a list is provided, the height, width and channels may differ between images within the provided batch. In most cases, the image array(s) should be of dtype `uint8`, which is supported by all augmenters. Support for other dtypes varies by augmenter – see the respective augmenter-specific documentation for more details.

- **parents** *(None or list of imgaug.augmenters.Augmenter, optional)* – Parent augmenters that have previously been called before the call to this function. Usually you can leave this parameter as `None`. It is set automatically for child augmenters.

- **hooks** *(None or imgaug.HooksImages, optional)* – *HooksImages* object to dynamically interfere with the augmentation process.

**Returns** Corresponding augmented images. If the input was an `ndarray`, the output is also an `ndarray`, unless the used augmentations have led to different output image sizes (as can happen in e.g. cropping).

**Return type** `ndarray` or list
Examples

```python
>>> import imgaug.augmenters as iaa
>>> import numpy as np
>>> aug = iaa.GaussianBlur((0.0, 3.0))
>>> # create empty example images
>>> images = np.zeros((2, 64, 64, 3), dtype=np.uint8)
>>> images_aug = aug.augment_images(images)
```

Create 2 empty (i.e. black) example numpy images and apply gaussian blurring to them.

```python
augment_keypoints(self, keypoints_on_images, parents=None, hooks=None)
```

Augment a batch of keypoints/landmarks.

This is the corresponding function to `Augmenter.augment_images()`, just for keypoints/landmarks (i.e. points on images). Usually you will want to call `Augmenter.augment_images()` with a list of images, e.g. `augment_images([A, B, C])` and then `augment_keypoints()` with the corresponding list of keypoints on these images, e.g. `augment_keypoints([Ak, Bk, Ck])`, where Ak are the keypoints on image A.

Make sure to first convert the augmenter(s) to deterministic states before augmenting images and their corresponding keypoint(s), e.g. by

```python
>>> import imgaug.augmenters as iaa
>>> from imgaug.augmentables.kps import Keypoint
>>> from imgaug.augmentables.kps import KeypointsOnImage
>>> A = B = C = np.zeros((10, 10), dtype=np.uint8)
>>> Ak = Bk = Ck = KeypointsOnImage([Keypoint(2, 2)], (10, 10))
>>> seq = iaa.Fliplr(0.5)
>>> seq_det = seq.to_deterministic()
>>> imgs_aug = seq_det.augment_images([A, B, C])
>>> kps_aug = seq_det.augment_keypoints([Ak, Bk, Ck])
```

Otherwise, different random values will be sampled for the image and keypoint augmentations, resulting in different augmentations (e.g. images might be rotated by 30deg and keypoints by -10deg). Also make sure to call `Augmenter.to_deterministic()` again for each new batch, otherwise you would augment all batches in the same way.

Note that there is also `Augmenter.augment()`, which automatically handles the random state alignment.

**Parameters**

- `keypoints_on_images` (*imgaug.augmentables.kps.KeypointsOnImage or list of imgaug.augmentables.kps.KeypointsOnImage*) – The keypoints/landmarks to augment. Either a single instance of `KeypointsOnImage` or a list of such instances. Each instance must contain the keypoints of a single image.

- `parents` (*None or list of imgaug.augmenters.meta.Augmenter, optional*) – Parent augmenters that have previously been called before the call to this function. Usually you can leave this parameter as `None`. It is set automatically for child augmenters.

- `hooks` (*None or imgaug.imgaug.HooksKeypoints, optional*) – `HooksKeypoints` object to dynamically interfere with the augmentation process.

**Returns** Augmented keypoints.

**Return type** *imgaug.augmentables.kps.KeypointsOnImage or list of imgaug.augmentables.kps.KeypointsOnImage*
**augment_line_strings** (self, line_strings_on_images, parents=None, hooks=None)

Augment a batch of line strings.

This is the corresponding function to `Augmenter.augment_images()` on images, but for lines. Usually you will want to call `Augmenter.augment_images([A, B, C])` with a list of images, e.g. `augment_images([A, B, C])`, and then `augment_line_strings()` with the corresponding list of line strings on these images, e.g. `augment_line_strings([A_line, B_line, C_line])`, where `A_line` are the line strings on image `A`.

Make sure to first convert the augmenter(s) to deterministic states before augmenting images and their corresponding line strings, e.g. by

```python
>>> import imgaug.augmenters as iaa
>>> from imgaug.augmentables.lines import LineString, LineStringsOnImage
>>> A = B = C = np.ones((10, 10), dtype=np.uint8)
>>> A_line = B_line = C_line = LineStringsOnImage([LineString([(0, 0), (1, 0), (1, 1), (0, 1)])], shape=(10, 10))
>>> seq = iaa.Fliplr(0.5)
>>> seq_det = seq.to_deterministic()
>>> imgs_aug = seq_det.augment_images([A, B, C])
>>> lines_aug = seq_det.augment_line_strings([A_line, B_line, C_line])
```

Otherwise, different random values will be sampled for the image and line string augmentations, resulting in different augmentations (e.g. images might be rotated by 30° and line strings by -10°). Also make sure to call `to_deterministic()` again for each new batch, otherwise you would augment all batches in the same way.

Note that there is also `Augmenter.augment()`, which automatically handles the random state alignment.

**Parameters**

- `line_strings_on_images` (imgaug.augmentables.lines.LineStringsOnImage or list of imgaug.augmentables.lines.LineStringsOnImage) – The line strings to augment. Either a single instance of `LineStringsOnImage` or a list of such instances, with each one of them containing the line strings of a single image.

- `parents` (None or list of imgaug.augmenters.meta.Augmenter, optional) – Parent augmenters that have previously been called before the call to this function. Usually you can leave this parameter as None. It is set automatically for child augmenters.

- `hooks` (None or imgaug.imgaug.HooksKeypoints, optional) – `HooksKeypoints` object to dynamically interfere with the augmentation process.

**Returns** Augmented line strings.

**Return type** `imgaug.augmentables.lines.LineStringsOnImage` or list of `imgaug.augmentables.lines.LineStringsOnImage`

**augment_polygons** (self, polygons_on_images, parents=None, hooks=None)

Augment a batch of polygons.

This is the corresponding function to `Augmenter.augment_images()`, just for polygons. Usually you will want to call `Augmenter.augment_images([A, B, C])` with a list of images, e.g. `augment_images([A, B, C])`, and then `augment_polygons()` with the corresponding list of polygons on these images, e.g. `augment_polygons([A_poly, B_poly, C_poly])`, where `A_poly` are the polygons on image `A`. 
Make sure to first convert the augmenter(s) to deterministic states before augmenting images and their corresponding polygons, e.g. by

```python
>>> import imgaug.augmenters as iaa
>>> from imgaug.augmentables.polys import Polygon, PolygonsOnImage
>>> A = B = C = np.ones((10, 10), dtype=np.uint8)
>>> Apoly = Bpoly = Cpoly = PolygonsOnImage(
>>>     [Polygon([(0, 0), (1, 0), (1, 1), (0, 1)])],
>>>     shape=(10, 10))
>>> seq = iaa.Fliplr(0.5)
>>> seq_det = seq.to_deterministic()
>>> imgs_aug = seq_det.augment_images([A, B, C])
>>> polys_aug = seq_det.augment_polygons([Apoly, Bpoly, Cpoly])
```

Otherwise, different random values will be sampled for the image and polygon augmentations, resulting in different augmentations (e.g. images might be rotated by $30\text{deg}$ and polygons by $-10\text{deg}$). Also make sure to call `to_deterministic()` again for each new batch, otherwise you would augment all batches in the same way.

Note that there is also `Augmenter.augment()`, which automatically handles the random state alignment.

**Parameters**

- `polygons_on_images` *(imgaug.augmentables.polys.PolygonsOnImage or list of imgaug.augmentables.polys.PolygonsOnImage)* – The polygons to augment. Either a single instance of `PolygonsOnImage` or a list of such instances, with each one of them containing the polygons of a single image.

- `parents` *(None or list of imgaug.augmenters.meta.Augmenter, optional)* – Parent augmenters that have previously been called before the call to this function. Usually you can leave this parameter as `None`. It is set automatically for child augmenters.

- `hooks` *(None or imgaug.HooksKeypoints, optional)* – `HooksKeypoints` object to dynamically interfere with the augmentation process.

**Returns** Augmented polygons.

**Return type** `imgaug.augmentables.polys.PolygonsOnImage` or list of `imgaug.augmentables.polys.PolygonsOnImage`

### augment_segmentation_maps

`augment_segmentation_maps(self, segmaps, parents=None, hooks=None)`

Augment a batch of segmentation maps.

**Parameters**

- `segmaps` *(imgaug.augmentables.segmaps.SegmentationMapsOnImage or list of imgaug.augmentables.segmaps.SegmentationMapsOnImage)* – Segmentation map(s) to augment. Either a single segmentation map or a list of segmentation maps.

- `parents` *(None or list of imgaug.augmenters.meta.Augmenter, optional)* – Parent augmenters that have previously been called before the call to this function. Usually you can leave this parameter as `None`. It is set automatically for child augmenters.

- `hooks` *(None or imgaug.HooksHeatmaps, optional)* – `HooksHeatmaps` object to dynamically interfere with the augmentation process.

**Returns** Corresponding augmented segmentation map(s).

**Return type** `imgaug.augmentables.segmaps.SegmentationMapsOnImage` or list of `imgaug.augmentables.segmaps.SegmentationMapsOnImage`
copy (self)
Create a shallow copy of this Augmenter instance.

Returns  Shallow copy of this Augmenter instance.

Return type  imgaug.augmenters.meta.Augmenter

copy_random_state (self, source, recursive=True, matching='position', matching_tolerant=True, copy_determinism=False)
Copy the RNGs from a source augmenter sequence.

Parameters

• source (imgaug.augmenters.meta.Augmenter) – See copy_random_state_().

• recursive (bool, optional) – See copy_random_state_().

• matching ({'position', 'name'}, optional) – See copy_random_state_().

• matching_tolerant (bool, optional) – See copy_random_state_().

• copy_determinism (bool, optional) – See copy_random_state_().

Returns  Copy of the augmenter itself (with copied RNGs).

Return type  imgaug.augmenters.meta.Augmenter

copy_random_state_ (self, source, recursive=True, matching='position', matching_tolerant=True, copy_determinism=False)
Copy the RNGs from a source augmenter sequence (in-place).

Note: The source augmenters are not allowed to use the global RNG. Call localize_random_state_() once on the source to localize all random states.

Parameters

• source (imgaug.augmenters.meta.Augmenter) – The source augmenter(s) from where to copy the RNG(s). The source may have children (e.g. the source can be a Sequential).

• recursive (bool, optional) – Whether to copy the RNGs of the source augmenter and all of its children (True) or just the source augmenter (False).

• matching ({'position', 'name'}, optional) – Defines the matching mode to use during recursive copy. This is used to associate source augmenters with target augmenters. If position then the target and source sequences of augmenters are turned into flattened lists and are associated based on their list indices. If name then the target and source augmenters are matched based on their names (i.e. augmenter.name).

• matching_tolerant (bool, optional) – Whether to use tolerant matching between source and target augmenters. If set to False: Name matching will raise an exception for any target augmenter which’s name does not appear among the source augmenters. Position matching will raise an exception if source and target augmenter have an unequal number of children.

• copy_determinism (bool, optional) – Whether to copy the deterministic attributes from source to target augmenters too.

Returns  The augmenter itself.

Return type  imgaug.augmenters.meta.Augmenter
**deepcopy** *(self)*

Create a deep copy of this Augmenter instance.

**Returns**  
Deep copy of this Augmenter instance.

**Return type**  
`imgaug.augmenters.meta.Augmenter`

**draw_grid** *(self, images, rows, cols)*

Augment images and draw the results as a single grid-like image.

This method applies this augmenter to the provided images and returns a grid image of the results. Each cell in the grid contains a single augmented version of an input image.

If multiple input images are provided, the row count is multiplied by the number of images and each image gets its own row. E.g. for `images = [A, B]`, `rows=2, cols=3`:

<table>
<thead>
<tr>
<th>A</th>
<th>A</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>B</td>
<td>B</td>
<td>B</td>
</tr>
</tbody>
</table>

for `images = [A], rows=2, cols=3`:

<table>
<thead>
<tr>
<th>A</th>
<th>A</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>

**Parameters**

- **images** *(N,H,W,3) ndarray or (H,W,3) ndarray or (H,W) ndarray or list of (H,W,3) ndarray or list of (H,W) ndarray)* – List of images to augment and draw in the grid. If a list, then each element is expected to have shape `(H,W)` or `(H,W,3)`. If a single array, then it is expected to have shape `(N,H,W,3)` or `(H,W,3)` or `(H,W)`.

- **rows** *(int)* – Number of rows in the grid. If N input images are given, this value will automatically be multiplied by N to create rows for each image.

- **cols** *(int)* – Number of columns in the grid.

**Returns**  
The generated grid image with augmented versions of the input images. Here, `Hg` and `Wg` reference the output size of the grid, and *not* the sizes of the input images.

**Return type**  
`(Hg, Wg, 3) ndarray`

**find_augmenters** *(self, func, parents=None, flat=True)*

Find augmenters that match a condition.

This function will compare this augmenter and all of its children with a condition. The condition is a lambda function.

**Parameters**

- **func** *(callable)* – A function that receives a `Augmenter` instance and a list of parent `Augmenter` instances and must return `True`, if that augmenter is valid match or `False` otherwise.

- **parents** *(None or list of imgaug.augmenters.meta.Augmenter, optional)* – List of parent augmenters. Intended for nested calls and can usually be left as `None`.

- **flat** *(bool, optional)* – Whether to return the result as a flat list (`True`) or a nested list (`False`). In the latter case, the nesting matches each augmenters position among the children.
Returns  Nested list if flat was set to False. Flat list if flat was set to True.

Return type  list of imgaug.augmenters.meta.Augmenter

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Sequential(
    
    iaa.Fliplr(0.5, name="fliplr"),
    iaa.Flipud(0.5, name="flipud")
    
)
>>> print(aug.find_augmenters(lambda a, parents: a.name == "fliplr"))
```

Return the first child augmenter (Fliplr instance).

find_augmenters_by_name (self, name, regex=False, flat=True)

Find augmenter(s) by name.

Parameters

- name (str) – Name of the augmenter(s) to search for.
- regex (bool, optional) – Whether name parameter is a regular expression.
- flat (bool, optional) – See find_augmenters().

Returns  augmenters – Nested list if flat was set to False. Flat list if flat was set to True.

Return type  list of imgaug.augmenters.meta.Augmenter

find_augmenters_by_names (self, names, regex=False, flat=True)

Find augmenter(s) by names.

Parameters

- names (list of str) – Names of the augmenter(s) to search for.
- regex (bool, optional) – Whether names is a list of regular expressions. If it is, an augmenter is considered a match if at least one of these expressions is a match.
- flat (boolean, optional) – See find_augmenters().

Returns  augmenters – Nested list if flat was set to False. Flat list if flat was set to True.

Return type  list of imgaug.augmenters.meta.Augmenter

get_all_children (self, flat=False)

Get all children of this augmenter as a list.

If the augmenter has no children, the returned list is empty.

Parameters  flat (bool) – If set to True, the returned list will be flat.

Returns  The children as a nested or flat list.

Return type  list of imgaug.augmenters.meta.Augmenter

get CHILDREN_lists (self)

Get a list of lists of children of this augmenter.

For most augmenters, the result will be a single empty list. For augmenters with children it will often be a list with one sublist containing all children. In some cases the augmenter will contain multiple distinct lists of children, e.g. an if-list and an else-list. This will lead to a result consisting of a single list with multiple sublists, each representing the respective sublist of children.
E.g. for an if/else-augmenter that executes the children \(A_1, A_2\) if a condition is met and otherwise executes the children \(B_1, B_2, B_3\) the result will be \([[A_1, A_2], [B_1, B_2, B_3]]\).

IMPORTANT: While the topmost list may be newly created, each of the sublist must be editable in place resulting in a changed children list of the augmenter. E.g. if an Augmenter \(\text{IfElse}(\text{condition, } [A_1, A_2], [B_1, B_2, B_3])\) returns \([[A_1, A_2], [B_1, B_2, B_3]]\) for a call to \(\text{get_children_lists()}\) and \(A_2\) is removed in place from \([A_1, A_2]\), then the children lists of \(\text{IfElse}(\ldots)\) must also change to \([A_1], [B_1, B_2, B_3]\). This is used in \(\text{remove_augmenters()}\).

Returns One or more lists of child augmenter. Can also be a single empty list.

Return type list of list of imgaug.augmenters.meta.Augmenter

get_parameters(self)
Get the parameters of this augmenter.

Returns List of parameters of arbitrary types (usually child class of StochasticParameter, but not guaranteed to be).

Return type list

localize_random_state(self, recursive=True)
Assign augmenter-specific RNGs to this augmenter and its children.

See Augmenter.localize_random_state_() for more details.

Parameters recursive (bool, optional) – See localize_random_state_().

Returns Copy of the augmenter and its children, with localized RNGs.

Return type imgaug.augmenters.meta.Augmenter

localize_random_state_ (self, recursive=True)
Assign augmenter-specific RNGs to this augmenter and its children.

This method iterates over this augmenter and all of its children and replaces any pointer to the global RNG with a new local (i.e. augmenter-specific) RNG.

A random number generator (RNG) is used for the sampling of random values. The global random number generator exists exactly once throughout the library and is shared by many augmenters. A local RNG (usually) exists within exactly one augmenter and is only used by that augmenter.

Usually there is no need to change global into local RNGs. The only noteworthy exceptions are

- Whenever you want to use determinism (so that the global RNG is not accidentally reverted).
- Whenever you want to copy RNGs from one augmenter to another. (Copying the global RNG would usually not be useful. Copying the global RNG from augmenter A to B, then executing A and then B would result in B’s (global) RNG’s state having already changed because of A’s sampling. So the samples of A and B would differ.)

The case of determinism is handled automatically by to_deterministic(). Only when you copy RNGs (via copy_random_state()), you need to call this function first.

Parameters recursive (bool, optional) – Whether to localize the RNGs of the augmenter’s children too.

Returns Returns itself (with localized RNGs).

Return type imgaug.augmenters.meta.Augmenter

pool (self, processes=None, maxtasksperchild=None, seed=None)
Create a pool used for multicore augmentation.
Parameters

- **processes** *(None or int, optional)* – Same as in `__init__()`. The number of background workers. If `None`, the number of the machine’s CPU cores will be used (this counts hyperthreads as CPU cores). If this is set to a negative value `p`, then `P - abs(p)` will be used, where `P` is the number of CPU cores. E.g. `-1` would use all cores except one (this is useful to e.g. reserve one core to feed batches to the GPU).

- **maxtasksperchild** *(None or int, optional)* – Same as for `__init__()`. The number of tasks done per worker process before the process is killed and restarted. If `None`, worker processes will not be automatically restarted.

- **seed** *(None or int, optional)* – Same as for `__init__()`. The seed to use for child processes. If `None`, a random seed will be used.

Returns Pool for multicore augmentation.

Return type `imgaug.multicore.Pool`

Examples

```python
>>> import numpy as np
>>> import imgaug as ia
>>> import imgaug.augmenters as iaa
>>> from imgaug.augmentables.batches import Batch
>>> aug = iaa.Add(1)
>>> images = np.zeros((16, 128, 128, 3), dtype=np.uint8)
>>> batches = [Batch(images=np.copy(images)) for _ in range(100)]
>>> with aug.pool(processes=-1, seed=2) as pool:
...     batches_aug = pool.map_batches(batches, chunksize=8)
...     print(np.sum(batches_aug[0].images_aug[0]))
49152
```

Create 100 batches of empty images. Each batch contains 16 images of size 128x128. The batches are then augmented on all CPU cores except one (`processes=-1`). After augmentation, the sum of pixel values from the first augmented image is printed.

```python
>>> import numpy as np
>>> import imgaug as ia
>>> import imgaug.augmenters as iaa
>>> from imgaug.augmentables.batches import Batch
>>> def generate_batches():
...     for _ in range(100):
...         yield Batch(images=np.copy(images))
>>> with aug.pool(processes=-1, seed=2) as pool:
...     batches_aug = pool.imap_batches(generate_batches(), chunksize=8)
...     batch_aug = next(batches_aug)
...     print(np.sum(batch_aug.images_aug[0]))
49152
```

Same as above. This time, a generator is used to generate batches of images. Again, the first augmented image’s sum of pixels is printed.
remove_augmenters (self, func, copy=True, identity_if_topmost=True, noop_if_topmost=None)

Remove this augmenter or children that match a condition.

Parameters

- **func (callable)** – Condition to match per augmenter. The function must expect the augmenter itself and a list of parent augmenters and returns True if that augmenter is supposed to be removed, or False otherwise. E.g. lambda a, parents: a.name == "fliplr" and len(parents) == 1 removes an augmenter with name fliplr if it is the direct child of the augmenter upon which remove_augmenters() was initially called.

- **copy (bool, optional)** – Whether to copy this augmenter and all its children before removing. If False, removal is performed in-place.

- **identity_if_topmost (bool, optional)** – If True and the condition (lambda function) leads to the removal of the topmost augmenter (the one this function is called on initially), then that topmost augmenter will be replaced by an instance of Noop (i.e. an augmenter that doesn’t change its inputs). If False, None will be returned in these cases. This can only be False if copy is set to True.

- **noop_if_topmost (bool, optional)** – Deprecated since 0.4.0.

Returns

This augmenter after the removal was performed. None is returned if the condition was matched for the topmost augmenter, copy was set to True and noop_if_topmost was set to False.

Return type

*imgaug.augmenters.meta.Augmenter* or None

Examples

```python
>>> import imgaug.augmenters as iaa
>>> seq = iaa.Sequential([
>>>     iaa.Fliplr(0.5, name="fliplr"),
>>>     iaa.Flipud(0.5, name="flipud"),
>>> ])
>>> seq = seq.remove_augmenters(lambda a, parents: a.name == "fliplr")
```

This removes the augmenter Fliplr from the Sequential object's children.

remove_augmenters_ (self, func, parents=None)

Remove in-place children of this augmenter that match a condition.

This is functionally identical to remove_augmenters() with copy=False, except that it does not affect the topmost augmenter (the one on which this function is initially called on).

Added in 0.4.0.

Parameters

- **func (callable)** – See remove_augmenters().

- **parents (None or list of imgaug.augmenters.meta.Augmenter, optional)** – List of parent *Augmenter* instances that lead to this augmenter. If None, an empty list will be used.

This parameter can usually be left empty and will be set automatically for children.
Examples

```python
>>> import imgaug.augmenters as iaa
>>> seq = iaa.Sequential([
>>>     iaa.Fliplr(0.5, name="fliplr"),
>>>     iaa.Flipud(0.5, name="flipud"),
>>> ])
>>> seq.remove_augmenters_(lambda a, parents: a.name == "fliplr")
```

This removes the augmenter `Fliplr` from the `Sequential` object’s children.

```python
remove_augmenters_inplace(self, func, parents=None)
```

Deprecated. Use `remove_augmenters_` instead.

Old name for `remove_augmenters_`.

Deprecated since 0.4.0.

```python
reseed(self, random_state=None, deterministic_too=False)
```

Deprecated. Use `imgaug.augmenters.meta.Augmenter.seed_inplace` instead.

Old name of `seed_`.

Deprecated since 0.4.0.

```python
seed_(self, entropy=None, deterministic_too=False)
```

Seed this augmenter and all of its children.

This method assigns a new random number generator to the augmenter and all of its children (if it has any). The new random number generator is derived from the provided seed or RNG – or from the global random number generator if `None` was provided. Note that as child RNGs are derived, they do not all use the same seed.

If this augmenter or any child augmenter had a random number generator that pointed to the global random state, it will automatically be replaced with a local random state. This is similar to what `localize_random_state()` does.

This method is useful when augmentations are run in the background (i.e. on multiple cores). It should be called before sending this `Augmenter` instance to a background worker or once within each worker with different seeds (i.e., if `N` workers are used, the function should be called `N` times). Otherwise, all background workers will use the same seeds and therefore apply the same augmentations. Note that `Augmenter.augment_batches()` and `Augmenter.pool()` already do this automatically.

Added in 0.4.0.

Parameters

- `entropy` (None or `int` or `imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or `numpy.random.RandomState`, optional) – A seed or random number generator that is used to derive new random number generators for this augmenter and its children. If an `int` is provided, it will be interpreted as a seed. If `None` is provided, the global random number generator will be used.

- `deterministic_too` (bool, optional) – Whether to also change the seed of an augmenter `A`, if `A` is deterministic. This is the case both when this augmenter object is `A` or one of its children is `A`. 

880 Chapter 13. API
Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Sequential([  
>>>     iaa.Crop(px=(0, 10)),  
>>>     iaa.Crop(px=(0, 10))  
>>> ])  
>>> aug.seed_(1)
```

Seed an augmentation sequence containing two crop operations. Even though the same seed was used, the two operations will still sample different pixel amounts to crop as the child-specific seed is merely derived from the provided seed.

`show_grid`  
Augment images and plot the results as a single grid-like image.  
This calls `draw_grid()` and simply shows the results. See that method for details.

Parameters

- **images** *(N,H,W,3) ndarray or (H,W,3) ndarray or (H,W) ndarray or list of (H,W,3) ndarray or list of (H,W) ndarray* – List of images to augment and draw in the grid. If a list, then each element is expected to have shape \((H, W)\) or \((H, W, 3)\). If a single array, then it is expected to have shape \((N, H, W, 3)\) or \((H, W, 3)\) or \((H, W)\).

- **rows** *(int)* – Number of rows in the grid. If \(N\) input images are given, this value will automatically be multiplied by \(N\) to create rows for each image.

- **cols** *(int)* – Number of columns in the grid.

`to_deterministic`  
Convert this augmenter from a stochastic to a deterministic one.

A stochastic augmenter samples pseudo-random values for each parameter, image and batch. A deterministic augmenter also samples new values for each parameter and image, but not batch. Instead, for consecutive batches it will sample the same values (provided the number of images and their sizes don’t change). From a technical perspective this means that a deterministic augmenter starts each batch’s augmentation with a random number generator in the same state (i.e. same seed), instead of advancing that state from batch to batch.

Using determinism is useful to (a) get the same augmentations for two or more image batches (e.g. for stereo cameras), (b) to augment images and corresponding data on them (e.g. segmentation maps or bounding boxes) in the same way.

Parameters **n** *(None or int, optional)* – Number of deterministic augmenters to return. If \(\text{None}\) then only one `Augmenter` instance will be returned. If \(1\) or higher, a list containing \(n\) `Augmenter` instances will be returned.

Returns  
A single `Augmenter` object if \(n\) was \(\text{None}\), otherwise a list of `Augmenter` objects (even if \(n\) was \(1\)).

Return type  
`imgaug.augmenters.meta.Augmenter` or list of `imgaug.augmenters.meta.Augmenter`

class `imgaug.augmenters.meta.ChannelShuffle` *(p=1.0, channels=None, seed=None, name=None, random_state=’deprecated’, deterministic=’deprecated’)*

Bases: `imgaug.augmenters.meta.Augmenter`

Randomize the order of channels in input images.

Supported dtypes:
• uint8: yes; fully tested
• uint16: yes; tested
• uint32: yes; tested
• uint64: yes; tested
• int8: yes; tested
• int16: yes; tested
• int32: yes; tested
• int64: yes; tested
• float16: yes; tested
• float32: yes; tested
• float64: yes; tested
• float128: yes; tested
• bool: yes; tested

Parameters

• p (float or imgaug.parameters.StochasticParameter, optional) – Probability of shuffling channels in any given image. May be a fixed probability as a float, or a StochasticParameter that returns 0s and 1s.

• channels (None or imgaug.ALL or list of int, optional) – Which channels are allowed to be shuffled with each other. If this is None or imgaug.ALL, then all channels may be shuffled. If it is a list of int s, then only the channels with indices in that list may be shuffled. (Values start at 0. All channel indices in the list must exist in each image.)

• seed (None or int or imgaug.random.RNG or numpy.random.random.RandomState, optional) – See __init__().

• name (None or str, optional) – See __init__().

• random_state (None or int or imgaug.random.RNG or numpy.random.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.ChannelShuffle(0.35)
```
Shuffle all channels of 35% of all images.

```python
>>> aug = iaa.ChannelShuffle(0.35, channels=[0, 1])
```
Shuffle only channels 0 and 1 of 35% of all images. As the new channel orders 0, 1 and 1, 0 are both valid outcomes of the shuffling, it means that for $0.35 \times 0.5 = 0.175$ or 17.5% of all images the order of channels 0 and 1 is inverted.

**Methods**

```python
__call__(self, *args, **kwargs) Alias for augment().
augment(self[, return_batch, hooks]) Augment a batch.
augment_batch(self[, batch, hooks]) Augment a single batch in-place.
augment_batch_(self[, batch[, parents, hooks]]) Augment multiple batches.
augment_bounding_boxes(self[, ...[, parents, ...]]) Augment a batch of bounding boxes.
augment_heatmaps(self[, heatmaps[, parents, ...]]) Augment a batch of heatmaps.
augment_image(self[, image[, hooks]]) Augment a single image.
augment_images(self[, images[, parents, hooks]]) Augment a batch of images.
augment_keypoints(self[, keypoints_on_images]) Augment a batch of keypoints/landmarks.
augment_line_strings(self[, ...[, parents, hooks]]) Augment a batch of line strings.
augment_polygons(self[, polygons_on_images[, ...]]) Augment a batch of polygons.
augment_segmentation_maps(self[, segmaps[, ...]]) Augment a batch of segmentation maps.
copy(self) Create a shallow copy of this Augmenter instance.
copy_random_state(self[, source[, recursive, ...]]) Copy the RNGs from a source augmenter sequence.
copy_random_state_(self[, source[, ...]]) Copy the RNGs from a source augmenter sequence (in-place).
deepcopy(self) Create a deep copy of this Augmenter instance.
draw_grid(self[, images, rows, cols]) Augment images and draw the results as a single grid-like image.
find_augmenters(self[, func[, parents, flat]]) Find augmenters that match a condition.
find_augmenters_by_name(self[, name[, ...]]) Find augmenter(s) by name.
find_augmenters_by_names(self[, names[, ...]]) Find augmenter(s) by names.
get_all_children(self[, flat]) Get all children of this augmenter as a list.
get_children_lists(self) Get a list of lists of children of this augmenter.
get_parameters(self) See get_parameters().
localize_random_state(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
localize_random_state_(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
pool(self[, processes, maxtasksperchild, seed]) Create a pool used for multicore augmentation.
remove_augmenters(self[, func[, copy, ...]]) Remove this augmenter or children that match a condition.
remove_augmenters_(self[, func[, parents]]) Remove in-place children of this augmenter that match a condition.
```
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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>remove_augmenters_inplace(self, func, parents)</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_tool])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
def get_parameters(self):  
    See get_parameters().

class imgaug.augmenters.meta.ClipCBAsToImagePlanes(seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

This augmenter inspects all coordinate-based augmentables (e.g. bounding boxes, line strings) within a given batch and from each of them parts that are outside of the image plane. Parts within the image plane will be retained. This may e.g. shrink down bounding boxes. For keypoints, it removes any single points outside of the image plane. Any augmentable that is completely outside of the image plane will be removed.

Added in 0.4.0.

**Supported dtypes:**
- uint8: yes; fully tested
- uint16: yes; fully tested
- uint32: yes; fully tested
- uint64: yes; fully tested
- int8: yes; fully tested
- int16: yes; fully tested
- int32: yes; fully tested
- int64: yes; fully tested
- float16: yes; fully tested
- float32: yes; fully tested
- float64: yes; fully tested
- float128: yes; fully tested
- bool: yes; fully tested

**Parameters**
- `seed` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.  
- `name` *(None or str, optional)* – See `__init__()`. 
- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator
  or numpy.random.BitGenerator or numpy.random.SeedSequence or
  numpy.random.RandomState, optional) – Old name for parameter seed. Its usage
  will not yet cause a deprecation warning, but it is still recommended to use seed now.
  Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method
to_deterministic() for an alternative and for details about what the “deterministic
mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa

>>> aug = iaa.Sequential([
    iaa.Affine(translate_px={"x": (-100, 100)}),
    iaa.ClipCBAsToImagePlanes()
])
```

Translate input data on the x-axis by -100 to 100 pixels, then cut all coordinate-based augmentables (e.g.
bounding boxes) down to areas that are within the image planes of their corresponding images.

### Methods

- `__call__` *(self, *args, **kwargs)*  
  Alias for `augment()`.

- `augment` *(self, return_batch, hooks)*  
  Augment a batch.

- `augment_batch` *(self, batch[, hooks])*  
  Deprecated.

- `augment_batch_` *(self, batch[, parents, hooks])*  
  Augment a single batch in-place.

- `augment_bounding_boxes` *(self, ...[, parents, ...])*  
  Augment a batch of bounding boxes.

- `augment_heatmaps` *(self, heatmaps[, parents, ...])*  
  Augment a batch of heatmaps.

- `augment_image` *(self, image[, hooks])*  
  Augment a single image.

- `augment_images` *(self, images[, parents, hooks])*  
  Augment a batch of images.

- `augment_keypoints` *(self, key-points_on_images)*  
  Augment a batch of keypoints/landmarks.

- `augment_line_strings` *(self, ...[, parents, hooks])*  
  Augment a batch of line strings.

- `augment_polygons` *(self, polygons_on_images[, ...])*  
  Augment a batch of polygons.

- `augment_segmentation_maps` *(self, segmaps[, ...])*  
  Augment a batch of segmentation maps.

- `copy` *(self)*  
  Create a shallow copy of this Augmenter instance.

- `copy_random_state` *(self, source[, recursive, ...])*  
  Copy the RNGs from a source augmenter sequence.

- `copy_random_state_` *(self, source[, ...])*  
  Copy the RNGs from a source augmenter sequence (in-place).

- `deepcopy` *(self)*  
  Create a deep copy of this Augmenter instance.

- `draw_grid` *(self, images, rows, cols)*  
  Augment images and draw the results as a single grid-like image.

- `find_augmenters` *(self, func[, parents, flat])*  
  Find augmenters that match a condition.
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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>find_augmenters_by_name(self, name[, regex, ...])</td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td>find_augmenters_by_names(self, names[, ...])</td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td>get_all_children(self[, flat])</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td>get_children_lists(self)</td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td>get_parameters(self)</td>
<td>See get_parameters().</td>
</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>localize_random_state_(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>pool(self[, processes, maxtasksperchild, seed])</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters(self, func[, copy, ...])</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**get_parameters(self)**

See get_parameters().

**class imgaug.augmenters.meta.Identity**

```python
seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: imgaug.augmenters.meta.Augmenter

Augmenter that does not change the input data.

This augmenter is useful e.g. during validation/testing as it allows to re-use the training code without actually performing any augmentation.

Added in 0.4.0.

**Supported dtypes:**

- uint8: yes; fully tested
- uint16: yes; tested
- uint32: yes; tested
- uint64: yes; tested
- int8: yes; tested
- int16: yes; tested
- int32: yes; tested
- int64: yes; tested
- float16: yes; tested
• float32: yes; tested
• float64: yes; tested
• float128: yes; tested
• bool: yes; tested

Parameters

• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

• name (None or str, optional) – See __init__().

• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
g >> import imgaug.augmenters as iaa
g >> aug = iaa.Identity()
```

Create an augmenter that does not change inputs.

Methods

```python
__call__(self, *args, **kwargs) Alias for augment().

augment(self, return_batch, hooks) Augment a batch.

augment_batch(self, batch[, hooks]) Deprecated.

augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.

augment_batches(self, batch, hooks) Augment multiple batches.

augment_bounding_boxes(self, ..., parents, ...) Augment a batch of bounding boxes.

augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.

augment_image(self, image[, hooks]) Augment a single image.

augment_images(self, images[, parents, hooks]) Augment a batch of images.

augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.

augment_line_strings(self, ..., parents, hooks) Augment a batch of line strings.

augment_polygons(self, polygons_on_images[, ...]) Augment a batch of polygons.

augment_segmentation_maps(self, segmaps[, ...]) Augment a batch of segmentation maps.
```
Table 182 – continued from previous page

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy()</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children([flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists()</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
</tbody>
</table>
| `get_parameters()` | See `get_parameters()`.
| `localize_random_state(recursive)` | Assign augmenter-specific RNGs to this augmenter and its children. |
| `localize_random_state_()` | Assign augmenter-specific RNGs to this augmenter and its children. |
| `pool(processes, maxtasksperchild, seed)` | Create a pool used for multicore augmentation. |
| `remove_augmenters(func[, copy, ...])` | Remove this augmenter or children that match a condition. |
| `remove_augmenters_(func[, parents])` | Remove in-place children of this augmenter that match a condition. |
| `remove_augmenters_inplace(func[, parents])` | Deprecated. |
| `reseed(random_state, deterministic_too)` | Deprecated. |
| `seed_(entropy, deterministic_too)` | Seed this augmenter and all of its children. |
| `show_grid(images, rows, cols)` | Augment images and plot the results as a single grid-like image. |
| `to_deterministic(n)` | Convert this augmenter from a stochastic to a deterministic one. |

**get_parameters**: See `get_parameters()`.

```python
class imgaug.augmenters.meta.Lambda(func_images=None, func_heatmaps=None, func_segmentation_maps=None, func_keypoints=None, func_bounding_boxes='keypoints', func_polygons='keypoints', func_line_strings='keypoints', seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases**: `imgaug.augmenters.meta.Augmenter`

Augmenter that calls a lambda function for each input batch.

This is useful to add missing functions to a list of augmenters.

**Supported dtypes:**
- `uint8`: yes; fully tested
- `uint16`: yes; tested
• `uint32`: yes; tested
• `uint64`: yes; tested
• `int8`: yes; tested
• `int16`: yes; tested
• `int32`: yes; tested
• `int64`: yes; tested
• `float16`: yes; tested
• `float32`: yes; tested
• `float64`: yes; tested
• `float128`: yes; tested
• `bool`: yes; tested

Parameters

• `func_images` *(None or callable, optional)* – The function to call for each batch of images. It must follow the form:

```python
function(images, random_state, parents, hooks)
```

and return the changed images (may be transformed in-place). This is essentially the interface of `_augment_images()`. If this is `None` instead of a function, the images will not be altered.

• `func_heatmaps` *(None or callable, optional)* – The function to call for each batch of heatmaps. It must follow the form:

```python
function(heatmaps, random_state, parents, hooks)
```

and return the changed heatmaps (may be transformed in-place). This is essentially the interface of `_augment_heatmaps()`. If this is `None` instead of a function, the heatmaps will not be altered.

• `func_segmentation_maps` *(None or callable, optional)* – The function to call for each batch of segmentation maps. It must follow the form:

```python
function(segmaps, random_state, parents, hooks)
```

and return the changed segmaps (may be transformed in-place). This is essentially the interface of `_augment_segmentation_maps()`. If this is `None` instead of a function, the segmentation maps will not be altered.

• `func_keypoints` *(None or callable, optional)* – The function to call for each batch of keypoints. It must follow the form:

```python
function(keypoints_on_images, random_state, parents, hooks)
```

and return the changed keypoints (may be transformed in-place). This is essentially the interface of `_augment_keypoints()`. If this is `None` instead of a function, the keypoints will not be altered.

• `func_bounding_boxes` *(“keypoints” or None or callable, optional)* – The function to call for each batch of bounding boxes. It must follow the form:
function(bounding_boxes_on_images, random_state, parents, hooks)

and return the changed bounding boxes (may be transformed in-place). This is essentially the interface of _augment_bounding_boxes(). If this is None instead of a function, the bounding boxes will not be altered. If this is the string "keypoints" instead of a function, the bounding boxes will automatically be augmented by transforming their corner vertices to keypoints and calling func_keypoints.

Added in 0.4.0.

- **func_polygons** ("keypoints" or None or callable, optional) – The function to call for each batch of polygons. It must follow the form:

  function(polygons_on_images, random_state, parents, hooks)

  and return the changed polygons (may be transformed in-place). This is essentially the interface of _augment_polygons(). If this is None instead of a function, the polygons will not be altered. If this is the string "keypoints" instead of a function, the polygons will automatically be augmented by transforming their corner vertices to keypoints and calling func_keypoints.

  Added in 0.4.0.

- **func_line_strings** ("keypoints" or None or callable, optional) – The function to call for each batch of line strings. It must follow the form:

  function(line_strings_on_images, random_state, parents, hooks)

  and return the changed line strings (may be transformed in-place). This is essentially the interface of _augment_line_strings(). If this is None instead of a function, the line strings will not be altered. If this is the string "keypoints" instead of a function, the line strings will automatically be augmented by transforming their corner vertices to keypoints and calling func_keypoints.

  Added in 0.4.0.

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- **name** (None or str, optional) – See __init__().

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa

>>> def func_images(images, random_state, parents, hooks):
...     images[:, ::2, :, :] = 0
...     return images
```

(continues on next page)
Replace every second row in input images with black pixels. Leave other data (e.g. heatmaps, keypoints) unchanged.

```python
>>> def func_images(images, random_state, parents, hooks):
>>>     images[:, ::2, :, :] = 0
>>>     return images

>>> def func_heatmaps(heatmaps, random_state, parents, hooks):
>>>     for heatmaps_i in heatmaps:
>>>         heatmaps.arr_0to1[:, ::2, :, :] = 0
>>>     return heatmaps

>>> def func_keypoints(keypoints_on_images, random_state, parents, hooks):
>>>     return keypoints_on_images

>>> aug = iaa.Lambda(
>>>     func_images=func_images,
>>>     func_heatmaps=func_heatmaps,
>>>     func_keypoints=func_keypoints
>>> )
```

Replace every second row in images with black pixels, set every second row in heatmaps to zero and leave other data (e.g. keypoints) unchanged.

```
Methods

__call__(self, *args, **kwargs) Alias for augment().

augment(self[, return_batch, hooks]) Augment a batch.
augment_batch(self[, batch[, hooks]]) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self, batches[, hooks, ...]) Augment multiple batches.
augment_bounding_boxes(self, ...[, parents, ...]) Augment a batch of bounding boxes.
augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
augment_image(self, image[, hooks]) Augment a single image.
augment_images(self, images[, parents, hooks]) Augment a batch of images.
augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
augment_line_strings(self, ...[, parents, hooks]) Augment a batch of line strings.
augment_polygons(self, polygons_on_images[, ...]) Augment a batch of polygons.
augment_segmentation_maps(self, segmaps[, ...]) Augment a batch of segmentation maps.
copy(self) Create a shallow copy of this Augmenter instance.
```
copy_random_state(self, source[, recursive, ...])  
Copy the RNGs from a source augmenter sequence.

copy_random_state_(self, source[, ...])  
Copy the RNGs from a source augmenter sequence (in-place).

deepcopy(self)  
Create a deep copy of this Augmenter instance.

draw_grid(self, images, rows, cols)  
Augment images and draw the results as a single grid-like image.

find_augmenters(self, func[, parents, flat])  
Find augmenters that match a condition.

find_augmenters_by_name(self, name[, regex, ...])  
Find augmenter(s) by name.

find_augmenters_by_names(self, names[, ...])  
Find augmenter(s) by names.

get_all_children(self[, flat])  
Get all children of this augmenter as a list.

get_children_lists(self)  
Get a list of lists of children of this augmenter.

get_parameters(self)  
See get_parameters().

localize_random_state(self[, recursive])  
Assign augmenter-specific RNGs to this augmenter and its children.

localize_random_state_(self[, recursive])  
Assign augmenter-specific RNGs to this augmenter and its children.

pool(self[, processes, maxtasksperchild, seed])  
Create a pool used for multicore augmentation.

remove_augmenters(self, func[, copy, ...])  
Remove this augmenter or children that match a condition.

remove_augmenters_(self, func[, parents])  
Remove in-place children of this augmenter that match a condition.

remove_augmenters_inplace(self, func[, parents])  
Deprecated.

reseed(self[, random_state, deterministic_too])  
Deprecated.

seed_(self[, entropy, deterministic_too])  
Seed this augmenter and all of its children.

show_grid(self, images, rows, cols)  
Augment images and plot the results as a single grid-like image.

to_deterministic(self[, n])  
Convert this augmenter from a stochastic to a deterministic one.

get_parameters(self)  
See get_parameters().

class imgaug.augmenters.meta.Noop(seed=None, name=None, random_state='deprecated', deterministic='deprecated')
Bases: imgaug.augmenters.meta.Identity

Alias for augmenter Identity.

It is recommended to now use Identity. Noop might be deprecated in the future.

Supported dtypes:
See Identity.

Parameters

- seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().
- name (None or str, optional) – See __init__().
• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Noop()
```

Create an augmenter that does not change inputs.

### Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><strong><strong>call</strong></strong> *(self, *args, *<em>kwargs)</em></td>
<td>Alias for <code>augment()</code>.</td>
</tr>
<tr>
<td><strong>augment</strong> <em>(self[, return_batch, hooks])</em></td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><strong>augment_batch</strong> <em>(self[, batch[, hooks]])</em></td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><strong>augment_batch_(self[, batch[, parents, hooks]])</strong></td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><strong>augment_batches</strong> <em>(self[, batches[, hooks]])</em></td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td><strong>augment_bounding_boxes</strong>(self[, ...[, parents, ...]])</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><strong>augment_heatmaps</strong>(self[, heatmaps[, parents, ...]])</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><strong>augment_image</strong>(self[, image[, hooks]])</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><strong>augment_images</strong> <em>(self[, images[, parents, hooks]])</em></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><strong>augment_keypoints</strong>(self[, keypoints_on_images])</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><strong>augment_line_strings</strong>(self[, ...[, parents, hooks]])</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><strong>augment_polygons</strong>(self[, polygons_on_images[, ...]])</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><strong>augment_segmentation_maps</strong>(self[, segmaps[, ...]])</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><strong>copy</strong>(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><strong>copy_random_state</strong>(self[, source[, recursive, ...]])</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><strong>copy_random_state_(self[, source[, ...]])</strong></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><strong>deepcopy</strong>(self)</td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><strong>draw_grid</strong>(self[, images, rows, cols])</td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><strong>find_augmenters</strong>(self[, func[, parents, flat]])</td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><strong>find_augmenters_by_name</strong>(self[, name[, regex, ...]])</td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><strong>find_augmenters_by_names</strong>(self[, names[, ...]])</td>
<td>Find augmenter(s) by names.</td>
</tr>
</tbody>
</table>

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Table 184 – continued from previous page

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>get_all_children(self[, flat])</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td>get_children_lists(self)</td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td>get_parameters(self)</td>
<td>See get_parameters().</td>
</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>localize_random_state_ (self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>pool(self[, processes, maxtasksperchild, seed])</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters(self, func[, copy,...])</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_ (self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self[, func[, parents]])</td>
<td>Depreciated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Depreciated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self[, images, rows, cols])</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

class imgaug.augmenters.meta.OneOf(children, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.meta.SomeOf

Augmenter that always executes exactly one of its children.

Supported dtypes:

See imgaug.augmenters.meta.SomeOf.

Parameters

- children (imgaug.augmenters.meta.Augmenter or list of imgaug.augmenters.meta.Augmenter) – The choices of augmenters to apply.
- seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().
- name (None or str, optional) – See __init__().
- random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
- deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples
**Methods**

```python
>>> import imgaug.augmenters as iaa
>>> images = [np.ones((10, 10), dtype=np.uint8)]  # dummy example images
>>> seq = iaa.OneOf(
>>>     [iaa.Fliplr(1.0),
>>>      iaa.Flipud(1.0)]
>>> )
>>> images_aug = seq.augment_images(images)
```

Flip each image either horizontally or vertically.

```python
>>> images = [np.ones((10, 10), dtype=np.uint8)]  # dummy example images
>>> seq = iaa.OneOf([iaa.Fliplr(1.0),
>>>                  iaa.Sequential([iaa.GaussianBlur(1.0),
>>>                                 iaa.Dropout(0.05),
>>>                                 iaa.AdditiveGaussianNoise(0.1*255)],
>>>                                 iaa.Noop())],
>>>                  iaa.Noop())
>>> images_aug = seq.augment_images(images)
```

Either flip each image horizontally, or add blur+dropout+noise or do nothing.

### Methods

- **`__call__`** *(self, *args, **kwargs)*: Alias for `augment()`.
- **`add`** *(self, augmenter)*: Add an augmenter to the list of child augmenters.
- **`append`** *(self, object, /)*: Append object to the end of the list.
- **`augment`** *(self[, return_batch, hooks])*: Augment a batch.
- **`augment_batch`** *(self, batch[, hooks])*: Deprecated.
- **`augment_batch_(self, batch[, parents, hooks])***: Augment a single batch in-place.
- **`augment_bounding_boxes`** *(self[, parents, ...])*: Augment a batch of bounding boxes.
- **`augment_heatmaps`** *(self[, heatmaps[, parents, ...]]*): Augment a batch of heatmaps.
- **`augment_image`** *(self[, image[, hooks]]*): Augment a single image.
- **`augment_images`** *(self[, images[, parents, hooks]]*): Augment a batch of images.
- **`augment_keypoints`** *(self, keypoints_on_images)*: Augment a batch of keypoints/landmarks.
- **`augment_line_strings`** *(self[, parents, hooks])***: Augment a batch of line strings.
- **`augment_polygons`** *(self[, polygons_on_images[, ...]]*): Augment a batch of polygons.
- **`augment_segmentation_maps`** *(self[, segmaps[, ...]]*): Augment a batch of segmentation maps.
- **`clear`** *(self, /)*: Remove all items from list.
- **`copy`** *(self)*: Create a shallow copy of this Augmenter instance.
- **`copy_random_state`** *(self[, source[, recursive, ...]]*): Copy the RNGs from a source augmenter sequence.

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<table>
<thead>
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<th>Description</th>
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</thead>
<tbody>
<tr>
<td><code>copy_random_state_(self, source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>count(self, value, /)</code></td>
<td>Return number of occurrences of value.</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>extend(self, iterable, /)</code></td>
<td>Extend list by appending elements from the iterable.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>See <code>get_children_lists()</code>.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>index(self, value[, start, stop])</code></td>
<td>Return first index of value.</td>
</tr>
<tr>
<td><code>insert(self, index, object, /)</code></td>
<td>Insert object before index.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>pop(self[, index])</code></td>
<td>Remove and return item at index (default last).</td>
</tr>
<tr>
<td><code>remove(self, value, /)</code></td>
<td>Remove first occurrence of value.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reverse(self, /)</code></td>
<td>Reverse IN PLACE.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>sort(self, /, *[key, reverse])</code></td>
<td>Stable sort IN PLACE.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.meta.RemoveCBAsByOutOfImageFraction:
    Bases: imgaug.augmenters.meta.Augmenter
```

Remove coordinate-based augmentables exceeding an out of image fraction.

This augmenter inspects all coordinate-based augmentables (e.g. bounding boxes, line strings) within a given batch and removes any such augmentable which’s out of image fraction is exactly a given value or greater than that. The out of image fraction denotes the fraction of the augmentable’s area that is outside of the image, e.g. for a bounding box that has half of its area outside of the image it would be 0.5.

Added in 0.4.0.
Supported dtypes:

- `uint8`: yes; fully tested
- `uint16`: yes; fully tested
- `uint32`: yes; fully tested
- `uint64`: yes; fully tested
- `int8`: yes; fully tested
- `int16`: yes; fully tested
- `int32`: yes; fully tested
- `int64`: yes; fully tested
- `float16`: yes; fully tested
- `float32`: yes; fully tested
- `float64`: yes; fully tested
- `float128`: yes; fully tested
- `bool`: yes; fully tested

Parameters

- `fraction (number)` – Remove any augmentable for which `fraction_{actual} >= fraction`, where `fraction_{actual}` denotes the estimated out of image fraction.

- `seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)` – See `__init__()`.

- `name (None or str, optional)` – See `__init__()`.

- `random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)` – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- `deterministic (bool, optional)` – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Sequential([
                        iaa.Affine(translate_px="x": (-100, 100)),
                        iaa.RemoveCBAsByOutOfImageFraction(0.5)
                        ])
```

Translate all inputs by $-100$ to $100$ pixels on the x-axis, then remove any coordinate-based augmentable (e.g. bounding boxes) which has at least 50% of its area outside of the image plane.
Create a bounding box on an example image, then translate the image so that 50% of the bounding box’s area is outside of the image and compare the effects and using `RemoveCBAsByOutOfImageFraction` with not using it.

**Methods**

__call__ (self, *args, **kwargs)  
Alias for `augment()`.

`augment` (self[, return_batch, hooks])  
Augment a batch.

`augment_batch` (self[, return_batch, hooks])  
Augment a single batch in-place.

`augment_bounding_boxes` (self[, return_batch, hooks])  
Augment a batch of bounding boxes.

`augment_heatmaps` (self[, return_batch, hooks])  
Augment a batch of heatmaps.

`augment_image` (self[, return_batch, hooks])  
Augment a single image.

`augment_images` (self[, return_batch, hooks])  
Augment multiple batches.

`augment_keypoints` (self[, return_batch, hooks])  
Augment a batch of keypoints/landmarks.

`augment_line_strings` (self[, return_batch, hooks])  
Augment a batch of line strings.

`augment_polygons` (self[, return_batch, hooks])  
Augment a batch of polygons.

`augment_segmentation_maps` (self[, return_batch, hooks])  
Augment a batch of segmentation maps.

`copy` (self)  
Create a shallow copy of this Augmenter instance.

`copy_random_state` (self[, source[, recursive[, ...]])  
Copy the RNGs from a source augmenter sequence.

`copy_random_state__` (self[, source[, ...]])  
Copy the RNGs from a source augmenter sequence (in-place).

`deepcopy` (self)  
Create a deep copy of this Augmenter instance.

`draw_grid` (self, images, rows, cols)  
Augment images and draw the results as a single grid-like image.

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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>find_augmenters</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>reseed</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>show_grid</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**get_parameters** *(self)*
See `get_parameters()`.

class `imgaug.augmenters.meta.Sequential`

Bases: `imgaug.augmenters.meta.Augmenter`, `list`

List augmenter containing child augmenters to apply to inputs.

This augmenter is simply a list of other augmenters. To augment an image or any other data, it iterates over its children and applies each one of them independently to the data. (This also means that the second applied augmenter will already receive augmented input data and augment it further.)

This augmenter offers the option to apply its children in random order using the `random_order` parameter. This should often be activated as it greatly increases the space of possible augmentations.

**Note:** You are not forced to use `Sequential` in order to use other augmenters. Each augmenter can be used on its own, e.g. the following defines an augmenter for horizontal flips and then augments a single image:

```python
>>> import numpy as np
>>> import imgaug.augmenters as iaa
>>> image = np.zeros((32, 32, 3), dtype=np.uint8)
>>> aug = iaa.Fliplr(0.5)
>>> image_aug = aug.augment_image(image)
```

Supported dtypes:
• `uint8`: yes; fully tested
• `uint16`: yes; tested
• `uint32`: yes; tested
• `uint64`: yes; tested
• `int8`: yes; tested
• `int16`: yes; tested
• `int32`: yes; tested
• `int64`: yes; tested
• `float16`: yes; tested
• `float32`: yes; tested
• `float64`: yes; tested
• `float128`: yes; tested
• `bool`: yes; tested

**Parameters**

- **children** (imgaug.augmenters.meta.Augmenter or list of imgaug.augmenters.meta.Augmenter or None, optional) – The augmenters to apply to images.
- **random_order** (bool, optional) – Whether to apply the child augmenters in random order. If True, the order will be randomly sampled once per batch.
- **seed** (None or int or imgaug.random.Random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See `__init__()`.
- **name** (None or str, optional) – See `__init__()`.
- **random_state** (None or int or imgaug.random.Random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import numpy as np
>>> import imgaug.augmenters as iaa
>>> imgs = [np.random.rand(10, 10)]
>>> seq = iaa.Sequential([
>>>     iaa.Fliplr(0.5),
>>>     iaa.Flipud(0.5)
>>> ])
>>> imgs_aug = seq.augment_images(imgs)
```
Create a `Sequential` that always first applies a horizontal flip augmenter and then a vertical flip augmenter. Each of these two augmenters has a 50% probability of actually flipping the image.

```python
>>> seq = iaa.Sequential([
>>>     iaa.Fliplr(0.5),
>>>     iaa.Flipud(0.5)
>>> ], random_order=True)
>>> imgs_aug = seq.augment_images(imgs)
```

Create a `Sequential` that sometimes first applies a horizontal flip augmenter (followed by a vertical flip augmenter) and sometimes first a vertical flip augmenter (followed by a horizontal flip augmenter). Again, each of them has a 50% probability of actually flipping the image.

**Methods**

- `_call_` (self, *args, **kwargs)  
  Alias for `augment()`.
- `add`(self, augmenter)  
  Add an augmenter to the list of child augmenters.
- `append`(self, object, /)  
  Append object to the end of the list.
- `augment`(self, return_batch, hooks)  
  Augment a batch.
- `augment_batch`(self, batch[, hooks])  
  Deprecated.
- `augment_batch_`(self, batch[, parents, hooks])  
  Augment a single batch in-place.
- `augment_batches`(self, batches[, hooks])  
  Augment multiple batches.
- `augment_bounding_boxes`(self, ..., [parents, ...])  
  Augment a batch of bounding boxes.
- `augment_heatmaps`(self, heatmaps[, parents, ...])  
  Augment a batch of heatmaps.
- `augment_image`(self, image[, hooks])  
  Augment a single image.
- `augment_images`(self, images[, parents, hooks])  
  Augment a batch of images.
- `augment_keypoints`(self, keypoints_on_images)  
  Augment a batch of keypoints/landmarks.
- `augment_line_strings`(self, ..., [parents, hooks])  
  Augment a batch of line strings.
- `augment_polygons`(self, polygons_on_images[, ...])  
  Augment a batch of polygons.
- `augment_segmentation_maps`(self, segmaps[, ...])  
  Augment a batch of segmentation maps.
- `clear`(self, /)  
  Remove all items from list.
- `copy`(self)  
  Create a shallow copy of this Augmenter instance.
- `copy_random_state`(self, source[, recursive, ...])  
  Copy the RNGs from a source augmenter sequence.
- `copy_random_state_`(self, source[, ...])  
  Copy the RNGs from a source augmenter sequence (in-place).
- `count`(self, value, /)  
  Return number of occurrences of value.
- `deepcopy`(self)  
  Create a deep copy of this Augmenter instance.
- `draw_grid`(self, images, rows, cols)  
  Augment images and draw the results as a single grid-like image.
- `extend`(self, iterable, /)  
  Extend list by appending elements from the iterable.
- `find_augmenters`(self, func[, parents, flat])  
  Find augmenters that match a condition.
- `find_augmenters_by_name`(self, name[, regex, ...])  
  Find augmenter(s) by name.

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<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>find_augmenters_by_names(*names, ...)</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(*self, flat)</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(*self)</code></td>
<td>See <code>get_children_lists()</code>.</td>
</tr>
<tr>
<td><code>get_parameters(*self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>index(*self, value[, start, stop])</code></td>
<td>Return first index of value.</td>
</tr>
<tr>
<td><code>insert(*self, index, object, /)</code></td>
<td>Insert object before index.</td>
</tr>
<tr>
<td><code>localize_random_state(*self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(*self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(*self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>pop(*self[, index])</code></td>
<td>Remove and return item at index (default last).</td>
</tr>
<tr>
<td><code>remove(*self, value, /)</code></td>
<td>Remove first occurrence of value.</td>
</tr>
<tr>
<td><code>remove_augmenters(*self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(*self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(*self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(*self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reverse(*self, /)</code></td>
<td>Reverse IN PLACE.</td>
</tr>
<tr>
<td><code>seed(*self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(*self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>sort(*self, /, *[, key, reverse])</code></td>
<td>Stable sort IN PLACE.</td>
</tr>
<tr>
<td><code>to_deterministic(*self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**add** (*self, augmenter*)

Add an augmenter to the list of child augmenters.

**Parameters** imgaug.augmenters.meta.Augmenter – The augmenter to add.

**get_children_lists** (*self*)

See `get_children_lists()`.

**get_parameters** (*self*)

See `get_parameters()`.

class imgaug.augmenters.meta.SomeOf (*n=None, children=None, random_order=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

**Bases:** imgaug.augmenters.meta.Augmenter, list

List augmenter that applies only some of its children to inputs.

This augmenter is similar to `Sequential`, but may apply only a fixed or random subset of its child augmenters to inputs. E.g. the augmenter could be initialized with a list of 20 child augmenters and then apply 5 randomly chosen child augmenters to images.

The subset of augmenters to apply (and their order) is sampled once per image. If `random_order` is True, the order will be sampled once per batch (similar to `Sequential`).

This augmenter currently does not support replacing (i.e. picking the same child multiple times) due to implementation difficulties in connection with deterministic augmenters.
Supported dtypes:

- uint8: yes; fully tested
- uint16: yes; tested
- uint32: yes; tested
- uint64: yes; tested
- int8: yes; tested
- int16: yes; tested
- int32: yes; tested
- int64: yes; tested
- float16: yes; tested
- float32: yes; tested
- float64: yes; tested
- float128: yes; tested
- bool: yes; tested

Parameters

- n (int or tuple of int or list of int or imgaug.parameters.StochasticParameter or None, optional) –
  Count of augmenters to apply.
  - If int, then exactly n of the child augmenters are applied to every image.
  - If tuple of two int s (a, b), then a random value will be uniformly sampled per image
    from the discrete interval [a..b] and denote the number of child augmenters to pick
    and apply. b may be set to None, which is then equivalent to (a..C) with C denoting
    the number of children that the augmenter has.
  - If StochasticParameter, then N numbers will be sampled for N images. The pa-
    rameter is expected to be discrete.
  - If None, then the total number of available children will be used (i.e. all children will be
    applied).

- children (imgaug.augmenters.meta.Augmenter or list of imgaug.augmenters.meta.Augmenter or None, optional) – The augmenters to apply to
  images. If this is a list of augmenters, it will be converted to a Sequential.

- random_order (boolean, optional) – Whether to apply the child augmenters in random
  order. If True, the order will be randomly sampled once per batch.

- seed (None or int or imgaug.random.RNG or numpy.random.Generator
  or numpy.random.BitGenerator or numpy.random.SeedSequence or
  numpy.random.RandomState, optional) – See __init__().

- name (None or str, optional) – See __init__().

- random_state (None or int or imgaug.random.RNG or numpy.random.Generator
  or numpy.random.BitGenerator or numpy.random.SeedSequence or
  numpy.random.RandomState, optional) – Old name for parameter seed. Its usage
  will not yet cause a deprecation warning, but it is still recommended to use seed now.
  Outdated since 0.4.0.
• **deterministic** (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> imgs = [np.random.rand(10, 10)]
>>> seq = iaa.SomeOf(1, [
>>>     iaa.Fliplr(1.0),
>>>     iaa.Flipud(1.0)
>>> ])
>>> imgs_aug = seq.augment_images(imgs)
```

Apply either *Fliplr* or *Flipud* to images.

```python
>>> seq = iaa.SomeOf((1, 3), [
>>>     iaa.Fliplr(1.0),
>>>     iaa.Flipud(1.0),
>>>     iaa.GaussianBlur(1.0)
>>> ], random_order=True)
>>> imgs_aug = seq.augment_images(imgs)
```

Apply one to three of the listed augmenters (*Fliplr*, *Flipud*, *GaussianBlur*) to images. They are always applied in the provided order, i.e. first *Fliplr*, second *Flipud*, third *GaussianBlur*.

```python
>>> seq = iaa.SomeOf((1, None), [
>>>     iaa.Fliplr(1.0),
>>>     iaa.Flipud(1.0),
>>>     iaa.GaussianBlur(1.0)
>>> ], random_order=True)
>>> imgs_aug = seq.augment_images(imgs)
```

Apply one to all of the listed augmenters (*Fliplr*, *Flipud*, *GaussianBlur*) to images. They are applied in random order, i.e. sometimes *GaussianBlur* first, followed by *Fliplr*, sometimes *Fliplr* followed by *Flipud* followed by *Blur* etc. The order is sampled once per batch.

### Methods

- `__call__`(self, *args, **kwargs)  
  Alias for `augment()`.
- `add`(self, augmenter)  
  Add an augmenter to the list of child augmenters.
- `append`(self, object, /)  
  Append object to the end of the list.
- `augment`(self[, return_batch, hooks])  
  Augment a batch.
- `augment_batch`(self[, batch[, hooks]])  
  Augment a single batch in-place.
- `augment_batch_(self, batch[, parents, hooks])`  
  Deprecated.
- `augment_batches`(self[, batches[, hooks, ...]])  
  Augment multiple batches.
- `augment_bounding_boxes`(self[, ...][, parents, ...])  
  Augment a batch of bounding boxes.
- `augment_heatmaps`(self[, heatmaps[, parents, ...]])  
  Augment a batch of heatmaps.
- `augment_image`(self[, image[, hooks]])  
  Augment a single image.
- `augment_images`(self[, images[, parents, hooks]])  
  Augment a batch of images.
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>augment_keypoints(self, keypoints_on_images)</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings(self, ...[, parents, hooks])</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td>augment_polygons(self, polygons_on_images[, ...])</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation_maps(self, segmaps[, ...])</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>clear(self, /)</td>
<td>Remove all items from list.</td>
</tr>
<tr>
<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state(self, source[, recursive, ...])</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td>count(self, value[, start, stop])</td>
<td>Return number of occurrences of value.</td>
</tr>
<tr>
<td>deepcopy(self)</td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td>draw_grid(self, images, rows, cols)</td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td>extend(self, iterable[, /])</td>
<td>Extend list by appending elements from the iterable.</td>
</tr>
<tr>
<td>find_augmenters(self, func[, parents, flat])</td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td>find_augmenters_by_names(self, name[, regex, ...])</td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td>find_augmenters_by_names(self, names[, ...])</td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td>get_all_children(self[, flat])</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td>get_children_lists(self)</td>
<td>See get_children_lists().</td>
</tr>
<tr>
<td>get_parameters(self)</td>
<td>See get_parameters().</td>
</tr>
<tr>
<td>index(self, value[, start, stop])</td>
<td>Return first index of value.</td>
</tr>
<tr>
<td>insert(self, index, object[, /])</td>
<td>Insert object before index.</td>
</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>pool(self[, processes, maxtasksperchild, seed])</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>pop(self[, index][, /])</td>
<td>Remove and return item at index (default last).</td>
</tr>
<tr>
<td>remove(self, value[, /])</td>
<td>Remove first occurrence of value.</td>
</tr>
<tr>
<td>remove_augmenters(self, func[, copy, ...])</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reverse(self[, /])</td>
<td>Reverse IN PLACE.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>sort(self, /, *[, key, reverse])</td>
<td>Stable sort IN PLACE.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>
add(self, augmenter)
Add an augmenter to the list of child augmenters.

Parameters augmenter (imgaug.augmenters.meta.Augmenter) – The augmenter to add.

get_children_lists(self)
See get_children_lists().

get_parameters(self)
See get_parameters().

class imgaug.augmenters.meta.Sometimes (p=0.5, then_list=None, else_list=None, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.meta.Augmenter

Apply child augmenter(s) with a probability of \( p \).

Let \( C \) be one or more child augmenters given to Sometimes. Let \( p \) be the fraction of images (or other data) to augment. Let \( I \) be the input images (or other data). Let \( N \) be the number of input images (or other entities). Then (on average) \( p \times N \) images of \( I \) will be augmented using \( C \).

Supported dtypes:

- uint8: yes; fully tested
- uint16: yes; tested
- uint32: yes; tested
- uint64: yes; tested
- int8: yes; tested
- int16: yes; tested
- int32: yes; tested
- int64: yes; tested
- float16: yes; tested
- float32: yes; tested
- float64: yes; tested
- float128: yes; tested
- bool: yes; tested

Parameters

- \( p \) (float or imgaug.parameters.StochasticParameter, optional) – Sets the probability with which the given augmenters will be applied to input images/data. E.g. a value of 0.5 will result in 50% of all input images (or other augmentables) being augmented.

- then_list (None or imgaug.augmenters.meta.Augmenter or list of imgaug.augmenters.meta.Augmenter, optional) – Augmenter(s) to apply to \( p \% \) percent of all images. If this is a list of augmenters, it will be converted to a Sequential.

- else_list (None or imgaug.augmenters.meta.Augmenter or list of imgaug.augmenters.meta.Augmenter, optional) – Augmenter(s) to apply to (1\( - p \)) percent of all images. These augmenters will be applied only when the ones in then_list are not applied (either-or-relationship). If this is a list of augmenters, it will be converted to a Sequential.
• **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See `__init__()`.

• **name** (None or str, optional) – See `__init__()`.

• **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

• **deterministic** (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Sometimes(0.5, iaa.GaussianBlur(0.3))
```

Apply GaussianBlur to 50% of all input images.

```python
>>> aug = iaa.Sometimes(0.5, iaa.GaussianBlur(0.3), iaa.Fliplr(1.0))
```

Apply GaussianBlur to 50% of all input images. Apply Fliplr to the other 50% of all input images.

**Methods**

- `__call__`(self, *args, **kwargs) Alias for `augment()`.
- `augment`(self, return_batch, hooks) Augment a batch.
- `augment_batch`(self, batch[, hooks]) Deprecated.
- `augment_batch_`(self, batch[, parents, hooks]) Augment a single batch in-place.
- `augment_batches`(self, batches[, hooks]) Augment multiple batches.
- `augment_bounding_boxes`(self, ...[, parents, ...]) Augment a batch of bounding boxes.
- `augment_heatmaps`(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
- `augment_image`(self, image[, hooks]) Augment a single image.
- `augment_images`(self, images[, parents, hooks]) Augment a batch of images.
- `augment_keypoints`(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
- `augment_line_strings`(self, ...[, parents, hooks]) Augment a batch of line strings.
- `augment_polygons`(self, polygons_on_images[, ...]) Augment a batch of polygons.
- `augment_segmentation_maps`(self, segmaps[, ...]) Augment a batch of segmentation maps.
- `copy`(self) Create a shallow copy of this Augmenter instance.
- `copy_random_state`(self, source[, recursive, ...]) Copy the RNGs from a source augmenter sequence.

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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>copy_random_state_(self, source[...])</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy(self)</td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td>draw_grid(self, images, rows, cols)</td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td>find_augmenters(self, func[, parents, flat])</td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td>find_augmenters_by_name(self, name[, regex, ...])</td>
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<td>find_augmenters_by_names(self, names[, ...])</td>
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<td>get_children_lists(self)</td>
<td>See get_children_lists().</td>
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<tr>
<td>get_parameters(self)</td>
<td>See get_parameters().</td>
</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>localize_random_state_(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
<td>pool(self[, processes, maxtasksperchild, seed])</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters(self, func[, copy, ...])</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self[, func[, parents]])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
get_children_lists(self)  
    See get_children_lists().
```

```python
get_parameters(self)  
    See get_parameters().
```

**class** `imgaug.augmenters.meta.WithChannels` *(channels=None, children=None, seed=None, name=None, random_state='deprecated', deterministic='deprecated')*

**Bases:** `imgaug.augmenters.meta.Augmenter`

Apply child augmenters to specific channels.

Let \( C \) be one or more child augmenters given to this augmenter. Let \( H \) be a list of channels. Let \( I \) be the input images. Then this augmenter will pick the channels \( H \) from each image in \( I \) (resulting in new images) and apply \( C \) to them. The result of the augmentation will be merged back into the original images.

**Supported dtypes:**

- **uint8**: yes; fully tested
- **uint16**: yes; tested
- **uint32**: yes; tested
- **uint64**: yes; tested
• int8: yes; tested
• int16: yes; tested
• int32: yes; tested
• int64: yes; tested
• float16: yes; tested
• float32: yes; tested
• float64: yes; tested
• float128: yes; tested
• bool: yes; tested

Parameters

• channels (None or list of int, optional) – Sets the channels to be extracted from each image. If None, all channels will be used. Note that this is not stochastic - the extracted channels are always the same ones.
• children (imgaug.augmenters.meta.Augmenter or list of imgaug.augmenters.meta.Augmenter or None, optional) – One or more augmenters to apply to images, after the channels are extracted.
• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().
• name (None or str, optional) – See __init__().
• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.WithChannels([0], iaa.Add(10))
```

Assuming input images are RGB, then this augmenter will add 10 only to the first channel, i.e. it will make images appear more red.

Methods

<table>
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<tr>
<th>Method</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><strong>call</strong>(self, *args, **kwargs)</td>
<td>Alias for augment().</td>
</tr>
<tr>
<td>augment(self, return_batch, hooks)</td>
<td>Augment a batch.</td>
</tr>
<tr>
<td>augment_batch(self, batch[, hooks])</td>
<td>Deprecated.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>augment_batch_(self, batch[, parents, hooks])</code></td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><code>augment_batches(self, batches[, hooks, ...])</code></td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td><code>augment_bounding_boxes(self, ...[, parents, ...])</code></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps(self, heatmaps[, parents, ...])</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(self, image[, hooks])</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images(self, images[, parents, hooks])</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints(self, keypoints_on_images)</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings(self, ...[, parents, hooks])</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons(self, polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(self, segmaps[, ...])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(self, source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(self, source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
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<tr>
<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
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<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>See <code>get_children_lists()</code>.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**get_children_lists**(self)

See `get_children_lists()`.
get_parameters(self)
    See get_parameters().

imgaug.augmenters.meta.clip_augmented_image(image, min_value, max_value)
    Deprecated. Use imgaug.dtypes.clip_instead.
    Clip image.

imgaug.augmenters.meta.clip_augmented_image_(image, min_value, max_value)
    Deprecated. Use imgaug.dtypes.clip_instead.
    Clip image in-place.

imgaug.augmenters.meta.clip_augmented_images(images, min_value, max_value)
    Deprecated. Use imgaug.dtypes.clip_instead.
    Clip images.

imgaug.augmenters.meta.clip_augmented_images_(images, min_value, max_value)
    Deprecated. Use imgaug.dtypes.clip_instead.
    Clip images in-place.

imgaug.augmenters.meta.copy_arrays(arrays)
    Copy the arrays of a single input array or list of input arrays.

imgaug.augmenters.meta.estimate_max_number_of_channels(images)
    Compute the maximum number of image channels among a list of images.

imgaug.augmenters.meta.handle_children_list(lst, augmenter_name, lst_name, default=’sequential’)
    Normalize an augmenter list provided by a user.

imgaug.augmenters.meta.invert_reduce_to_nonempty(objs, ids, objs_reduced)
    Inverse of reduce_to_nonempty().

imgaug.augmenters.meta.reduce_to_nonempty(objs)
    Remove from a list all objects that don’t follow obj.empty==True.

imgaug.augmenters.meta.shuffle_channels(image, random_state, channels=None)
    Randomize the order of (color) channels in an image.

Supported dtypes:

- uint8: yes; fully tested
- uint16: yes; indirectly tested (1)
- uint32: yes; indirectly tested (1)
- uint64: yes; indirectly tested (1)
- int8: yes; indirectly tested (1)
- int16: yes; indirectly tested (1)
- int32: yes; indirectly tested (1)
- int64: yes; indirectly tested (1)
- float16: yes; indirectly tested (1)
- float32: yes; indirectly tested (1)
- float64: yes; indirectly tested (1)
- float128: yes; indirectly tested (1)
• **bool**: yes; indirectly tested (1)

• (1) Indirectly tested via `ChannelShuffle`.

**Parameters**

- **image** (`(H,W,C)` ndarray) – Image of any dtype for which to shuffle the channels.
- **random_state** (`imgaug.random.RNG`) – The random state to use for this shuffling operation.
- **channels** (None or `imgaug.ALL` or list of int, optional) – Which channels are allowed to be shuffled with each other. If this is `None` or `imgaug.ALL`, then all channels may be shuffled. If it is a list of int s, then only the channels with indices in that list may be shuffled. (Values start at 0. All channel indices in the list must exist in the image.)

**Returns** The input image with shuffled channels.

**Return type** ndarray

### 13.32 `imgaug.augmenters.pillike`

Augmenters that have identical outputs to well-known PIL functions.

The *like in pillike* indicates that the augmenters in this module have identical outputs and mostly identical inputs to corresponding PIL functions, but do not have to wrap these functions internally. They may use internally different (e.g. faster) techniques to produce these outputs.

Some of the augmenters in this module may also exist in other modules under similar name. These other augmenters may currently have the same outputs as the corresponding PIL functions, but that is not guaranteed for the future. Use the augmenters in this module if identical outputs to PIL are required.

List of augmenters:

- **Solarize**
- **Posterize**
- **Equalize**
- **Autocontrast**
- **EnhanceColor**
- **EnhanceContrast**
- **EnhanceBrightness**
- **EnhanceSharpness**
- **FilterBlur**
- **FilterSmooth**
- **FilterSmoothMore**
- **FilterEdgeEnhance**
- **FilterEdgeEnhanceMore**
- **FilterFindEdges**
- **FilterContour**
- **FilterEmboss**
• FilterSharpen
• FilterDetail
• Affine

Standard usage of these augmenters follows roughly the schema:

```python
import numpy as np
import imgaug.augmenters as iaa

aug = iaa.pillike.Affine(translate_px={"x": (-5, 5)})
image = np.full((32, 32, 3), 255, dtype=np.uint8)
images_aug = aug(images=[image, image, image])
```

Added in 0.4.0.

class imgaug.augmenters.pillike.Affine(scale=1.0, translate_percent=None, translate_px=None, rotate=0.0, shear=0.0, fill_color=0, center=(0.5, 0.5), seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.geometric.Affine

Apply PIL-like affine transformations to images.

This augmenter has identical outputs to PIL.Image.transform with parameter method=PIL.Image.AFFINE.

**Warning:** This augmenter can currently only transform image-data. Batches containing heatmaps, segmentation maps and coordinate-based augmentables will be rejected with an error. Use Affine if you have to transform such inputs.

**Note:** This augmenter uses the image center as the transformation center. This has to be explicitly enforced in PIL using corresponding translation matrices. Without such translation, PIL uses the image top left corner as the transformation center. To mirror that behaviour, use center=(0.0, 0.0).

Added in 0.4.0.

**Supported dtypes:**

See warp_affine().
• rotate (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See Affine.

• shear (number or tuple of number or list of number or imgaug.parameters.StochasticParameter or dict {"x": int/tuple/list/StochasticParameter, "y": int/tuple/list/StochasticParameter}, optional) – See Affine.

• fillcolor (number or tuple of number or list of number or imgaug.ALL or imgaug.parameters.StochasticParameter, optional) – See parameter cval in Affine.

• center ("uniform", ‘normal’, ‘center’, ‘left-top’, ‘left-center’, ‘left-bottom’, ‘center-top’, ‘center-center’, ‘center-bottom’, ‘right-top’, ‘right-center’, ‘right-bottom’) or tuple of float or StochasticParameter or tuple of StochasticParameter, optional) – The center point of the affine transformation, given as relative xy-coordinates. Set this to (0.0, 0.0) or left-top to use the top left image corner as the transformation center. Set this to (0.5, 0.5) or center-center to use the image center as the transformation center. See also parameter position in PadToFixedSize for details about valid datatypes of this parameter.

• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

• name (None or str, optional) – See __init__().

• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.pillike.Affine(scale="x": (0.8, 1.2), "y": (0.5, 1.5))
```

Create an augmenter that applies affine scaling (zoom in/out) to images. Along the x-axis they are scaled to 80-120% of their size, along the y-axis to 50-150% (both values randomly and uniformly chosen per image).

```python
>>> aug = iaa.pillike.Affine(translate_px="x": 0, "y": [-10, 10]),
>>> fillcolor=128)
```

Create an augmenter that translates images along the y-axis by either -10px or 10px. Newly created pixels are always filled with the value 128 (along all channels).

```python
>>> aug = iaa.pillike.Affine(rotate=(-20, 20), fillcolor=(0, 256))
```

Rotate an image by -20 to 20 degrees and fill up all newly created pixels with a random RGB color. See the similar augmenter Affine for more examples.
Methods

```python
__call__(self, *args, **kwargs) Alias for augment().

augment(self, return_batch, hooks) Augment a batch.

augment_batch(self, batch[, hooks]) Deprecated.

augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.

augment_batches(self, batches[, hooks, ...]) Augment multiple batches.

augment_bounding_boxes(self, ...[, parents, ...]) Augment a batch of bounding boxes.

augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.

augment_image(self, image[, hooks]) Augment a single image.

augment_images(self, images[, parents, hooks]) Augment a batch of images.

augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.

augment_line_strings(self, ...[, parents, hooks]) Augment a batch of line strings.

augment_polygons(self, polygons_on_images[, ...]) Augment a batch of polygons.

augment_segmentation_maps(self, segmaps[, ...]) Augment a batch of segmentation maps.

copy(self) Create a shallow copy of this Augmenter instance.

copy_random_state(self, source[, recursive, ...]) Copy the RNGs from a source augmenter sequence.

copy_random_state_(self, source[, ...]) Copy the RNGs from a source augmenter sequence (in-place).

depcopy(self) Create a deep copy of this Augmenter instance.

draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.

find_augmenters(self, func[, parents, flat]) Find augmenters that match a condition.

find_augmenters_by_name(self, name[, regex, ...]) Find augmenter(s) by name.

find_augmenters_by_names(self, names[, ...]) Find augmenter(s) by names.

get_all_children(self[, flat]) Get all children of this augmenter as a list.

get_children_lists(self) Get a list of lists of children of this augmenter.

get_parameters(self) See get_parameters().

localize_random_state(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.

localize_random_state_(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.

pool(self, processes, maxtasksperchild, seed) Create a pool used for multicore augmentation.

remove_augmenters(self, func[, copy, ...]) Remove this augmenter or children that match a condition.

remove_augmenters_(self, func[, parents]) Remove in-place children of this augmenter that match a condition.

remove_augmenters_inplace(self, func[, parents]) Deprecated.

reseed(self[, random_state, deterministic_too]) Deprecated.

seed_(self[, entropy, deterministic_too]) Seed this augmenter and all of its children.
```

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<td><code>show_grid(images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
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<tr>
<td><code>to_deterministic()</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>

```python
def get_parameters(self):
    See `get_parameters()`.
```

Class `imgaug.augmenters.pillike.Autocontrast`

```python
class imgaug.augmenters.pillike.Autocontrast:
    def __init__(self, cutoff=(0, 20), per_channel=False, seed=None, name=None, random_state='deprecated', deterministic='deprecated'):
        Bases: imgaug.augmenters.contrast._ContrastFuncWrapper
        Adjust contrast by cutting off p% of lowest/highest histogram values.
        This augmenter has identical outputs to PIL.ImageOps.autocontrast.
        See `autocontrast()` for more details.
        Added in 0.4.0.
        Supported dtypes:
        See `autocontrast()`.

Parameters

- **cutoff** (int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional) – Percentage of values to cut off from the low and high end of each image's histogram, before stretching it to \([0, 255]\).
  - If int: The value will be used for all images.
  - If tuple \((a, b)\): A value will be uniformly sampled from the discrete interval \([a..b]\) per image.
  - If list: A random value will be sampled from the list per image.
  - If StochasticParameter: A value will be sampled from that parameter per image.
- **per_channel** (bool or float, optional) – Whether to use the same value for all channels (False) or to sample a new value for each channel (True). If this value is a float p, then for p percent of all images **per_channel** will be treated as True, otherwise as False.
- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See `__init__()`. (old)
- **name** (None or str, optional) – See `__init__()`. (old)
- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter **seed**. Its usage will not yet cause a deprecation warning, but it is still recommended to use **seed** now. Outdated since 0.4.0.
- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.
```
Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.pillike.Autocontrast()
```

Modify the contrast of images by cutting off the 0 to 20% lowest and highest values from the histogram, then stretching it to full length.

```python
>>> aug = iaa.pillike.Autocontrast((10, 20), per_channel=True)
```

Modify the contrast of images by cutting off the 10 to 20% lowest and highest values from the histogram, then stretching it to full length. The cutoff value is sampled per channel instead of per image.

Methods

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<td><code>augment</code></td>
<td>Augment a batch.</td>
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<tr>
<td><code>augment_batch</code></td>
<td>Augment a single batch in-place.</td>
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<td><code>augment_batch_(self, batch[, parents, hooks])</code></td>
<td>Augment multiple batches.</td>
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<td><code>augment_bounding_boxes</code></td>
<td>Augment a batch of bounding boxes.</td>
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<td><code>augment_heatmaps</code></td>
<td>Augment a batch of heatmaps.</td>
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<td><code>augment_image</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images</code></td>
<td>Augment a batch of images.</td>
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<td><code>augment_keypoints(self, key-points_on_images)</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
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<tr>
<td><code>augment_line_strings</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons</code></td>
<td>Augment a batch of polygons.</td>
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<tr>
<td><code>augment_segmentation_maps</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
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<tr>
<td><code>copy_random_state_</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
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<td><code>deepcopy</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name</code></td>
<td>Find augmenter(s) by name.</td>
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<tr>
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<td>Find augmenter(s) by names.</td>
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<tr>
<td><code>get_all_children</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists</code></td>
<td>Get a list of lists of children of this augmenter.</td>
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<tr>
<td><code>get_parameters</code></td>
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<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>localize_random_state_(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
<td>pool(self[, processes, maxtasksperchild, seed])</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters(self, func[, copy, ...])</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self, func[,</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>parents])</td>
<td></td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
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</table>

### Class: `imgaug.augmenters.pillike.EnhanceBrightness`

```python
class imgaug.augmenters.pillike.EnhanceBrightness(factor=(0.5, 1.5), seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases:** `imgaug.augmenters.pillike._EnhanceBase`

Change the brightness of images.

This augmenter has identical outputs to `PIL.ImageEnhance.Brightness`.

Added in 0.4.0.

**Supported dtypes:**

See `enhance_brightness()`.

**Parameters**

- **factor** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Brightness of the image. Values below 1.0 decrease the brightness, leading to a black image around 0.0. Values above 1.0 increase the brightness. Sane values are roughly in `[0.5, 1.5]`.

  - If `number`: The value will be used for all images.
  - If `tuple (a, b)`: A value will be uniformly sampled per image from the interval `[a, b)`.
  - If `list`: A random value will be picked from the list per image.
  - If `StochasticParameter`: Per batch of size `N`, the parameter will be queried once to return `(N,)` samples.

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.  

- **name** *(None or str, optional)* – See `__init__()`.  

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage
will not yet cause a deprecation warning, but it is still recommended to use `seed` now.
Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
generate += iaa.JpegCompression(compression=90)
```

Create an augmenter that worsens the brightness of an image by a random factor.

### Methods

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<td><code>__call__</code></td>
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</tr>
<tr>
<td><code>augment</code></td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><code>augment_batch</code></td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><code>augment_batch_(self, batch[, parents, hooks])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>augment_bounding_boxes(self, ...[, parents, ...])</code></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps(self, heatmaps[, parents, ...])</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(image[, parents, hooks])</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images(images[, parents, hooks])</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints(keypoints_on_images)</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings(self, ...[, parents, hooks])</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons(polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
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<td><code>augment_segmentation_maps(segmaps[, ...])</code></td>
<td>Augment a batch of segmentation maps.</td>
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<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(self, source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
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</tr>
<tr>
<td><code>draw_grid(images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(name[, name, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
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<tr>
<td><code>find_augmenters_by_names(names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
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<td><code>get_parameters(self)</code></td>
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</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
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<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
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<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
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<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
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</table>

```python
class imgaug.augmenters.pillike.EnhanceColor (factor=(0.0, 3.0), seed=None, name=None,
random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.pillike._EnhanceBase`

Convert images to grayscale.

This augmenter has identical outputs to `PIL.ImageEnhance.Color`.

Added in 0.4.0.

Supported dtypes:

See `enhance_color()`.

Parameters

- **factor** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Colorfulness of the output image. Values close to 0.0 lead to grayscale images, values above 1.0 increase the strength of colors. Sane values are roughly in [0.0, 3.0].
  - If number: The value will be used for all images.
  - If tuple (a, b): A value will be uniformly sampled per image from the interval [a, b).
  - If list: A random value will be picked from the list per image.
  - If StochasticParameter: Per batch of size N, the parameter will be queried once to return (N, ) samples.

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.

- **name** *(None or str; optional)* – See `__init__()`.

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage
will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.pillike.EnhanceColor()
```

Create an augmenter to remove a random fraction of color from input images.

### Methods

```python
def __call__(self, *args, **kwargs)
    """Alias for `augment()`."""

daugment(self[, return_batch, hooks])
    """Augment a batch."

daugment_batch(self[, batch[, hooks]])
    """Deprecated."

daugment_batch_(self, batch[, parents, hooks])
    """Augment a single batch in-place."

daugment_batches(self, batches[, hooks, ...])
    """Augment multiple batches."

daugment_bounding_boxes(self, ...[, parents, ...])
    """Augment a batch of bounding boxes."

daugment_heatmaps(self, heatmaps[, parents, ...])
    """Augment a batch of heatmaps."

daugment_image(self, image[, hooks])
    """Augment a single image."

daugment_images(self, images[, parents, hooks])
    """Augment a batch of images."

daugment_keypoints(self, keypoints_on_images)
    """Augment a batch of keypoints/landmarks."

daugment_line_strings(self, ...[, parents, hooks])
    """Augment a batch of line strings."

daugment_polygons(self, polygons_on_images[, ...])
    """Augment a batch of polygons."

daugment_segmentation_maps(self, segmaps[, ...])
    """Augment a batch of segmentation maps."

copy(self)
    """Create a shallow copy of this Augmenter instance."

copy_random_state(self, source[, recursive, ...])
    """Copy the RNGs from a source augmenter sequence."

copy_random_state_(self, source[...])
    """Copy the RNGs from a source augmenter sequence (in-place)."

decopy(self)
    """Create a deep copy of this Augmenter instance."

draw_grid(self, images, rows, cols)
    """Augment images and draw the results as a single grid-like image."

find_augmenters(self, func[, parents, flat])
    """Find augmenters that match a condition."

find_augmenters_by_name(self, name[, regex, ...])
    """Find augmenter(s) by name."

find_augmenters_by_names(self, names[, ...])
    """Find augmenter(s) by names."

get_all_children(self[, flat])
    """Get all children of this augmenter as a list."

get_children_lists(self)
    """Get a list of lists of children of this augmenter."
```

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**get_parameters** *(self)*  
See **get_parameters()**.

**localize_random_state**(self[, recursive])  
Assign augmenter-specific RNGs to this augmenter and its children.

**localize_random_state_(self[, recursive])**  
Assign augmenter-specific RNGs to this augmenter and its children.

**pool**(self[, processes, maxtasksperchild, seed])  
Create a pool used for multicore augmentation.

**remove_augmenters**(self, func[, copy, ...])  
Remove this augmenter or children that match a condition.

**remove_augmenters_(self, func[, parents])**  
Remove in-place children of this augmenter that match a condition.

**remove_augmenters_inplace**(self, func[, parents])  
Deprecated.

**reseed**(self[, random_state, deterministic_too])  
Deprecated.

**seed_(self[, entropy, deterministic_too])**  
Seed this augmenter and all of its children.

**show_grid**(self, images, rows, cols)  
Augment images and plot the results as a single grid-like image.

**to_deterministic**(self[, n])  
Convert this augmenter from a stochastic to a deterministic one.

---

**class**  
`imgaug.augmenters.pillike.EnhanceContrast` *(factor=(0.5, 1.5), seed=None, name=None, random_state=’deprecated’, deterministic=’deprecated’)*

Bases: `imgaug.augmenters.pillike._EnhanceBase`

Change the contrast of images.

This augmenter has identical outputs to `PIL.ImageEnhance.Contrast`.

Added in 0.4.0.

**Supported dtypes:**

See **enhance_contrast()**.

**Parameters**

- **factor** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)*  
Strength of contrast in the image. Values below 1.0 decrease the contrast, leading to a gray image around 0.0. Values above 1.0 increase the contrast. Sane values are roughly in [0.5, 1.5].

  - If **number**: The value will be used for all images.
  - If **tuple** (a, b): A value will be uniformly sampled per image from the interval [a, b).
  - If **list**: A random value will be picked from the list per image.
  - If **StochasticParameter**: Per batch of size N, the parameter will be queried once to return (N, ) samples.

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)*  
See **__init__()**.

- **name** *(None or str, optional)*  
See **__init__()**.

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or
numpy.random.RandomState, optional] – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.pillike.EnhanceContrast()
```

Create an augmenter that worsens the contrast of an image by a random factor.

### Methods

```python
__call__(self, *args, **kwargs) Alias for augment().
```

```python
augment(self, return_batch, hooks)) Augment a batch.
augment_batch(self, batch[, hooks]) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self, batches[, hooks, ...]) Augment multiple batches.
augment_bounding_boxes(self, ...[, parents, ...]) Augment a batch of bounding boxes.
augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
augment_image(self, image[, hooks]) Augment a single image.
augment_images(self, images[, parents, hooks]) Augment a batch of images.
augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
augment_line_strings(self, ...[, parents, hooks]) Augment a batch of line strings.
augment_polygons(self, polygons_on_images[, ...]) Augment a batch of polygons.
augment_segmentation(self, segmaps[, ...]) Augment a batch of segmentation maps.
copy(self) Create a shallow copy of this Augmenter instance.
copy_random_state(self, source[, recursive, ...]) Copy the RNGs from a source augmenter sequence.
copy_random_state_(self, source[, ...]) Copy the RNGs from a source augmenter sequence (in-place).
deepcopy(self) Create a deep copy of this Augmenter instance.
draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.
find_augmenters(self, func[, parents, flat]) Find augmenters that match a condition.
find_augmenters_by_name(self, name[, regex, ...]) Find augmenter(s) by name.
find_augmenters_by_names(self, names[, ...]) Find augmenter(s) by names.
get_all_children(self[, flat]) Get all children of this augmenter as a list.
```

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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>get_children_lists(self)</td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td>get_parameters(self)</td>
<td>See get_parameters().</td>
</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>localize_random_state_(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>pool(self[, processes, maxtasksperchild, seed])</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters(self, func[, copy,...])</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_tool])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.pillike.EnhanceSharpness:
```

Bases: imgaug.augmenters.pillike._EnhanceBase

Change the sharpness of images.

This augmenter has identical outputs to PIL.ImageEnhance.Sharpness.

Added in 0.4.0.

Supported dtypes:

See enhance_sharpness().

**Parameters**

- **factor** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Sharpness of the image. Values below 1.0 decrease the sharpness, values above 1.0 increase it. Sane values are roughly in [0.0, 2.0].
  - If number: The value will be used for all images.
  - If tuple (a, b): A value will be uniformly sampled per image from the interval [a, b).
  - If list: A random value will be picked from the list per image.
  - If StochasticParameter: Per batch of size N, the parameter will be queried once to return (N,) samples.

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- **name** (None or str, optional) – See __init__().
• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter *seed*. Its usage will not yet cause a deprecation warning, but it is still recommended to use *seed* now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

## Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.pillike.EnhanceSharpness()
```

Create an augmenter that randomly decreases or increases the sharpness of an image.

## Methods

```python
_call_ (self, *args, **kwargs) Alias for augment().
augment(self[, return_batch, hooks]) Augment a batch.
augment_batch(self[, batch[, hooks]]) Deprecated.
augment_batch_(self[, batch[, parents, hooks]]) Augment a single batch in-place.
augment_batches(self[, batches[, parents, ...]]) Augment multiple batches.
augment_bounding_boxes(self[, ...[, parents, ...]]) Augment a batch of bounding boxes.
augment_heatmaps(self[, heatmaps[, parents, ...]]) Augment a batch of heatmaps.
augment_image(self[, image[, hooks]]) Augment a single image.
augment_images(self[, images[, parents, hooks]]) Augment a batch of images.
augment_keypoints(self[, keypoints_on_images]) Augment a batch of keypoints/landmarks.
augment_line_strings(self[, ...[, parents, hooks]]) Augment a batch of line strings.
augment_polygons(self[, polygons_on_images[, ...]]) Augment a batch of polygons.
augment_segmentation_maps(self[, segmaps[, ...]]) Augment a batch of segmentation maps.
copy(self) Create a shallow copy of this Augmenter instance.
copy_random_state(self[, source[, recursive[, ...]]]) Copy the RNGs from a source augmenter sequence.
copy_random_state_(self[, source[, ...]]) Copy the RNGs from a source augmenter sequence (in-place).
deepcopy(self) Create a deep copy of this Augmenter instance.
draw_grid(self[, images, rows, cols]) Augment images and draw the results as a single grid-like image.
find_augmenters(self[, func[, parents, flat]]) Find augmenters that match a condition.
find_augmenters_by_name(self[, name[, regex, ...]]) Find augmenter(s) by name.
find_augmenters_by_names(self[, names[, ...]]) Find augmenter(s) by names.
```

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**Table 196 – continued from previous page**

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**class imgaug.augmenters.pillike.Equalize**

*seed=None, name=None, random_state='deprecated', deterministic='deprecated')*

Bases: `imgaug.augmenters.meta.Augmenter`

Equalize the image histogram.

This augmenter has identical outputs to PIL.ImageOps.equalize.

Added in 0.4.0.

**Supported dtypes:**

See `equalize_()`.

**Parameters**

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See `__init__()`. Outdated since 0.4.0.

- **name** (None or str, optional) – See `__init__()`. Outdated since 0.4.0.

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.
Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.pillike.Equalize()
```

Equalize the histograms of all input images.

Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>call</strong></td>
<td>Alias for <code>augment()</code>.</td>
</tr>
<tr>
<td>augment</td>
<td>Augment a batch.</td>
</tr>
<tr>
<td>augment_batch</td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td>augment_batches</td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td>augment_bounding_boxes</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td>augment_heatmaps</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td>augment_image</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td>augment_images</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td>augment_keypoints</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td>augment_polygons</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation_maps</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>copy</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td>copy_random_state_</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy</td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td>draw_grid</td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td>find_augmenters</td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td>find_augmenters_by_name</td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td>find_augmenters_by_names</td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td>get_all_children</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td>get_children_lists</td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td>get_parameters</td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td>localize_random_state</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>localize_random_state_</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>pool</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>remove_augmenters</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
get_parameters(self)
```
See `get_parameters()`.

```python
class imgaug.augmenters.pillike.FilterBlur
```
Bases: `imgaug.augmenters.pillike._FilterBase`

Apply a blur filter kernel to images.

This augmenter has identical outputs to calling `PIL.Image.filter` with kernel `PIL.ImageFilter.BLUR`.

Added in 0.4.0.

**Supported dtypes:**
See `filter_blur()`.

**Parameters**

- `seed` (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See `__init__()`.
- `name` (None or str, optional) – See `__init__()`.
- `random_state` (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
- `deterministic` (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.pillike.FilterBlur()
```
Create an augmenter that applies a blur filter kernel to images.
## Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>__call__</code></td>
<td>Alias for <code>augment()</code></td>
</tr>
<tr>
<td><code>augment(self, return_batch, hooks)</code></td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><code>augment_batch(self, batch, hooks)</code></td>
<td></td>
</tr>
<tr>
<td><code>augment_batch_(self, batch[, parents, hooks])</code></td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><code>augment_bounding_boxes(self, ...[, parents, ...])</code></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps(self, heatmaps[, parents, ...])</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(self, image[, hooks])</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images(self, images[, parents, hooks])</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints(self, keypoints_on_images)</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings(self, ...[, parents, hooks])</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons(self, polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(self, segmaps[, ...])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(self, source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(self[, recursive])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self, processes, maxtasksperchild, seed)</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>show_grid</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.pillike.FilterContour
```

Bases: imgaug.augmenters.pillike._FilterBase

Apply a contour detection filter kernel to images.

This augmenter has identical outputs to calling `PIL.Image.filter` with kernel `PIL.ImageFilter.CONTOUR`.

Added in 0.4.0.

**Supported dtypes:**

See `filter_contour()`.

**Parameters**

- `seed` (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See `__init__()`.  
- `name` (None or str, optional) – See `__init__()`.  
- `random_state` (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
- `deterministic` (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.pillike.FilterContour()
```

Create an augmenter that applies a contour detection filter kernel to images.

**Methods**

```python
__call__(self, *args, **kwargs)  
augment(self[, return_batch, hooks])  
augment_batch(self[, batch[, hooks]])  
augment_batch_(self[, batch[, parents, hooks]])  
augment_batches(self[, batch[, hooks, ...]])
```

Alias for `augment()`.

Augment a batch.

Deprecated.

Augment a single batch in-place.

Augment multiple batches.

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<table>
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<tr>
<th>Function</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>augment_bounding_boxes</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td>augment_heatmaps</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td>augment_image</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td>augment_images</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td>augment_keypoints</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td>augment_polygons</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation_maps</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>copy</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
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<td>draw_grid</td>
<td>Augment images and draw the results as a single grid-like image.</td>
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<tr>
<td>get_all_children</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
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<td>get_children_lists</td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td>get_parameters</td>
<td>See <code>get_parameters()</code></td>
</tr>
<tr>
<td>localize_random_state</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>pool</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
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<td>remove_augmenters_inplace</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>reseed</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic</td>
<td>Convert this augmenter from a stochastic to a determin-</td>
</tr>
<tr>
<td>class imgaug.augmenters.pillike.FilterDetail</td>
<td><code>seed=None, name=None, random_state='deprecated', determinant='deprecated')</code></td>
</tr>
</tbody>
</table>

**Bases:** `imgaug.augmenters.pillike._FilterBase`
Apply a detail enhancement filter kernel to images.

This augmenter has identical outputs to calling PIL.Image.filter with kernel PIL.ImageFilter.DETAIL.

Added in 0.4.0.

**Supported dtypes:**

See `filter_detail()`.

**Parameters**

- **seed** *(None or int or imgaug.random.RNG or numpy.random.RandomState, optional)* – See `__init__()`.

- **name** *(None or str, optional)* – See `__init__()`.

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.pillike.FilterDetail()
```

Create an augmenter that applies a detail enhancement filter kernel to images.

**Methods**

```python
__call__(self, *args, **kwargs)  # Alias for `augment()`.

augment(self, return_batch, hooks)  # Augment a batch.

augment_batch(self, batch, hooks)  # Deprecated.

augment_batch_(self, batch, parents, hooks)  # Augment a single batch in-place.

augment_batches(self, batches, hooks)  # Augment multiple batches.

augment_bounding_boxes(self, parents, hooks)  # Augment a batch of bounding boxes.

augment_heatmaps(self, heatmaps, parents, hooks)  # Augment a batch of heatmaps.

augment_image(self, image, hooks)  # Augment a single image.

augment_images(self, images, parents, hooks)  # Augment a batch of images.

augment_keypoints(self, keypoints_on_images, hooks)  # Augment a batch of keypoints/landmarks.

augment_line_strings(self, parents, hooks)  # Augment a batch of line strings.

augment_polygons(self, polygons_on_images, hooks)  # Augment a batch of polygons.
```

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<table>
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<td>augment_segmentation_maps</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>copy</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td>copy_random_state_</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy</td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td>draw_grid</td>
<td>Augment images and draw the results as a single grid-like image.</td>
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<tr>
<td>localize_random_state</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td>localize_random_state_</td>
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<td>remove_augmenters</td>
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<tr>
<td>remove_augmenters_inplace</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed</td>
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</tr>
<tr>
<td>seed_</td>
<td>Seed this augmenter and all of its children.</td>
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<tr>
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<td>Augment images and plot the results as a single grid-like image.</td>
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<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.pillike.FilterEdgeEnhance(seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases:** imgaug.augmenters.pillike._FilterBase

Apply an edge enhance filter kernel to images.

This augmenter has identical outputs to calling PIL.Image.filter with kernel PIL.ImageFilter.EDGE_ENHANCE.

Added in 0.4.0.

**Supported dtypes:**

See filter_edge_enhance().

**Parameters**

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or)*

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• **name** (*None or str, optional*) – See `__init__()`.

• **random_state** (*None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional*) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

• **deterministic** (*bool, optional*) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.pillike.FilterEdgeEnhance()
```

Create an augmenter that applies a edge enhancement filter kernel to images.

### Methods

- `__call__`(self, *args, **kwargs) Alias for `augment()`.
- `augment`(self[, return_batch, hooks]) Augment a batch.
- `augment_batch`(self[, batch[, hooks]]) Deprecated.
- `augment_batch_`(self[, batch[, parents[, hooks]]]) Augment a single batch in-place.
- `augment_batches`(self[, batches[, parents[, hooks]]]) Augment multiple batches.
- `augment_bounding_boxes`(self[, ...[, parents[, ...]]]) Augment a batch of bounding boxes.
- `augment_heatmaps`(self[, heatmaps[, parents[, ...]]]) Augment a batch of heatmaps.
- `augment_image`(self[, image[, hooks]]) Augment a single image.
- `augment_images`(self[, images[, parents[, hooks]]]) Augment a batch of images.
- `augment_keypoints`(self[, keypoints_on_images]) Augment a batch of keypoints/landmarks.
- `augment_line_strings`(self[, ...[, parents[, hooks]]]) Augment a batch of line strings.
- `augment_polygons`(self[, polygons_on_images[, ...]]) Augment a batch of polygons.
- `augment_segmentation_maps`(self[, segmaps[, ...]]) Augment a batch of segmentation maps.
- `copy`(self) Create a shallow copy of this Augmenter instance.
- `copy_random_state`(self[, source[, recursive[, ...]]]) Copy the RNGs from a source augmenter sequence.
- `copy_random_state_`(self[, source[, ...]]) Copy the RNGs from a source augmenter sequence (in-place).
- `deepcopy`(self) Create a deep copy of this Augmenter instance.
- `draw_grid`(self[, images, rows, cols]) Augment images and draw the results as a single grid-like image.
- `find_augmenters`(self[, func[, parents[, flat]]]) Find augmenters that match a condition.

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<table>
<thead>
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</tr>
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<tr>
<td><code>find_augmenters_by_name</code></td>
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<td><code>localize_random_state</code></td>
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<tr>
<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters</code></td>
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<td>Remove in-place children of this augmenter that match a condition.</td>
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<tr>
<td><code>remove_augmenters_inplace</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_</code></td>
<td>Seed this augmenter and all of its children.</td>
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<td><code>show_grid</code></td>
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<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.pillike.FilterEdgeEnhanceMore:

    Bases: imgaug.augmenters.pillike._FilterBase
```

Apply a strong edge enhancement filter kernel to images.

This augmenter has identical outputs to calling `PIL.Image.filter` with kernel `PIL.ImageFilter.EDGE_ENHANCE_MORE`.

Added in 0.4.0.

**Supported dtypes:**

See `filter_edge_enhance_more()`.

**Parameters**

- **seed** (None or int or `imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or `numpy.random.RandomState`, optional) – See `__init__()`.  

- **name** (None or str, optional) – See `__init__()`.  

- **random_state** (None or int or `imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or `numpy.random.RandomState`, optional) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.  

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.
### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.pillike.FilterEdgeEnhanceMore()
```

Create an augmenter that applies a strong edge enhancement filter kernel to images.

### Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><code>__call__</code></td>
<td>Alias for <code>augment()</code></td>
</tr>
<tr>
<td><code>augment</code></td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><code>augment_batch</code></td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><code>augment_batches</code></td>
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</tr>
<tr>
<td><code>augment_bounding_boxes</code></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
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<tr>
<td><code>draw_grid</code></td>
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<tr>
<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
</tbody>
</table>
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<table>
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<tr>
<th>Method</th>
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<tbody>
<tr>
<td><code>remove_augmenters</code></td>
<td>Remove this augmenter or children that match a condition.</td>
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<tr>
<td><code>remove_augmenters_inplace</code></td>
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<td><code>reseed</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</tbody>
</table>

**class** `imgaug.augmenters.pillike.FilterEmboss` *(seed=None, name=None, random_state='deprecated', deterministic='deprecated')*

**Bases:** `imgaug.augmenters.pillike._FilterBase`

Apply an emboss filter kernel to images.

This augmenter has identical outputs to calling `PIL.Image.filter` with kernel `PIL.ImageFilter.EMBOSS`.

Added in 0.4.0.

**Supported dtypes:**

See `filter_emboss()`.

**Parameters**

- **seed** (None or int or `imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or `numpy.random.RandomState`, optional) – See `__init__()`.  
- **name** (None or str, optional) – See `__init__()`.  
- **random_state** (None or int or `imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or `numpy.random.RandomState`, optional) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.  
- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.pillike.FilterEmboss()
```

Create an augmenter that applies an emboss filter kernel to images.
Methods

___call__(self, *args, **kwargs) Alias for `augment()`.

`augment(self[, return_batch, hooks])` Augment a batch.

`augment_batch(self[, batch[, hooks]])` Deprecated.

`augment_batch_(self, batch[, parents, hooks])` Augment a single batch in-place.

`augment_batches(self[, batches[, hooks, ...]])` Augment multiple batches.

`augment_bounding_boxes(self[, ...[, parents, ...]])` Augment a batch of bounding boxes.

`augment_heatmaps(self[, heatmaps[, parents, ...]])` Augment a batch of heatmaps.

`augment_image(self[, image[, hooks]])` Augment a single image.

`augment_images(self[, images[, parents, hooks]])` Augment a batch of images.

`augment_keypoints(self[, keypoints_on_images])` Augment a batch of keypoints/landmarks.

`augment_line_strings(self[, ...[, parents, hooks]])` Augment a batch of line strings.

`augment_polygons(self[, polygons_on_images[, ...]])` Augment a batch of polygons.

`augment_segmentation_maps(self[, segmaps[, ...]])` Augment a batch of segmentation maps.

`copy(self)` Create a shallow copy of this Augmenter instance.

`copy_random_state(self[, source[, recursive[, ...]])` Copy the RNGs from a source augmenter sequence.

`copy_random_state_(self[, recursive])` Copy the RNGs from a source augmenter sequence in-place.

`deepcopy(self)` Create a deep copy of this Augmenter instance.

`draw_grid(self[, images, rows, cols])` Augment images and draw the results as a single grid-like image.

`find_augmenters(self[, func[, parents, flat]])` Find augmenters that match a condition.

`find_augmenters_by_name(self[, name[, regex, ...]])` Find augmenter(s) by name.

`find_augmenters_by_names(self[, names[, ...]])` Find augmenter(s) by names.

`get_all_children(self[, flat])` Get all children of this augmenter as a list.

`get_children_lists(self)` Get a list of lists of children of this augmenter.

`get_parameters(self)` See `get_parameters()`.

`localize_random_state(self[, recursive])` Assign augmenter-specific RNGs to this augmenter and its children.

`localize_random_state_(self[, recursive])` Assign augmenter-specific RNGs to this augmenter and its children.

`pool(self[, processes, maxtasksperchild, seed])` Create a pool used for multicore augmentation.

`remove_augmenters(self[, func[, copy, ...]])` Remove this augmenter or children that match a condition.

`remove_augmenters_(self[, func[, parents]])` Remove in-place children of this augmenter that match a condition.

`remove_augmenters_inplace(self[, func[, parents]])` Deprecated.

`reseed(self[, random_state, deterministic_too])` Deprecated.

`seed_(self[, entropy, deterministic_too])` Seed this augmenter and all of its children.

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| show_grid(self, images, rows, cols) | Augment images and plot the results as a single grid-like image. |
| to_deterministic(self[, n]) | Convert this augmenter from a stochastic to a deterministic one. |

```python
class imgaug.augmenters.pillike.FilterFindEdges(
    seed=None, name=None, random_state='deprecated', deterministic='deprecated'
)
```

Bases: imgaug.augmenters.pillike._FilterBase

Apply a edge detection kernel to images.

This augmenter has identical outputs to calling PIL.Image.filter with kernel PIL.ImageFilter.FIND_EDGES.

Added in 0.4.0.

**Supported dtypes:**

See `filter_find_edges()`.

**Parameters**

- **seed** (None or int or `imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or `numpy.random.RandomState`, optional) – See `__init__()`.
- **name** (None or str, optional) – See `__init__()`.
- **random_state** (None or int or `imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or `numpy.random.RandomState`, optional) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.pillike.FilterFindEdges()
```

Create an augmenter that applies an edge detection filter kernel to images.

**Methods**

```
__call__(self, *args, **kwargs) Alias for augment().
 augment(self[, return_batch, hooks]) Augment a batch.
 augment_batch(self[, return_batch, hooks]) Deprecated.
 augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
 augment_batches(self, batches[, hooks, ...]) Augment multiple batches.
```

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<th>Description</th>
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<tbody>
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<td>augment_bounding_boxes(self, ..., parents, ...)</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td>augment_heatmaps(self, heatmaps, parents, ...)</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td>augment_image(self, image, hooks)</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td>augment_images(self, images, parents, hooks)</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td>augment_keypoints(self, keypoints_on_images)</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings(self, ..., parents, hooks)</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td>augment_polygons(self, polygons_on_images, ...)</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation_maps(self, segmaps, ...)</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state(self, source, recursive, ...)</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td>copy_random_state_(self, source, ...)</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy(self)</td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td>draw_grid(self, images, rows, cols)</td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td>find_augmenters(self, func, parents, flat)</td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td>find_augmenters_by_name(self, name, regex, ...)</td>
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<td>get_all_children(self, flat)</td>
<td>Get all children of this augmenter as a list.</td>
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<td>Get a list of lists of children of this augmenter.</td>
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<tr>
<td>get_parameters</td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td>localize_random_state(self, recursive)</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>localize_random_state_(self, recursive)</td>
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<tr>
<td>pool(self, processes, maxtasksperchild, seed)</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters(self, func, copy, ...)</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_(self, func, parents)</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self, func, parents)</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self, random_state, deterministic_too)</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed(self, entropy, deterministic_too)</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self, n)</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**class** imgaug.augmenters.pillike.FilterSharpen

```
seed=seed, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases:** imgaug.augmenters.pillike._FilterBase
Apply a sharpening filter kernel to images.

This augmenter has identical outputs to calling PIL.Image.filter with kernel PIL.ImageFilter.SHARPEN.

Added in 0.4.0.

**Supported dtypes:**

See filter_sharpen().

**Parameters**

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().
- **name** (None or str, optional) – See __init__().
- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.pillike.FilterSharpen()
```

Create an augmenter that applies a sharpening filter kernel to images.

**Methods**

- **__call__**(self, *args, **kwargs) Alias for augment().
- **augment**(self, return_batch, hooks) Augment a batch.
- **augment_batch**(self, batch[, hooks]) Deprecated.
- **augment_batch_(self, batch[, parents, hooks])** Augment a single batch in-place.
- **augment_batches**(self, batches[, hooks, ...]) Augment multiple batches.
- **augment_bounding_boxes**(self, [...[, parents, ...]]) Augment a batch of bounding boxes.
- **augment_heatmaps**(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
- **augment_image**(self, image[, hooks]) Augment a single image.
- **augment_images**(self, images[, parents, hooks]) Augment a batch of images.
- **augment_keypoints**(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
- **augment_line_strings**(self, [...[, parents, ...]]) Augment a batch of line strings.
- **augment_polygons**(self, polygons_on_images[, ...]) Augment a batch of polygons.

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<tbody>
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<td><code>augment_segmentation_maps(self, segmaps[,...])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
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<tr>
<td><code>copy_random_state(self, source[, recursive, ...])</code></td>
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<td><code>copy_random_state_(self, source[,...])</code></td>
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<td><code>deepcopy(self)</code></td>
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<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
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<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
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<td><code>find_augmenters_by_name(self, name[, regex,...])</code></td>
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<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
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<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
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<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
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<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.pillike.FilterSmooth (seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.pillike._FilterBase`

Apply a smoothing filter kernel to images.

This augmenter has identical outputs to calling `PIL.Image.filter` with kernel `PIL.ImageFilter.SMOOTH`.

Added in 0.4.0.

**Supported dtypes:**

See `filter_smooth()`.

**Parameters**

- `seed` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or)*
numpy.random.RandomState, optional) – See __init__().

• name (None or str, optional) – See __init__().

• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.pillike.FilterSmooth()
```

Create an augmenter that applies a smoothing filter kernel to images.

Methods

```python
__call__(self, *args, **kwargs) Alias for augment().

augment(self[, return_batch, hooks]) Augment a batch.

augment_batch(self[, batch[, hooks]]) Deprecated.

augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.

augment_batches(self[, batches[, hooks]]) Augment multiple batches.

augment_bounding_boxes(self[, ...[, parents, ...]]) Augment a batch of bounding boxes.

augment_heatmaps(self[, heatmaps[, parents, ...]]) Augment a batch of heatmaps.

augment_image(self[, image[, hooks]]) Augment a single image.

augment_images(self[, images[, parents, hooks]]) Augment a batch of images.

augment_keypoints(self[, keypoints_on_images]) Augment a batch of keypoints/landmarks.

augment_line_strings(self[, ...[, parents, hooks]]) Augment a batch of line strings.

augment_polygons(self[, polygons_on_images[, ...]]) Augment a batch of polygons.

augment_segmentation_maps(self[, segmaps[, ...]]) Augment a batch of segmentation maps.

copy(self) Create a shallow copy of this Augmenter instance.

copy_random_state(self[, source[, recursive, ...]]) Copy the RNGs from a source augmenter sequence.

copy_random_state_(self, source[, ...]) Copy the RNGs from a source augmenter sequence (in-place).

decopy(self) Create a deep copy of this Augmenter instance.

draw_grid(self[, images, rows, cols]) Augment images and draw the results as a single grid-like image.

find_augmenters(self[, func[, parents, flat]]) Find augmenters that match a condition.
```

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<table>
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<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
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<tr>
<td><code>get_all_children(self[, flat])</code></td>
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</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**class** `imgaug.augmenters.pillike.FilterSmoothMore`

```python
seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.pillike._FilterBase`

Apply a strong smoothing filter kernel to images.

This augmenter has identical outputs to calling `PIL.Image.filter` with kernel `PIL.ImageFilter.BLUR`.

Added in 0.4.0.

**Supported dtypes:**

See `filter_smooth_more()`.

**Parameters**

- `seed` *(None or int or imgaug.random.RNG or numpy.random.RandomState)*
- `name` *(None or str, optional)*
- `random_state` *(None or int or imgaug.random.RNG or numpy.random.RandomState)*
- `deterministic` *(bool, optional)*

Outdated since 0.4.0.

- `to_deterministic` *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.
Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.pillike.FilterSmoothMore()
```

Create an augmenter that applies a strong smoothening filter kernel to images.

Methods

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<th>Method</th>
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<tr>
<td><strong>call</strong></td>
<td>Alias for <code>augment()</code>.</td>
</tr>
<tr>
<td>augment(self, return_batch, hooks)</td>
<td>Augment a batch.</td>
</tr>
<tr>
<td>augment_batch(self, batch[, hooks])</td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td>augment_batch_(self, batch[, parents, hooks])</td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td>augment_bounding_boxes(self, ..., [parents, ...])</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td>augment_heatmaps(self, heatmaps[, parents, ...])</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td>augment_image(self, image[, hooks])</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td>augment_images(self, images[, parents, hooks])</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td>augment_keypoints(self, keypoints_on_images)</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings(self, ..., [parents, hooks])</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td>augment_polygons(self, polygons_on_images[, ...])</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation_maps(self, segmaps[, ...])</td>
<td>Augment a batch of segmentation maps.</td>
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<tr>
<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
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<tr>
<td>copy_random_state(self, source[, recursive, ...])</td>
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<td>draw_grid(self, images, rows, cols)</td>
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<td>find_augmenters(self, func[, parents, flat])</td>
<td>Find augmenters that match a condition.</td>
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<td>find_augmenters_by_name(self, name[, regex, ...])</td>
<td>Find augmenter(s) by name.</td>
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<tr>
<td>find_augmenters_by_names(self, names[, ...])</td>
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<td>get_all_children(self[, flat])</td>
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</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
<td>localize_random_state_(self[, recursive])</td>
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</tr>
<tr>
<td>pool(self[, processes, maxtasksperchild, seed])</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
</tbody>
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<thead>
<tr>
<th>Function</th>
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</thead>
<tbody>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.pillike.Posterize
(nb_bits=(1, 8), from_colorspace='RGB',
to_colorspace=None, max_size=None, interpolation='linear', seed=None, name=None,
random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.color.Posterize`

Augmenter with identical outputs to PIL's `posterize()` function.

This augmenter quantizes each array component to \( N \) bits.

This class is currently an alias for `Posterize`, which again is an alias for `UniformColorQuantizationToNBits`, i.e. all three classes are right now guaranteed to have the same outputs as PIL's function.

Added in 0.4.0.

**Supported dtypes:**

See `Posterize`.

**Methods**

- `__call__` (self, *args, **kwargs): Alias for `augment()`.
- `augment(self[, return_batch, hooks])`: Augment a batch.
- `augment_batch(self[, batch[, hooks]])`: Deprecated.
- `augment_batch (self, batch[, parents, hooks])`: Augment a single batch in-place.
- `augment_batches (self, [batch[, hooks[, ...]]])`: Augment multiple batches.
- `augment_bounding_boxes (self, [parents, ...])`: Augment a batch of bounding boxes.
- `augment_heatmaps (self, [heatmaps[, parents[, ...]]])`: Augment a batch of heatmaps.
- `augment_image (self, [image[, hooks]])`: Augment a single image.
- `augment_images (self, [images[, parents[, hooks]]])`: Augment a batch of images.
- `augment_keypoints (self, [keypoints_on_images])`: Augment a batch of keypoints/landmarks.
- `augment_line_strings (self, [parents[, hooks]])`: Augment a batch of line strings.
- `augment_polygons (self, [polygons_on_images[, ...]])`: Augment a batch of polygons.
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augment_segmentation_maps(self, segmaps[, ...]) Augment a batch of segmentation maps.
copy(self) Create a shallow copy of this Augmenter instance.
copy_random_state(self, source[, recursive, ...]) Copy the RNGs from a source augmenter sequence.
copy_random_state_(self, source[, ...]) Copy the RNGs from a source augmenter sequence (in-place).
deepcopy(self) Create a deep copy of this Augmenter instance.
draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.
find_augmenters(self, func[, parents, flat]) Find augmenters that match a condition.
find_augmenters_by_name(self, name[, regex, ...]) Find augmenter(s) by name.
find_augmenters_by_names(self, names[, ...]) Find augmenter(s) by names.
get_all_children(self[, flat]) Get all children of this augmenter as a list.
get_children_lists(self) Get a list of lists of children of this augmenter.
get_parameters() See get_parameters().
localize_random_state(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
localize_random_state_(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
pool(self[, processes, maxtasksperchild, seed]) Create a pool used for multicore augmentation.
remove_augmenters(self, func[, copy, ...]) Remove this augmenter or children that match a condition.
remove_augmenters_(self, func[, parents]) Remove in-place children of this augmenter that match a condition.
remove_augmenters_inplace(self, func[, parents]) Deprecated.
reseed(self[, random_state, deterministic_too]) Deprecated.
seed_(self[, entropy, deterministic_too]) Seed this augmenter and all of its children.
show_grid(self, images, rows, cols) Augment images and plot the results as a single grid-like image.
to_deterministic(self[, n]) Convert this augmenter from a stochastic to a deterministic one.

class imgaug.augmenters.pillike.Solarize (p=1.0, threshold=128, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.arithmetic.Invert

Augmenter with identical outputs to PIL's solarize() function.
This augmenter inverts all pixel values above a threshold.
The outputs are identical to PIL's solarize().
Added in 0.4.0.

Supported dtypes:
See ~imgaug.augmenters.arithmetic.invert_(min_value=None and max_value=None).

Parameters
• p (float or imgaug.parameters.StochasticParameter, optional) – See **Invert**.

• threshold (None or number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See **Invert**.

• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See **__init__()**.

• name (None or str, optional) – See **__init__()**.

• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa

>>> aug = iaa.Solarize(0.5, threshold=(32, 128))
```

Invert the colors in 50 percent of all images for pixels with a value between 32 and 128 or more. The threshold is sampled once per image. The thresholding operation happens per channel.

**Methods**

<table>
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<tr>
<th>Method</th>
<th>Description</th>
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<tr>
<td><strong>call</strong>(self, *args, **kwargs)</td>
<td>Alias for augment().</td>
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<tr>
<td>augment(self[, return_batch, hooks])</td>
<td>Augment a batch.</td>
</tr>
<tr>
<td>augment_batch(self, batch[, hooks])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>augment_batch_(self, batch[, parents, hooks])</td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td>augment_batches(self, batches[, hooks,...])</td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td>augment_bounding_boxes(self, ...[, parents, ...])</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td>augment_heatmaps(self, ...[, parents, ...])</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td>augment_image(self, image[, hooks])</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td>augment_images(self, images[, parents, hooks])</td>
<td>Augment a batch of images.</td>
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<tr>
<td>augment_keypoints(self, key-points_on_images)</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings(self, ...[, parents, hooks])</td>
<td>Augment a batch of line strings.</td>
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<tr>
<td>augment_polygons(self, polygons_on_images[, ...])</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation_maps(self, segmaps[, ...])</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state(self, source[, recursive, ...])</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
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<table>
<thead>
<tr>
<th>Method</th>
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<tbody>
<tr>
<td><code>copy_random_state_(self, source[,...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[,...])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[,...])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(self, names[,...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[,recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[,processes,maxtasksperchild,seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self,func[,parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self,func[,parents])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>reseed_(self[,random_state,deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[,entropy,deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[,n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**imgaug.augmenters.pillike.autocontrast** *(image, cutoff=0, ignore=None)*

Maximize (normalize) image contrast.

This function calculates a histogram of the input image, removes `cutoff` percent of the lightest and darkest pixels from the histogram, and remaps the image so that the darkest pixel becomes black (0), and the lightest becomes white (255).

This function has identical outputs to PIL.ImageOps.autocontrast. The speed is almost identical.

Added in 0.4.0.

**Supported dtypes:**

- `uint8`: yes; fully tested
- `uint16`: no
- `uint32`: no
- `uint64`: no
- `int8`: no
- `int16`: no
- `int32`: no
Parameters

- **image** (*ndarray*) – The image for which to enhance the contrast.
- **cutoff** (*number*) – How many percent to cut off at the low and high end of the histogram. E.g. 20 will cut off the lowest and highest 20% of values. Expected value range is [0, 100].
- **ignore** (*None or int or iterable of int*) – Intensity values to ignore, i.e. to treat as background. If None, no pixels will be ignored. Otherwise exactly the given intensity value(s) will be ignored.

Returns Contrast-enhanced image.

Return type *ndarray*

**imgaug.augmenters.pillike.enhance_brightness(image, factor)**

Change the brightness of images.

This function has identical outputs to PIL.ImageEnhance.Brightness.

Added in 0.4.0.

**Supported dtypes:**

- uint8: yes; fully tested
- uint16: no
- uint32: no
- uint64: no
- int8: no
- int16: no
- int32: no
- int64: no
- float16: no
- float32: no
- float64: no
- float128: no
- bool: no

Parameters

- **image** (*ndarray*) – The image to modify.
- **factor** (*number*) – Brightness of the image. Values below 1.0 decrease the brightness, leading to a black image around 0.0. Values above 1.0 increase the brightness. Sane values are roughly in \([0.5, 1.5]\).

**Returns**  
Brightness-modified image.

**Return type**  
ndarray

```python
imgaug.augmenters.pillike.enhance_color(image, factor)
```

Change the strength of colors in an image.

This function has identical outputs to PIL.ImageEnhance.Color.

Added in 0.4.0.

**Supported dtypes:**
- uint8: yes; fully tested
- uint16: no
- uint32: no
- uint64: no
- int8: no
- int16: no
- int32: no
- int64: no
- float16: no
- float32: no
- float64: no
- float128: no
- bool: no

**Parameters**
- **image** (*ndarray*) – The image to modify.
- **factor** (*number*) – Colorfulness of the output image. Values close to 0.0 lead to grayscale images, values above 1.0 increase the strength of colors. Sane values are roughly in \([0.0, 3.0]\).

**Returns**  
Color-modified image.

**Return type**  
ndarray

```python
imgaug.augmenters.pillike.enhance_contrast(image, factor)
```

Change the contrast of an image.

This function has identical outputs to PIL.ImageEnhance.Contrast.

Added in 0.4.0.

**Supported dtypes:**
- uint8: yes; fully tested
- uint16: no
Parameters

- **image (ndarray)** – The image to modify.
- **factor (number)** – Strength of contrast in the image. Values below 1.0 decrease the contrast, leading to a gray image around 0.0. Values above 1.0 increase the contrast. Sane values are roughly in [0.5, 1.5].

Returns Contrast-modified image.

Return type ndarray

```python
ingaug.augmenters.pillike.enhance_sharpness(image, factor)
```
Change the sharpness of an image.

This function has identical outputs to PIL.ImageEnhance.Sharpness.

Added in 0.4.0.

Supported dtypes:

- uint8: yes; fully tested
- uint16: no
- uint32: no
- uint64: no
- int8: no
- int16: no
- int32: no
- int64: no
- float16: no
- float32: no
- float64: no
- float128: no
- bool: no
Parameters

- **image (ndarray)** – The image to modify.
- **factor (number)** – Sharpness of the image. Values below 1.0 decrease the sharpness, values above 1.0 increase it. Sane values are roughly in [0.0, 2.0].

Returns Sharpness-modified image.

Return type ndarray

`imgaug.augmenters.pillike.equalize(image, mask=None)`

Equalize the image histogram.

See `equalize_()` for details.

This function is identical in inputs and outputs to PIL.ImageOps.equalize.

Added in 0.4.0.

Supported dtypes:

See `equalize_()`.

Parameters

- **image (ndarray)** – uint8 (H, W, [C]) image to equalize.
- **mask (None or ndarray, optional)** – An optional mask. If given, only the pixels selected by the mask are included in the analysis.

Returns Equalized image.

Return type ndarray

`imgaug.augmenters.pillike.equalize_(image, mask=None)`

Equalize the image histogram in-place.

This function applies a non-linear mapping to the input image, in order to create a uniform distribution of grayscale values in the output image.

This function has identical outputs to PIL.ImageOps.equalize. It does however work in-place.

Added in 0.4.0.

Supported dtypes:

- uint8: yes; fully tested
- uint16: no
- uint32: no
- uint64: no
- int8: no
- int16: no
- int32: no
- int64: no
- float16: no
- float32: no
- float64: no
• float128: no
• bool: no

Parameters

- **image** (*ndarray*) – uint8 ([H,W,[C]]) image to equalize.
- **mask** (*None or ndarray, optional*) – An optional mask. If given, only the pixels selected by the mask are included in the analysis.

**Returns**

Equalized image. *Might* have been modified in-place.

**Return type** *ndarray*

```python
imgaug.augmenters.pillike.filter_blur(image)
```

Apply a blur filter kernel to the image.

This is the same as using PIL's PIL.ImageFilter.BLUR kernel.

Added in 0.4.0.

**Supported dtypes:**

- uint8: yes; fully tested
- uint16: no
- uint32: no
- uint64: no
- int8: no
- int16: no
- int32: no
- int64: no
- float16: no
- float32: no
- float64: no
- float128: no
- bool: no

**Parameters**

- **image** (*ndarray*) – The image to modify.

**Returns**

Blurred image.

**Return type** *ndarray*

```python
imgaug.augmenters.pillike.filter_contour(image)
```

Apply a contour filter kernel to the image.

This is the same as using PIL's PIL.ImageFilter.CONTOUR kernel.

Added in 0.4.0.

**Supported dtypes:**

- uint8: yes; fully tested
- uint16: no
**Parameters** image (ndarray) – The image to modify.

**Returns** Image with pronounced contours.

**Return type** ndarray

```python
imgaug.augmenters.pillike.filter_detail(image)
```

Apply a detail enhancement filter kernel to the image.

This is the same as using PIL's `PIL.ImageFilter.DETAIL` kernel.

Added in 0.4.0.

**Supported dtypes:**

- `uint8`: yes; fully tested
- `uint16`: no
- `uint32`: no
- `uint64`: no
- `int8`: no
- `int16`: no
- `int32`: no
- `int64`: no
- `float16`: no
- `float32`: no
- `float64`: no
- `float128`: no
- `bool`: no

**Parameters** image (ndarray) – The image to modify.

**Returns** Image with enhanced details.

**Return type** ndarray
imgaug.augmenters.pillike.filter_edge_enhance(image)
Apply an edge enhancement filter kernel to the image.

This is the same as using PIL's PIL.ImageFilter.EDGE_ENHANCE kernel.
Added in 0.4.0.

Supported dtypes:
• uint8: yes; fully tested
• uint16: no
• uint32: no
• uint64: no
• int8: no
• int16: no
• int32: no
• int64: no
• float16: no
• float32: no
• float64: no
• float128: no
• bool: no

Parameters image (ndarray) – The image to modify.

Returns Image with enhanced edges.

Return type ndarray

imgaug.augmenters.pillike.filter_edge_enhance_more(image)
Apply a stronger edge enhancement filter kernel to the image.

This is the same as using PIL's PIL.ImageFilter.EDGE_ENHANCE_MORE kernel.
Added in 0.4.0.

Supported dtypes:
• uint8: yes; fully tested
• uint16: no
• uint32: no
• uint64: no
• int8: no
• int16: no
• int32: no
• int64: no
• float16: no
• float32: no
• float64: no
• float128: no
• bool: no

Parameters **image** (*ndarray*) – The image to modify.

Returns Smoothened image.

Return type *ndarray*

```python
ingaug.augmenters.pillike.filter_emboss(image)
```

Apply an emboss filter kernel to the image.

This is the same as using PIL’s `PIL.ImageFilter.EMBOSS` kernel.

Added in 0.4.0.

Supported dtypes:

• uint8: yes; fully tested
• uint16: no
• uint32: no
• uint64: no
• int8: no
• int16: no
• int32: no
• int64: no
• float16: no
• float32: no
• float64: no
• float128: no
• bool: no

Parameters **image** (*ndarray*) – The image to modify.

Returns Embossed image.

Return type *ndarray*

```python
ingaug.augmenters.pillike.filter_find_edges(image)
```

Apply an edge detection filter kernel to the image.

This is the same as using PIL’s `PIL.ImageFilter.FIND_EDGES` kernel.

Added in 0.4.0.

Supported dtypes:

• uint8: yes; fully tested
• uint16: no
• uint32: no
• uint64: no
• int8: no
• int16: no
• int32: no
• int64: no
• float16: no
• float32: no
• float64: no
• float128: no
• bool: no

Parameters image (ndarray) – The image to modify.

Returns Image with detected edges.

Return type ndarray

imgaug.augmenters.pillike.filter_sharpen(image)
Apply a sharpening filter kernel to the image.

This is the same as using PIL’s PIL.ImageFilter.SHARPEN kernel.

Added in 0.4.0.

Supported dtypes:
• uint8: yes; fully tested
• uint16: no
• uint32: no
• uint64: no
• int8: no
• int16: no
• int32: no
• int64: no
• float16: no
• float32: no
• float64: no
• float128: no
• bool: no

Parameters image (ndarray) – The image to modify.

Returns Sharpened image.

Return type ndarray
imgaug.augmenters.pillike.filter_smooth(image)
Apply a smoothness filter kernel to the image.

This is the same as using PIL's PIL.ImageFilter.SMOOTH kernel.
Added in 0.4.0.

Supported dtypes:

- uint8: yes; fully tested
- uint16: no
- uint32: no
- uint64: no
- int8: no
- int16: no
- int32: no
- int64: no
- float16: no
- float32: no
- float64: no
- float128: no
- bool: no

Parameters image (ndarray) – The image to modify.

Returns Smoothened image.

Return type ndarray

imgaug.augmenters.pillike.filter_smooth_more(image)
Apply a strong smoothness filter kernel to the image.

This is the same as using PIL's PIL.ImageFilter.SMOOTH_MORE kernel.
Added in 0.4.0.

Supported dtypes:

- uint8: yes; fully tested
- uint16: no
- uint32: no
- uint64: no
- int8: no
- int16: no
- int32: no
- int64: no
- float16: no
- float32: no
- float64: no
• float64: no
• float128: no
• bool: no

Parameters

image (ndarray) – The image to modify.

Returns

Smoothened image.

Return type

ndarray

imaggaug.augmenters.pillike.posterize(image, bits)

Reduce the number of bits for each color channel.

This function has identical outputs to PIL.ImageOps.posterize.

Added in 0.4.0.

Supported dtypes:

See quantize_uniform_to_n_bits().

Parameters

• image (ndarray) – Image array of shape (H, W, [C]).
• bits (int) – The number of bits to keep per component. Values in the interval [1, 8] are valid.

Returns

Posterized image.

Return type

ndarray

imaggaug.augmenters.pillike.posterize_(image, bits)

Reduce the number of bits for each color channel in-place.

This function has identical outputs to PIL.ImageOps.posterize. It does however work in-place.

Added in 0.4.0.

Supported dtypes:

See quantize_uniform_to_n_bits_().

Parameters

• image (ndarray) – Image array of shape (H, W, [C]).
• bits (int) – The number of bits to keep per component. Values in the interval [1, 8] are valid.

Returns

Posterized image. This can be the same array as input in image, modified in-place.

Return type

ndarray

imaggaug.augmenters.pillike.solarize(image, threshold=128)

Invert all array components above a threshold.

This function has identical outputs to PIL.ImageOps.solarize.

Added in 0.4.0.

Supported dtypes:

See ~imgaug.augmenters.arithmetic.invert_(min_value=None and max_value=None).
Parameters

- **image** *(ndarray)* – Image array of shape *(H, W, [C])*.
- **threshold** *(int, optional)* – A threshold to use in order to invert only numbers above or below the threshold.

**Returns** Inverted image.

**Return type** ndarray

```python
imgaug.augmenters.pillike.solarize_(image, threshold=128)
```

Invert all array components above a threshold in-place.

This function has identical outputs to `PIL.ImageOps.solarize`. It does however work in-place.

Added in 0.4.0.

**Supported dtypes:**

See `imgaug.augmenters.arithmetic.invert_` *(min_value=None and max_value=None)*.

Parameters

- **image** *(ndarray)* – Image array of shape *(H, W, [C])*.
  
  The array *might* be modified in-place.

- **threshold** *(int, optional)* – A threshold to use in order to invert only numbers above or below the threshold.

**Returns** Inverted image. This *can* be the same array as input in `image`, modified in-place.

**Return type** ndarray

```python
imgaug.augmenters.pillike.warp_affine(image, scale_x=1.0, scale_y=1.0, translate_x_px=0, translate_y_px=0, rotate_deg=0, shear_x_deg=0, shear_y_deg=0, fillcolor=None, center=(0.5, 0.5))
```

Apply an affine transformation to an image.

This function has identical outputs to `PIL.Image.transform` with `method=PIL.Image.AFFINE`.

Added in 0.4.0.

**Supported dtypes:**

- `uint8`: yes; fully tested
- `uint16`: no
- `uint32`: no
- `uint64`: no
- `int8`: no
- `int16`: no
- `int32`: no
- `int64`: no
- `float16`: no
- `float32`: no
- `float64`: no
- `float128`: no
* bool: no

Parameters

- **image (ndarray)** – The image to modify. Expected to be `uint8` with shape `(H, W)` or `(H, W, C)` with `C` being 3 or 4.

- **scale_x (number, optional)** – Affine scale factor along the x-axis, where 1.0 denotes an identity transform and 2.0 is a strong zoom-in effect.

- **scale_y (number, optional)** – Affine scale factor along the y-axis, where 1.0 denotes an identity transform and 2.0 is a strong zoom-in effect.

- **translate_x_px (number, optional)** – Affine translation along the x-axis in pixels. Positive values translate the image towards the right.

- **translate_y_px (number, optional)** – Affine translation along the y-axis in pixels. Positive values translate the image towards the bottom.

- **rotate_deg (number, optional)** – Affine rotation in degrees around the top left of the image.

- **shear_x_deg (number, optional)** – Affine shearing in degrees along the x-axis with center point being the top-left of the image.

- **shear_y_deg (number, optional)** – Affine shearing in degrees along the y-axis with center point being the top-left of the image.

- **fillcolor (None or int or tuple of int, optional)** – Color tuple or intensity value to use when filling up newly created pixels. `None` fills with zeros, `int` will only fill the 0 th channel with that intensity value and all other channels with 0 (this is the default behaviour of PIL, use a tuple to fill all channels).

- **center (tuple of number, optional)** – Center xy-coordinate of the affine transformation, given as relative values, i.e. `(0.0, 0.0)` sets the transformation center to the top-left image corner, `(1.0, 0.0)` sets it to the the top-right image corner and `(0.5, 0.5)` sets it to the image center. The transformation center is relevant e.g. for rotations ("rotate around this center point"). PIL uses the image top-left corner as the transformation center if no centerization is included in the affine transformation matrix.

**Returns** Image after affine transformation.

**Return type** ndarray

### 13.33 imgaug.augmenters.pooling

Augmenters that apply pooling operations to images.

List of augmenters:

- **AveragePooling**
- **MaxPooling**
- **MinPooling**
- **MedianPooling**
class imgaug.augmenters.pooling.AveragePooling(kernel_size=(1, 5), keep_size=True, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.pooling._AbstractPoolingBase

Apply average pooling to images.

This augmenter pools images with kernel sizes $H \times W$ by averaging the pixel values within these windows. For e.g. $2 \times 2$ this halves the image size. Optionally, the augmenter will automatically re-upscale the image to the input size (by default this is activated).

Note that this augmenter is very similar to AverageBlur. AverageBlur applies averaging within windows of given kernel size without striding, while AveragePooling applies striding corresponding to the kernel size, with optional upscaling afterwards. The upscaling is configured to create “pixelated”/“blocky” images by default.

**Note:** During heatmap or segmentation map augmentation, the respective arrays are not changed, only the shapes of the underlying images are updated. This is because imgaug can handle maps/maks that are larger/smaller than their corresponding image.

**Supported dtypes:**

See `avg_pool()`.

**Variables**

- `kernel_size` (int or tuple of int or list of int or imgaug.parameters.StochasticParameter or tuple of tuple of int or tuple of list of int or tuple of imgaug.parameters.StochasticParameter, optional) – The kernel size of the pooling operation.
  - If an int, then that value will be used for all images for both kernel height and width.
  - If a tuple $(a, b)$, then a value from the discrete range $[a..b]$ will be sampled per image.
  - If a list, then a random value will be sampled from that list per image and used for both kernel height and width.
  - If a StochasticParameter, then a value will be sampled per image from that parameter per image and used for both kernel height and width.
  - If a tuple of tuple of int given as $((a, b), (c, d))$, then two values will be sampled independently from the discrete ranges $[a..b]$ and $[c..d]$ per image and used as the kernel height and width.
  - If a tuple of lists of int, then two values will be sampled independently per image, one from the first list and one from the second, and used as the kernel height and width.
  - If a tuple of StochasticParameter, then two values will be sampled independently per image, one from the first parameter and one from the second, and used as the kernel height and width.

- `keep_size` (bool, optional) – After pooling, the result image will usually have a different height/width compared to the original input image. If this parameter is set to True, then the pooled image will be resized to the input image’s size, i.e. the augmenter’s output shape is always identical to the input shape.
**seed**
(None or int or *imgaug.random.RNG* or *numpy.random.*
*Generator* or *numpy.random.BitGenerator* or *numpy.random.*
*SeedSequence* or *numpy.random.RandomState*, optional) — See
__init__()

**name**
(None or str, optional) — See __init__()

**random_state**
(None or int or *imgaug.random.RNG* or *numpy.random.*
*Generator* or *numpy.random.BitGenerator* or *numpy.random.*
*SeedSequence* or *numpy.random.RandomState*, optional)
- Old name for parameter *seed*. Its usage will not yet cause a deprecation warning, but it is
still recommended to use *seed* now. Outdated since 0.4.0.

**deterministic**
(bool, optional) — Deprecated since 0.4.0. See method
to_deterministic() for an alternative and for details about what the “deterministic
mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.AveragePooling(2)
Create an augmenter that always pools with a kernel size of 2 x 2.

>>> aug = iaa.AveragePooling(2, keep_size=False)
Create an augmenter that always pools with a kernel size of 2 x 2 and does *not* resize back to the input image
size, i.e. the resulting images have half the resolution.

>>> aug = iaa.AveragePooling([2, 8])
Create an augmenter that always pools either with a kernel size of 2 x 2 or 8 x 8.

>>> aug = iaa.AveragePooling([1, 7])
Create an augmenter that always pools with a kernel size of 1 x 1 (does nothing) to 7 x 7. The kernel sizes
are always symmetric.

>>> aug = iaa.AveragePooling(((1, 7), (1, 7)))
Create an augmenter that always pools with a kernel size of H x W where H and W are both sampled indepen-
dently from the range [1..7]. E.g. resulting kernel sizes could be 3 x 7 or 5 x 1.

**Methods**

- __call__(self, *args, **kwargs)  Alias for augment().
- augment(self, return_batch, hooks)  Augment a batch.
- augment_batch(self, batch, hooks)  Deprecated.
- augment_batch_(self, batch, parents, hooks)  Augment a single batch in-place.
- augment_batches(self, batches, hooks)  Augment multiple batches.
- augment_bounding_boxes(self, batch, parents, ...)  Augment a batch of bounding boxes.

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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>augment_heatmaps(self, heatmaps[, parents], ...)</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(self, image[, hooks])</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images(self, images[, parents, hooks])</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints(self, keypoints_on_images)</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings(self, ...)[, parents, hooks])</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons(self, polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(self, segmaps[, ...])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(self, source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence. (in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**Class**: `imgaug.augmenters.pooling.MaxPooling`

```python
class imgaug.augmenters.pooling.MaxPooling:
    def __init__(self, kernel_size=(1, 5), keep_size=True, seed=None, name=None, random_state='deprecated', deterministic='deprecated'):
        ...  
Bases: imgaug.augmenters.pooling._AbstractPoolingBase
```

Apply max pooling to images.

13.33. `imgaug.augmenters.pooling`
This augmenter pools images with kernel sizes $H \times W$ by taking the maximum pixel value over windows. For e.g. $2 \times 2$ this halves the image size. Optionally, the augmenter will automatically re-upscale the image to the input size (by default this is activated).

The maximum within each pixel window is always taken channelwise.

**Note:** During heatmap or segmentation map augmentation, the respective arrays are not changed, only the shapes of the underlying images are updated. This is because imgaug can handle maps/maks that are larger/smaller than their corresponding image.

**Supported dtypes:**
See `max_pool()`.

**Variables**

- `kernel_size` `(int or tuple of int or list of int or imgaug.parameters.StochasticParameter or tuple of tuple of int or tuple of list of int or tuple of imgaug.parameters.StochasticParameter, optional)` – The kernel size of the pooling operation.

  - If an int, then that value will be used for all images for both kernel height and width.
  - If a tuple `(a, b)`, then a value from the discrete range `[a..b]` will be sampled per image.
  - If a list, then a random value will be sampled from that list per image and used for both kernel height and width.
  - If a StochasticParameter, then a value will be sampled per image from that parameter per image and used for both kernel height and width.
  - If a tuple of int given as `((a, b), (c, d))`, then two values will be sampled independently from the discrete ranges `[a..b]` and `[c..d]` per image and used as the kernel height and width.
  - If a tuple of lists of int, then two values will be sampled independently per image, one from the first list and one from the second, and used as the kernel height and width.
  - If a tuple of StochasticParameter, then two values will be sampled independently per image, one from the first parameter and one from the second, and used as the kernel height and width.

- `keep_size` `(bool, optional)` – After pooling, the result image will usually have a different height/width compared to the original input image. If this parameter is set to True, then the pooled image will be resized to the input image’s size, i.e. the augmenter’s output shape is always identical to the input shape.

- `seed` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.

- `name` *(None or str, optional)* – See `__init__()`.

- `random_state` *(None or int or imgaug.random.RNG or numpy.random.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.MaxPooling(2)
```

Create an augmenter that always pools with a kernel size of 2 × 2.

```python
>>> aug = iaa.MaxPooling(2, keep_size=False)
```

Create an augmenter that always pools with a kernel size of 2 × 2 and does not resize back to the input image size, i.e. the resulting images have half the resolution.

```python
>>> aug = iaa.MaxPooling([2, 8])
```

Create an augmenter that always pools either with a kernel size of 2 × 2 or 8 × 8.

```python
>>> aug = iaa.MaxPooling((1, 7))
```

Create an augmenter that always pools with a kernel size of 1 × 1 (does nothing) to 7 × 7. The kernel sizes are always symmetric.

```python
>>> aug = iaa.MaxPooling(((1, 7), (1, 7)))
```

Create an augmenter that always pools with a kernel size of H × W where H and W are both sampled independently from the range [1..7]. E.g. resulting kernel sizes could be 3 × 7 or 5 × 1.

**Methods**

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
</table>
| `__call__` | Alias for `augment()`.
| `augment` | Augment a batch. |
| `augment_batch` | Augment a single batch in-place. |
| `augment_batches` | Augment multiple batches. |
| `augment_bounding_boxes` | Augment a batch of bounding boxes. |
| `augment_heatmaps` | Augment a batch of heatmaps. |
| `augment_image` | Augment a single image. |
| `augment_images` | Augment a batch of images. |
| `augment_keypoints` | Augment a batch of keypoints/landmarks. |
| `augment_line_strings` | Augment a batch of line strings. |
| `augment_polygons` | Augment a batch of polygons. |
| `augment_segmentation_maps` | Augment a batch of segmentation maps. |

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<table>
<thead>
<tr>
<th>Method</th>
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</tr>
</thead>
<tbody>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_(source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy()</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children([flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
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<td><code>get_children_lists()</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters()</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(recursive)</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(recursive)</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(processes, maxtasksperchild, seed)</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(func[, copy, ...])</code></td>
<td>Remove this augmentor or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(random_state, deterministic_too)</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed(entropy, deterministic_too)</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(n)</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**Class**: `imgaug.augmenters.pooling.MedianPooling`  
```
kernel_size=(1, 5), keep_size=True, 
seed=None, name=None, random_state='deprecated', deterministic='deprecated'
```

**Bases**: `imgaug.augmenters.pooling._AbstractPoolingBase`

Apply median pooling to images.

This augmenter pools images with kernel sizes $H \times W$ by taking the median pixel value over windows. For e.g. $2 \times 2$ this halves the image size. Optionally, the augmenter will automatically re-upscale the image to the input size (by default this is activated).

The median within each pixel window is always taken channelwise.

**Note**: During heatmap or segmentation map augmentation, the respective arrays are not changed, only the shapes of the underlying images are updated. This is because imgaug can handle maps/maks that are larger/smaller than their corresponding image.

**Supported dtypes**: 

See median_pool().

Variables

- **kernel_size** (int or tuple of int or list of int or imgaug.parameters.StochasticParameter or tuple of tuple of int or tuple of list of int or tuple of imgaug.parameters.StochasticParameter, optional) – The kernel size of the pooling operation.
  - If an int, then that value will be used for all images for both kernel height and width.
  - If a tuple \((a, b)\), then a value from the discrete range \([a..b]\) will be sampled per image.
  - If a list, then a random value will be sampled from that list per image and used for both kernel height and width.
  - If a StochasticParameter, then a value will be sampled per image from that parameter per image and used for both kernel height and width.
  - If a tuple of tuple of int given as \(((a, b), (c, d))\), then two values will be sampled independently from the discrete ranges \([a..b]\) and \([c..d]\) per image and used as the kernel height and width.
  - If a tuple of lists of int, then two values will be sampled independently per image, one from the first list and one from the second, and used as the kernel height and width.
  - If a tuple of StochasticParameter, then two values will be sampled independently per image, one from the first parameter and one from the second, and used as the kernel height and width.

- **keep_size** (bool, optional) – After pooling, the result image will usually have a different height/width compared to the original input image. If this parameter is set to True, then the pooled image will be resized to the input image’s size, i.e. the augmenter’s output shape is always identical to the input shape.

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- **name** (None or str, optional) – See __init__().

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.MedianPooling(2)
```

Create an augmenter that always pools with a kernel size of \(2 \times 2\).
Create an augmenter that always pools with a kernel size of $2 \times 2$ and does not resize back to the input image size, i.e. the resulting images have half the resolution.

Create an augmenter that always pools either with a kernel size of $2 \times 2$ or $8 \times 8$.

Create an augmenter that always pools with a kernel size of $1 \times 1$ (does nothing) to $7 \times 7$. The kernel sizes are always symmetric.

Create an augmenter that always pools with a kernel size of $H \times W$ where $H$ and $W$ are both sampled independently from the range $[1..7]$. E.g. resulting kernel sizes could be $3 \times 7$ or $5 \times 1$.

### Methods

- **__call__**(self, *args, **kwargs) Alias for `augment()`.
- **augment**(self[, return_batch, hooks]) Augment a batch.
- **augmentBatch**(self[, batch[, hooks]]) Deprecated.
- **augmentBatch**(self[, batch[, parents, hooks]]) Augment a single batch in-place.
- **augmentBatches**(self[, batches[, hooks,...]]) Augment multiple batches.
- **augmentBoundingBoxes**(self[, ...[, parents, ...]]) Augment a batch of bounding boxes.
- **augmentHeatmaps**(self[, heatmaps[, parents, ...]]) Augment a batch of heatmaps.
- **augmentImage**(self[, image[, hooks]]) Augment a single image.
- **augmentImages**(self[, images[, parents, hooks]]) Augment a batch of images.
- **augmentKeypoints**(self[, keypoints_on_images]) Augment a batch of keypoints/landmarks.
- **augmentLineStrings**(self[, ...[, parents, hooks]]) Augment a batch of line strings.
- **augmentPolygons**(self[, polygons_on_images[, ...]]) Augment a batch of polygons.
- **augmentSegmentationMaps**(self[, segmaps[, ...]]) Augment a batch of segmentation maps.
- **copy**(self) Create a shallow copy of this Augmenter instance.
- **copyRandomState**(self[, source[, recursive, ...]]) Copy the RNGs from a source augmenter sequence.
- **copyRandomState_(self[, source[, ...]])** Copy the RNGs from a source augmenter sequence (in-place).
- **deepcopy**(self) Create a deep copy of this Augmenter instance.
- **drawGrid**(self[, images, rows, cols]) Augment images and draw the results as a single grid-like image.
- **findAugmenters**(self[, func[, parents, flat]]) Find augmenters that match a condition.
- **findAugmentersByName**(self[, name[, regex,...]]) Find augmenter(s) by name.
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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self, flat)</code></td>
<td>Get all children of this augmenter as a list.</td>
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<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
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<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td>Remove in-place children of this augmenter that match a condition.</td>
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<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.pooling.MinPooling(kernel_size=(1, 5), keep_size=True, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.pooling._AbstractPoolingBase`

Apply minimum pooling to images.

This augmenter pools images with kernel sizes $H \times W$ by taking the minimum pixel value over windows. For e.g. $2 \times 2$ this halves the image size. Optionally, the augmenter will automatically re-upscale the image to the input size (by default this is activated).

The minimum within each pixel window is always taken channelwise.

**Note:** During heatmap or segmentation map augmentation, the respective arrays are not changed, only the shapes of the underlying images are updated. This is because imgaug can handle maps/maks that are larger/smaller than their corresponding image.

**Supported dtypes:**

See `min_pool()`.  

**Variables**

- `kernel_size` *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter or tuple of tuple of int or tuple of list of int or tuple of imgaug.parameters.StochasticParameter, optional)* – The kernel size of the pooling operation.
  - If an int, then that value will be used for all images for both kernel height and width.
  - If a tuple $(a, b)$, then a value from the discrete range $[a..b]$ will be sampled per image.

---

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- If a list, then a random value will be sampled from that list per image and used for both kernel height and width.
- If a StochasticParameter, then a value will be sampled per image from that parameter per image and used for both kernel height and width.
- If a tuple of tuple of int given as ((a, b), (c, d)), then two values will be sampled independently from the discrete ranges [a..b] and [c..d] per image and used as the kernel height and width.
- If a tuple of lists of int, then two values will be sampled independently per image, one from the first list and one from the second, and used as the kernel height and width.
- If a tuple of StochasticParameter, then two values will be sampled independently per image, one from the first parameter and one from the second, and used as the kernel height and width.

- **keep_size** (bool, optional) – After pooling, the result image will usually have a different height/width compared to the original input image. If this parameter is set to True, then the pooled image will be resized to the input image’s size, i.e. the augmenter’s output shape is always identical to the input shape.

- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- **name** (None or str, optional) – See __init__().

- **random_state** (None or int or imgaug.random.RNG or numpy.random.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.MinPooling(2)
```

Create an augmenter that always pools with a kernel size of $2 \times 2$.

```python
>>> aug = iaa.MinPooling(2, keep_size=False)
```

Create an augmenter that always pools with a kernel size of $2 \times 2$ and does not resize back to the input image size, i.e. the resulting images have half the resolution.

```python
>>> aug = iaa.MinPooling([2, 8])
```

Create an augmenter that always pools either with a kernel size of $2 \times 2$ or $8 \times 8$.

```python
>>> aug = iaa.MinPooling((1, 7))
```

Create an augmenter that always pools with a kernel size of $1 \times 1$ (does nothing) to $7 \times 7$. The kernel sizes are always symmetric.
Create an augmenter that always pools with a kernel size of $H \times W$ where $H$ and $W$ are both sampled independently from the range $[1..7]$. E.g. resulting kernel sizes could be $3 \times 7$ or $5 \times 1$.

Methods

```python
>>> aug = iaa.MinPooling(((1, 7), (1, 7)))
```

Methods

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<td>augment(self, return_batch, hooks)</td>
<td>Augment a batch.</td>
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<td>augment_batch(self, batch, hooks</td>
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<td>augment_batch(self, batch[, parents, hooks])</td>
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<td>augment_batches(self, batches[, hooks, ...])</td>
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<td>Augment a batch of heatmaps.</td>
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<td>Augment a single image.</td>
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<td>Augment a batch of line strings.</td>
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<td>Augment a batch of polygons.</td>
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<td>Copy the RNGs from a source augmenter sequence.</td>
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<td>copy_random_state_(self, source[, ...])</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
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<td>deepcopy(self)</td>
<td>Create a deep copy of this Augmenter instance.</td>
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<td>draw_grid(self, images, rows, cols)</td>
<td>Augment images and draw the results as a single grid-like image.</td>
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<td>get_all_children(self[, flat])</td>
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<tr>
<td>get_children_lists(self)</td>
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</tr>
<tr>
<td>get_parameters(self)</td>
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</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters(self, func[, copy, ...])</td>
<td>Remove this augmenter or children that match a condition.</td>
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<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
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<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
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<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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### 13.34 `imgaug.augmenters.segmentation`

Augmenters that apply changes to images based on segmentation methods.

List of augmenters:
- Superpixels
- Voronoi
- UniformVoronoi
- RegularGridVoronoi
- RelativeRegularGridVoronoi

#### class `imgaug.augmenters.segmentation.DropoutPointsSampler`

```python
other_points_sampler, p_drop)
```

Bases: `imgaug.augmenters.segmentation.IPointsSampler`

Remove a defined fraction of sampled points.

**Parameters**

- **other_points_sampler** (`IPointsSampler`) – Another point sampler that is queried to generate a list of points. The dropout operation will be applied to that list.

- **p_drop** (`number or tuple of number or imgaug.parameters.StochasticParameter`) – The probability that a coordinate will be removed from the list of all sampled coordinates. A value of 1.0 would mean that (on average) 100 percent of all coordinates will be dropped, while 0.0 denotes 0 percent. Note that this sampler will always ensure that at least one coordinate is left after the dropout operation, i.e. even 1.0 will only drop all except one coordinate.
  - If a float, then that value will be used for all images.
  - If a tuple (a, b), then a value p will be sampled from the interval [a, b] per image.
  - If a StochasticParameter, then this parameter will be used to determine per coordinate whether it should be kept (sampled value of >0.5) or shouldn’t be kept (sampled value of <=0.5). If you instead want to provide the probability as a stochastic parameter, you can usually do `imgaug.parameters.Binomial(1-p)` to convert parameter p to a 0/1 representation.
Examples

```python
>>> import imgaug.augmenters as iaa
>>> sampler = iaa.DropoutPointsSampler(iaa.RegularGridPointsSampler(10, 20), 0.2)
```

Create a point sampler that first generates points following a regular grid of 10 rows and 20 columns, then randomly drops 20 percent of these points.

Methods

```python
sample_points(self, images, random_state)  # Generate coordinates of points on images.
```

Parameters

- **images** (*ndarray or list of ndarray*) – One or more images for which to generate points. If this is a list of arrays, each one of them is expected to have three dimensions. If this is an array, it must be four-dimensional and the first axis is expected to denote the image index. For RGB images the array would hence have to be of shape \((N, H, W, 3)\).

- **random_state** (*None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState*) – A random state to use for any probabilistic function required during the point sampling. See `RNG()` for details.

Returns

An \((N, 2)\) float32 array containing \((x, y)\) subpixel coordinates, all of which being within the intervals \([0.0, \text{width}]\) and \([0.0, \text{height}]\).

Return type

`ndarray`

class imgaug.augmenters.segmentation.IPointsSampler

Bases: `object`

Interface for all point samplers.

Point samplers return coordinate arrays of shape \(N \times 2\). These coordinates can be used in other augmenters, see e.g. `Voronoi`.

Methods

```python
sample_points(self, images, random_state)  # Generate coordinates of points on images.
```

Parameters

- **images** (*ndarray or list of ndarray*) – One or more images for which to generate points. If this is a list of arrays, each one of them is expected to have three dimensions. If this is an array, it must be four-dimensional and the first axis is expected to denote the image index. For RGB images the array would hence have to be of shape \((N, H, W, 3)\).
**random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState) – A random state to use for any probabilistic function required during the point sampling. See RNG() for details.

**Returns**
An \((N,2)\) float32 array containing \((x,y)\) subpixel coordinates, all of which being within the intervals \([0.0, \text{width}]\) and \([0.0, \text{height}]\).

**Return type**
ndarray

```python
class imgaug.augmenters.segmentation.RegularGridPointsSampler(n_rows, n_cols)
Bases: imgaug.augmenters.segmentation.IPointsSampler

Sampler that generates a regular grid of coordinates on an image.

‘Regular grid’ here means that on each axis all coordinates have the same distance from each other. Note that the distance may change between axis.

**Parameters**

- **n_rows** (int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)
  - Number of rows of coordinates to place on each image, i.e. the number of coordinates on the y-axis. Note that for each image, the sampled value is clipped to the interval \([1..H]\), where \(H\) is the image height.
    - If a single int, then that value will always be used.
    - If a tuple \((a, b)\), then a value from the discrete interval \([a..b]\) will be sampled per image.
    - If a list, then a random value will be sampled from that list per image.
    - If a StochasticParameter, then that parameter will be queried to draw one value per image.

- **n_cols** (int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)
  - Number of columns of coordinates to place on each image, i.e. the number of coordinates on the x-axis. Note that for each image, the sampled value is clipped to the interval \([1..W]\), where \(W\) is the image width.
    - If a single int, then that value will always be used.
    - If a tuple \((a, b)\), then a value from the discrete interval \([a..b]\) will be sampled per image.
    - If a list, then a random value will be sampled from that list per image.
    - If a StochasticParameter, then that parameter will be queried to draw one value per image.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> sampler = iaa.RegularGridPointsSampler(
>>>     n_rows=(5, 20),
>>>     n_cols=50)
```

Create a point sampler that generates regular grids of points. These grids contain \(r\) points on the y-axis, where \(r\) is sampled uniformly from the discrete interval \([5..20]\) per image. On the x-axis, the grids always contain 50 points.
Methods

sample_points(self, images, random_state) Generate coordinates of points on images.

Parameters

• images (ndarray or list of ndarray) – One or more images for which to generate points. If this is a list of arrays, each one of them is expected to have three dimensions. If this is an array, it must be four-dimensional and the first axis is expected to denote the image index. For RGB images the array would hence have to be of shape (N, H, W, 3).

• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState) – A random state to use for any probabilistic function required during the point sampling. See RNG() for details.

Returns An (N, 2) float32 array containing (x, y) subpixel coordinates, all of which being within the intervals [0.0, width] and [0.0, height].

Return type ndarray

class imgaug.augmenters.segmentation.RegularGridVoronoi(n_rows=(10, 30), n_cols=(10, 30), p_drop_points=(0.0, 0.5), p_replace=(0.5, 1.0), max_size=128, interpolation='linear', seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.segmentation.Voronoi

Sample Voronoi cells from regular grids and color-average them.

This augmenter is a shortcut for the combination of Voronoi, RegularGridPointsSampler and DropoutPointsSampler. Hence, it generates a regular grid with R rows and C columns of coordinates on each image. Then, it drops p percent of the R*C coordinates to randomize the grid. Each image pixel then belongs to the voronoi cell with the closest coordinate.

Supported dtypes:

See Voronoi.

Parameters

• n_rows (int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional) – Number of rows of coordinates to place on each image, i.e. the number of coordinates on the y-axis. Note that for each image, the sampled value is clipped to the interval [1..H], where H is the image height.

  – If a single int, then that value will always be used.

  – If a tuple (a, b), then a value from the discrete interval [a..b] will be sampled per image.

  – If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, then that parameter will be queried to draw one value per image.

**n_cols (int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)**
- Number of columns of coordinates to place on each image, i.e. the number of coordinates on the x-axis. Note that for each image, the sampled value is clipped to the interval \([1..W]\), where \(W\) is the image width.
  - If a single int, then that value will always be used.
  - If a tuple \((a, b)\), then a value from the discrete interval \([a..b]\) will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then that parameter will be queried to draw one value per image.

**p_drop_points (number or tuple of number or imgaug.parameters.StochasticParameter, optional)** – The probability that a coordinate will be removed from the list of all sampled coordinates. A value of 1.0 would mean that (on average) 100 percent of all coordinates will be dropped, while 0.0 denotes 0 percent. Note that this sampler will always ensure that at least one coordinate is left after the dropout operation, i.e. even 1.0 will only drop all except one coordinate.
  - If a float, then that value will be used for all images.
  - If a tuple \((a, b)\), then a value \(p\) will be sampled from the interval \([a, b]\) per image.
  - If a StochasticParameter, then this parameter will be used to determine per coordinate whether it should be kept (sampled value of \(>0.5\)) or shouldn’t be kept (sampled value of \(\leq 0.5\)). If you instead want to provide the probability as a stochastic parameter, you can usually do `imgaug.parameters.Binomial(1-p)` to convert parameter \(p\) to a 0/1 representation.

**p_replace (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)** – Defines for any segment the probability that the pixels within that segment are replaced by their average color (otherwise, the pixels are not changed). Examples:
  - A probability of 0.0 would mean, that the pixels in no segment are replaced by their average color (image is not changed at all).
  - A probability of 0.5 would mean, that around half of all segments are replaced by their average color.
  - A probability of 1.0 would mean, that all segments are replaced by their average color (resulting in a voronoi image).

Behaviour based on chosen datatypes for this parameter:
  - If a number, then that number will always be used.
  - If tuple \((a, b)\), then a random probability will be sampled from the interval \([a, b]\) per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, it is expected to return values between 0.0 and 1.0 and will be queried *for each individual segment* to determine whether it is supposed to be averaged \((>0.5)\) or not \((\leq 0.5)\). Recommended to be some form of `Binomial(...)`.
• **max_size** *(int or None, optional)* – Maximum image size at which the augmentation is performed. If the width or height of an image exceeds this value, it will be downscaled before the augmentation so that the longest side matches *max_size*. This is done to speed up the process. The final output image has the same size as the input image. Note that in case *p_replace* is below 1.0, the down-/upscaling will affect the not-replaced pixels too. Use *None* to apply no down-/upscaling.

• **interpolation** *(int or str, optional)* – Interpolation method to use during downscaling when *max_size* is exceeded. Valid methods are the same as in *imresize_single_image()*.

• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See *__init__()__.*

• **name** *(None or str, optional)* – See *__init__()__.*

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter *seed*. Its usage will not yet cause a deprecation warning, but it is still recommended to use *seed* now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method *to_deterministic()* for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.RegularGridVoronoi(10, 20)
```

Place a regular grid of 10x20 (height x width) coordinates on each image. Randomly drop on average 20 percent of these points to create a less regular pattern. Then use the remaining coordinates to group the image pixels into voronoi cells and average the colors within them. The process is performed at an image size not exceeding 128 px on any side (default). If necessary, the downscaling is performed using linear interpolation (default).

```python
>>> aug = iaa.RegularGridVoronoi()
>>> (10, 30), 20, p_drop_points=0.0, p_replace=0.9, max_size=None)
```

Same as above, generates a grid with randomly 10 to 30 rows, drops none of the generates points, replaces only 90 percent of the voronoi cells with their average color (the pixels of the remaining 10 percent are not changed) and performs the transformation at the original image size (*max_size=None*).

**Methods**

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<td><em>augment_batch</em>(self, batch[, hooks])</td>
<td>Deprecated.</td>
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<tr>
<td><em>augment_batch_</em> (self, batch[, parents, hooks])</td>
<td>Augment a single batch in-place.</td>
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<td><em>augment_batches</em>(self, batches[, hooks, ...])</td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td><em>augment_bounding_boxes</em>(self, ...[, parents, ...])</td>
<td>Augment a batch of bounding boxes.</td>
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<td>Augment a batch of heatmaps.</td>
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<td>Augment a single image.</td>
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<td>reseed(self[, random_state, deterministic_too])</td>
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<td>seed_(self[, entropy, deterministic_too])</td>
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<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
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<td>to_deterministic(self[, n])</td>
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class imgaug.augmenters.segmentation.RelativeRegularGridPointsSampler(n_rows_frac, n_cols_frac)

Bases: imgaug.augmenters.segmentation.IPointsSampler

Regular grid coordinate sampler; places more points on larger images.

This is similar to RegularGridPointsSampler, but the number of rows and columns is given as fractions.
of each image’s height and width. Hence, more coordinates are generated for larger images.

Parameters

- **n_rows_frac** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Relative number of coordinates to place on the y-axis. For a value $y$ and image height $H$ the number of actually placed coordinates (i.e. computed rows) is given by $\text{int}(\text{round}(y\times H))$. Note that for each image, the number of coordinates is clipped to the interval $[1, H]$, where $H$ is the image height.
  - If a single number, then that value will always be used.
  - If a tuple $(a, b)$, then a value from the interval $[a, b]$ will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then that parameter will be queried to draw one value per image.

- **n_cols_frac** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Relative number of coordinates to place on the x-axis. For a value $x$ and image width $W$ the number of actually placed coordinates (i.e. computed columns) is given by $\text{int}(\text{round}(x\times W))$. Note that for each image, the number of coordinates is clipped to the interval $[1, W]$, where $W$ is the image width.
  - If a single number, then that value will always be used.
  - If a tuple $(a, b)$, then a value from the interval $[a, b]$ will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then that parameter will be queried to draw one value per image.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> sampler = iaa.RelativeRegularGridPointsSampler(
>>>     n_rows_frac=(0.01, 0.1),
>>>     n_cols_frac=0.2)
```

Create a point sampler that generates regular grids of points. These grids contain $\text{round}(y\times H)$ points on the y-axis, where $y$ is sampled uniformly from the interval $[0.01, 0.1]$ per image and $H$ is the image height. On the x-axis, the grids always contain $0.2\times W$ points, where $W$ is the image width.

Methods

```python
def sample_points(self, images, random_state)
    Generate coordinates of points on images.
```

```python
sample_points(self, images, random_state)
    Generate coordinates of points on images.
```

Parameters

- **images** *(ndarray or list of ndarray)* – One or more images for which to generate points.
  If this is a list of arrays, each one of them is expected to have three dimensions. If this
is an array, it must be four-dimensional and the first axis is expected to denote the image index. For RGB images the array would hence have to be of shape \((N, H, W, 3)\).

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState)* – A random state to use for any probabilistic function required during the point sampling. See \texttt{RNG()} for details.

**Returns**  An \((N, 2)\) float32 array containing \((x, y)\) subpixel coordinates, all of which being within the intervals \([0.0, \text{width}]\) and \([0.0, \text{height}]\).

**Return type**  ndarray

class imgaug.augmenters.segmentation.RelativeRegularGridVoronoi(n_rows_frac=(0.05, 0.15), n_cols_frac=(0.05, 0.15), p_drop_points=(0.0, 0.5), p_replace=(0.5, 1.0), max_size=None, interpolation='linear', seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.segmentation.Voronoi

Sample Voronoi cells from image-dependent grids and color-average them.

This augmenter is a shortcut for the combination of Voronoi, RegularGridPointsSampler and DropoutPointsSampler. Hence, it generates a regular grid with \(R\) rows and \(C\) columns of coordinates on each image. Then, it drops \(p\) percent of the \(R \times C\) coordinates to randomize the grid. Each image pixel then belongs to the voronoi cell with the closest coordinate.

**Note:** In contrast to the other voronoi augmenters, this one uses None as the default value for max_size, i.e. the color averaging is always performed at full resolution. This enables the augmenter to make use of the additional points on larger images. It does however slow down the augmentation process.

**Supported dtypes:**

See Voronoi.

**Parameters**

- **n_rows_frac** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Relative number of coordinates to place on the y-axis. For a value \(y\) and image height \(H\) the number of actually placed coordinates (i.e. computed rows) is given by \(\text{int} (\text{round}(y \times H))\). Note that for each image, the number of coordinates is clipped to the interval \([1, H]\), where \(H\) is the image height.
  - If a single number, then that value will always be used.
  - If a tuple \((a, b)\), then a value from the interval \([a, b]\) will be sampled per image.
- If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, then that parameter will be queried to draw one value per image.

**n_cols_frac** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Relative number of coordinates to place on the x-axis. For a value $x$ and image height $W$, the number of actually placed coordinates (i.e., computed columns) is given by $\text{int}(\text{round}(x \cdot W))$. Note that for each image, the number of coordinates is clipped to the interval $[1, W]$, where $W$ is the image width.

- If a single number, then that value will always be used.
- If a tuple $(a, b)$, then a value from the interval $[a, b]$ will be sampled per image.
- If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, then that parameter will be queried to draw one value per image.

**p_drop_points** *(number or tuple of number or imgaug.parameters.StochasticParameter, optional)* – The probability that a coordinate will be removed from the list of all sampled coordinates. A value of 1.0 would mean that (on average) 100 percent of all coordinates will be dropped, while 0.0 denotes 0 percent. Note that this sampler will always ensure that at least one coordinate is left after the dropout operation, i.e., even 1.0 will only drop all except one coordinate.

- If a float, then that value will be used for all images.
- If a tuple $(a, b)$, then a value $p$ will be sampled from the interval $[a, b]$ per image.
- If a StochasticParameter, then this parameter will be used to determine per coordinate whether it should be kept (sampled value of $>0.5$) or shouldn’t be kept (sampled value of $\leq 0.5$). If you instead want to provide the probability as a stochastic parameter, you can usually do `imgaug.parameters.Binomial(1-p)` to convert parameter $p$ to a 0/1 representation.

**p_replace** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Defines for any segment the probability that the pixels within that segment are replaced by their average color (otherwise, the pixels are not changed). Examples:

- A probability of 0.0 would mean, that the pixels in no segment are replaced by their average color (image is not changed at all).
- A probability of 0.5 would mean, that around half of all segments are replaced by their average color.
- A probability of 1.0 would mean, that all segments are replaced by their average color (resulting in a voronoi image).

Behaviour based on chosen datatypes for this parameter:

- If a number, then that number will always be used.
- If a tuple $(a, b)$, then a random probability will be sampled from the interval $[a, b]$ per image.
- If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, it is expected to return values between 0.0 and 1.0 and will be queried for each individual segment to determine whether it is supposed to be averaged (>0.5) or not (<=0.5). Recommended to be some form of Binomial(...).

- **max_size** (int or None, optional) – Maximum image size at which the augmentation is performed. If the width or height of an image exceeds this value, it will be downscaled before the augmentation so that the longest side matches max_size. This is done to speed up the process. The final output image has the same size as the input image. Note that in case p_replace is below 1.0, the down-/upscaling will affect the not-replaced pixels too. Use None to apply no down-/upscaling.

- **interpolation** (int or str, optional) – Interpolation method to use during downscaling when max_size is exceeded. Valid methods are the same as in imresize_single_image().

- **seed**  
  (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- **name** (None or str, optional) – See __init__().

- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.RelativeRegularGridVoronoi(0.1, 0.25)
```

Place a regular grid of \(R \times C\) coordinates on each image, where \(R\) is the number of rows and computed as \(R=0.1 \times H\) with \(H\) being the height of the input image. \(C\) is the number of columns and analogously estimated from the image width \(W\) as \(C=0.25 \times W\). Larger images will lead to larger \(R\) and \(C\) values. On average, 20 percent of these grid coordinates are randomly dropped to create a less regular pattern. Then, the remaining coordinates are used to group the image pixels into voronoi cells and the colors within them are averaged.

```python
>>> aug = iaa.RelativeRegularGridVoronoi((0.03, 0.1), 0.1, p_drop_points=0.0, p_replace=0.9, max_size=512)
```

Same as above, generates a grid with randomly \(R=r \times H\) rows, where \(r\) is sampled uniformly from the interval \([0.03, 0.1]\) and \(C=0.1 \times W\) rows. No points are dropped. The augmenter replaces only 90 percent of the voronoi cells with their average color (the pixels of the remaining 10 percent are not changed). Images larger than 512 px are temporarily downscaled (before sampling the grid points) so that no side exceeds 512 px. This improves performance, but degrades the quality of the resulting image.

Methods

```python
__call__ (self, *args, **kwargs)  
Alias for augment().
```

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<td>Augment a batch of heatmaps.</td>
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<td>augment_image(self[, image[, hooks]])</td>
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<td>augment_images(self[, images[, parents, hooks]])</td>
<td>Augment a batch of images.</td>
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<td>Augment a batch of keypoints/landmarks.</td>
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<td>augment_line_strings(self[, ..., parents, hooks])</td>
<td>Augment a batch of line strings.</td>
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<td>augment_polygons(self[, polygons_on_images[, ...]])</td>
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<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
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<td>deepcopy(self)</td>
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<td>get_all_children(self[, flat])</td>
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<td>get_children_lists(self)</td>
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<td>get_parameters(self)</td>
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</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self[, images, rows, cols])</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
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</table>
class imgaug.augmenters.segmentation.SubsamplingPointsSampler(other_points_sampler, n_points_max)

Bases: imgaug.augmenters.segmentation.IPointsSampler

Ensure that the number of sampled points is below a maximum.

This point sampler will sample points from another sampler and then – in case more points were generated than an allowed maximum – will randomly pick n_points_max of these.

Parameters

- **other_points_sampler** (*IPointsSampler*) – Another point sampler that is queried to generate a list of points. The dropout operation will be applied to that list.
- **n_points_max** (*int*) – Maximum number of allowed points. If other_points_sampler generates more points than this maximum, a random subset of size n_points_max will be selected.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> sampler = iaa.SubsamplingPointsSampler(
>>>    iaa.RelativeRegularGridPointsSampler(0.1, 0.2),
>>>    50
>>> )
```

Create a points sampler that places y*H points on the y-axis (with y being 0.1 and H being an image’s height) and x*W on the x-axis (analogous). Then, if that number of placed points exceeds 50 (can easily happen for larger images), a random subset of 50 points will be picked and returned.

Methods

```
sample_points(self, images, random_state)
```

Generate coordinates of points on images.

Parameters

- **images** (*ndarray or list of ndarray*) – One or more images for which to generate points. If this is a list of arrays, each one of them is expected to have three dimensions. If this is an array, it must be four-dimensional and the first axis is expected to denote the image index. For RGB images the array would hence have to be of shape (N, H, W, 3).
- **random_state** (*None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState*) – A random state to use for any probabilistic function required during the point sampling. See `RNG()` for details.

Returns

An (N, 2) float32 array containing (x, y) subpixel coordinates, all of which being within the intervals [0.0, width] and [0.0, height].

Return type

ndarray
class `imgaug.augmenters.segmentation.Superpixels`(*p_replace*=(0.5, 1.0),
*n_segments*=(50, 120),
*max_size*=128, `interpolation`='linear', `seed`=None,
`name`=None, `random_state`='deprecated', `deterministic`='deprecated')

Bases: `imgaug.augmenters.meta.Augmenter`

Transform images partially/completely to their superpixel representation.

This implementation uses skimage’s version of the SLIC algorithm.

**Note:** This augmenter is fairly slow. See *Performance*.

**Supported dtypes:**

if (image size <= max_size):
    • uint8: yes; fully tested
    • uint16: yes; tested
    • uint32: yes; tested
    • uint64: limited (1)
    • int8: yes; tested
    • int16: yes; tested
    • int32: yes; tested
    • int64: limited (1)
    • float16: no (2)
    • float32: no (2)
    • float64: no (3)
    • float128: no (2)
    • bool: yes; tested

    • (1) Superpixel mean intensity replacement requires computing these means as float64 s.
        This can cause inaccuracies for large integer values.
    • (2) Error in scikit-image.
    • (3) Loss of resolution in scikit-image.

if (image size > max_size):
    `minimum of` ( `imgaug.augmenters.segmentation.Superpixels(image size <= max_size), _ensure_image_max_size()`)

**Parameters**
• **p_replace** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Defines for any segment the probability that the pixels within that segment are replaced by their average color (otherwise, the pixels are not changed). Examples:
  - A probability of 0.0 would mean, that the pixels in no segment are replaced by their average color (image is not changed at all).
  - A probability of 0.5 would mean, that around half of all segments are replaced by their average color.
  - A probability of 1.0 would mean, that all segments are replaced by their average color (resulting in a voronoi image).

Behaviour based on chosen datatypes for this parameter:
  - If a number, then that number will always be used.
  - If a tuple (a, b), then a random probability will be sampled from the interval [a, b] per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then that parameter will be queried to draw one value per image.

• **n_segments** (int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional) – Rough target number of how many superpixels to generate (the algorithm may deviate from this number). Lower value will lead to coarser superpixels. Higher values are computationally more intensive and will hence lead to a slowdown.
  - If a single int, then that value will always be used as the number of segments.
  - If a tuple (a, b), then a value from the discrete interval [a..b] will be sampled per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then that parameter will be queried to draw one value per image.

• **max_size** (int or None, optional) – Maximum image size at which the augmentation is performed. If the width or height of an image exceeds this value, it will be downscaled before the augmentation so that the longest side matches max_size. This is done to speed up the process. The final output image has the same size as the input image. Note that in case p_replace is below 1.0, the down-/upscale will affect the not-replaced pixels too. Use None to apply no down-/upscale.

• **interpolation** (int or str, optional) – Interpolation method to use during downsampling when max_size is exceeded. Valid methods are the same as in imresize_single_image().

• **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

• **name** (None or str, optional) – See __init__().

• **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage
will not yet cause a deprecation warning, but it is still recommended to use `seed` now.
Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method
  `to_deterministic()` for an alternative and for details about what the “deterministic
  mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Superpixels(p_replace=1.0, n_segments=64)
```

Generate around 64 superpixels per image and replace all of them with their average color (standard superpixel image).

```python
>>> aug = iaa.Superpixels(p_replace=0.5, n_segments=64)
```

Generate around 64 superpixels per image and replace half of them with their average color, while the other half are left unchanged (i.e. they still show the input image’s content).

```python
>>> aug = iaa.Superpixels(p_replace=(0.25, 1.0), n_segments=(16, 128))
```

Generate between 16 and 128 superpixels per image and replace 25 to 100 percent of them with their average color.

### Methods

- `__call__(self, *args, **kwargs)`  
  Alias for `augment()`.

- `augment(self[, return_batch, hooks])`  
  Augment a batch.

- `augment_batch(self[, batch[, hooks]])`  
  Deprecated.

- `augment_batch_(self, batch[, parents, hooks])`  
  Augment a single batch in-place.

- `augment_bounding_boxes(self, [...[, parents, ...]])`  
  Augment a batch of bounding boxes.

- `augment_heatmaps(self, heatmaps[, parents, ...])`  
  Augment a batch of heatmaps.

- `augment_image(self, image[, hooks])`  
  Augment a single image.

- `augment_images(self, images[, parents, hooks])`  
  Augment a batch of images.

- `augment_keypoints(self, keypoints_on_images)`  
  Augment a batch of keypoints/landmarks.

- `augment_line_strings(self, [...[, parents, hooks]])`  
  Augment a batch of line strings.

- `augment_polygons(self, polygons_on_images[, ...])`  
  Augment a batch of polygons.

- `augment_segmentation_maps(self, segmaps[, ...])`  
  Augment a batch of segmentation maps.

- `copy(self)`  
  Create a shallow copy of this Augmenter instance.

- `copy_random_state(self, source[, recursive, ...])`  
  Copy the RNGs from a source augmenter sequence.

- `copy_random_state_(self, source[, ...])`  
  Copy the RNGs from a source augmenter sequence (in-place).
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<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
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<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
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<td>show_grid(self, images, rows, cols)</td>
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<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>

```python

def find_augmenters(self, func[, parents, flat])
    Find augmenters that match a condition.
```

```python

class imgaug.augmenters.segmentation.UniformPointsSampler(n_points)
    Sample points uniformly on images.
    This point sampler generates n_points points per image. The x- and y-coordinates are both sampled from uniform distributions matching the respective image width and height.

    Parameters
    n_points (int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional) –
        Number of points to sample on each image.
        - If a single int, then that value will always be used.
        - If a tuple (a, b), then a value from the discrete interval [a..b] will be sampled per image.
        - If a list, then a random value will be sampled from that list per image.
        - If a StochasticParameter, then that parameter will be queried to draw one value per image.
```
Examples

```python
>>> import imgaug.augmenters as iaa
>>> sampler = iaa.UniformPointsSampler(500)
```

Create a point sampler that generates an array of 500 random points for each input image. The x- and y-coordinates of each point are sampled from uniform distributions.

Methods

```python
sample_points(self, images, random_state)  # Generate coordinates of points on images.
```

Parameters

- `images` *(ndarray or list of ndarray)* – One or more images for which to generate points. If this is a list of arrays, each one of them is expected to have three dimensions. If this is an array, it must be four-dimensional and the first axis is expected to denote the image index. For RGB images the array would hence have to be of shape \((N, H, W, 3)\).

- `random_state` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState)* – A random state to use for any probabilistic function required during the point sampling. See `RNG()` for details.

Returns

An \((N, 2)\) float32 array containing \((x, y)\) subpixel coordinates, all of which being within the intervals \([0.0, \, \text{width}]\) and \([0.0, \, \text{height}]\).

Return type

ndarray

```python
class imgaug.augmenters.segmentation.UniformVoronoi(n_points=(50, 500),
p_replace=(0.5, 1.0),
max_size=128, interpolation='linear', seed=None,
name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.segmentation.Voronoi`

Uniformly sample Voronoi cells on images and average colors within them.

This augmenter is a shortcut for the combination of `Voronoi` with `UniformPointsSampler`. Hence, it generates a fixed amount of \(N\) random coordinates of voronoi cells on each image. The cell coordinates are sampled uniformly using the image height and width as maxima.

Supported dtypes:

See `Voronoi`.

Parameters

- `n_points` *(int or tuple of int or list of int or imgaug.parameters.StochasticParameter, optional)* –

  Number of points to sample on each image.

  - If a single int, then that value will always be used.
- If a tuple \((a, b)\), then a value from the discrete interval \([a..b]\) will be sampled per image.
- If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, then that parameter will be queried to draw one value per image.

**p_replace** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – Defines for any segment the probability that the pixels within that segment are replaced by their average color (otherwise, the pixels are not changed). Examples:

- A probability of 0.0 would mean, that the pixels in no segment are replaced by their average color (image is not changed at all).
- A probability of 0.5 would mean, that around half of all segments are replaced by their average color.
- A probability of 1.0 would mean, that all segments are replaced by their average color (resulting in a voronoi image).

Behaviour based on chosen datatypes for this parameter:

- If a number, then that number will always be used.
- If tuple \((a, b)\), then a random probability will be sampled from the interval \([a, b]\) per image.
- If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, it is expected to return values between 0.0 and 1.0 and will be queried for each individual segment to determine whether it is supposed to be averaged (>0.5) or not (<=0.5). Recommended to be some form of Binomial(...).

**max_size** (int or None, optional) – Maximum image size at which the augmentation is performed. If the width or height of an image exceeds this value, it will be downcaled before the augmentation so that the longest side matches max_size. This is done to speed up the process. The final output image has the same size as the input image. Note that in case p_replace is below 1.0, the down-/upscaling will affect the not-replaced pixels too. Use None to apply no down-/upscaling.

**interpolation** (int or str, optional) – Interpolation method to use during downscaling when max_size is exceeded. Valid methods are the same as in imresize_single_image().

**seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

**name** (None or str, optional) – See __init__().

**random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

**deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.
Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.UniformVoronoi((100, 500))
```

Sample for each image uniformly the number of voronoi cells \( N \) from the interval \([100, 500]\). Then generate \( N \) coordinates by sampling uniformly the x-coordinates from \([0, \, W]\) and the y-coordinates from \([0, \, H]\), where \( H \) is the image height and \( W \) the image width. Then use these coordinates to group the image pixels into voronoi cells and average the colors within them. The process is performed at an image size not exceeding 128 px on any side (default). If necessary, the downscaling is performed using linear interpolation (default).

```python
>>> aug = iaa.UniformVoronoi(250, p_replace=0.9, max_size=None)
```

Same as above, but always samples \( N=250 \) cells, replaces only 90 percent of them with their average color (the pixels of the remaining 10 percent are not changed) and performs the transformation at the original image size (max_size=None).

Methods

```python
__call__(self, *args, **kwargs) Alias for augment().
augment(self[, return_batch, hooks]) Augment a batch.
augment_batch(self, batch[, hooks]) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self, batches[, hooks, ...]) Augment multiple batches.
augment_bounding_boxes(self, ..., parents, ...[,]) Augment a batch of bounding boxes.
augment_heatmaps(self, heatmaps[, parents, ...[,]) Augment a batch of heatmaps.
augment_image(self, image[, hooks]) Augment a single image.
augment_images(self, images[, parents, hooks]) Augment a batch of images.
augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
augment_line_strings(self, ..., parents, hooks) Augment a batch of line strings.
augment_polygons(self, polygons_on_images[, ...[,]) Augment a batch of polygons.
augment_segmentation(self, segmentation_on_images, ...) Augment a batch of segmentation maps.
copy(self) Create a shallow copy of this Augmenter instance.
copy_random_state(self[, source[, recursive, ...]]) Copy the RNGs from a source augmenter sequence.
copy_random_state_(self, source[, ...]) Copy the RNGs from a source augmenter sequence (in-place).
deepcopy(self) Create a deep copy of this Augmenter instance.
draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.
find_augmenters(self, func[, parents, flat]) Find augmenters that match a condition.
find_augmenters_by_name(self, name[, regex, ...]) Find augmenter(s) by name.
find_augmenters_by_names(self, names[, ...]) Find augmenter(s) by names.
```
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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, . . .])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**class** `imgaug.augmenters.segmentation.Voronoi` *(points_sampler, p_replace=1.0, max_size=128, interpolation='linear', seed=None, name=None, random_state='deprecated', deterministic='deprecated')*

Bases: `imgaug.augmenters.meta.Augmenter`

Average colors of an image within Voronoi cells.

This augmenter performs the following steps:

1. Query `points_sampler` to sample random coordinates of cell centers. On the image.
2. Estimate for each pixel to which voronoi cell (i.e. segment) it belongs. Each pixel belongs to the cell with the closest center coordinate (euclidean distance).
3. Compute for each cell the average color of the pixels within it.
4. Replace the pixels of `p_replace` percent of all cells by their average color. Do not change the pixels of `(1 - p_replace)` percent of all cells. (The percentages are average values over many images. Some images may get more/less cells replaced by their average color.)

This code is very loosely based on [https://codegolf.stackexchange.com/questions/50299/draw-an-image-as-a-voronoi-map/50345#50345](https://codegolf.stackexchange.com/questions/50299/draw-an-image-as-a-voronoi-map/50345#50345)

**Supported dtypes:**

if (image size <= max_size):

- uint8: yes; fully tested
- uint16: no; not tested
- uint32: no; not tested
- uint64: no; not tested
- int8: no; not tested
• int16: no; not tested
• int32: no; not tested
• int64: no; not tested
• float16: no; not tested
• float32: no; not tested
• float64: no; not tested
• float128: no; not tested
• bool: no; not tested

if (image size > max_size):
    minimum of ( imgaug.augmenters.segmentation.Voronoi(image size <=
                 max_size), _ensure_image_max_size() )

Parameters

• points_sampler (IPointsSampler) – A points sampler which will be queried per image to
generate the coordinates of the centers of voronoi cells.

• p_replace (number or tuple of number or list of number or im-
gaug.parameters.StochasticParameter, optional) – Defines for any segment the probability
that the pixels within that segment are replaced by their average color (otherwise, the pixels
are not changed). Examples:
  - A probability of 0.0 would mean, that the pixels in no segment are replaced by their
    average color (image is not changed at all).
  - A probability of 0.5 would mean, that around half of all segments are replaced by their
    average color.
  - A probability of 1.0 would mean, that all segments are replaced by their average color
    (resulting in a voronoi image).

Behaviour based on chosen datatypes for this parameter:
  - If a number, then that number will always be used.
  - If tuple (a, b), then a random probability will be sampled from the interval [a, b]
    per image.
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, it is expected to return values between 0.0 and 1.0
    and will be queried for each individual segment to determine whether it is supposed to be
    averaged (>0.5) or not (<=0.5). Recommended to be some form of Binomial(...).

• max_size (int or None, optional) – Maximum image size at which the augmentation is
performed. If the width or height of an image exceeds this value, it will be downscaled
before the augmentation so that the longest side matches max_size. This is done to speed up
the process. The final output image has the same size as the input image. Note that in case
p_replace is below 1.0, the down-/upscaling will affect the not-replaced pixels too. Use
None to apply no down-/upsampling.

• interpolation (int or str, optional) – Interpolation method to use during downscaling when
max_size is exceeded. Valid methods are the same as in imresize_single_image().
• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

• name (None or str, optional) – See __init__().

• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> points_sampler = iaa.RegularGridPointsSampler(n_cols=20, n_rows=40)
>>> aug = iaa.Voronoi(points_sampler)
```

Create an augmenter that places a 20x40 (HxW) grid of cells on the image and replaces all pixels within each cell by the cell’s average color. The process is performed at an image size not exceeding 128 px on any side (default). If necessary, the downscaling is performed using linear interpolation (default).

```python
>>> points_sampler = iaa.DropoutPointsSampler(  
>>>     iaa.RelativeRegularGridPointsSampler(  
>>>         n_cols_frac=(0.05, 0.2),  
>>>         n_rows_frac=0.1),  
>>>     0.2)  
>>> aug = iaa.Voronoi(points_sampler, p_replace=0.9, max_size=None)
```

Create a voronoi augmenter that generates a grid of cells dynamically adapted to the image size. Larger images get more cells. On the x-axis, the distance between two cells is \( w \times W \) pixels, where \( W \) is the width of the image and \( w \) is always 0.1. On the y-axis, the distance between two cells is \( h \times H \) pixels, where \( H \) is the height of the image and \( h \) is sampled uniformly from the interval \([0.05, 0.2]\). To make the voronoi pattern less regular, about 20 percent of the cell coordinates are randomly dropped (i.e. the remaining cells grow in size). In contrast to the first example, the image is not resized (if it was, the sampling would happen after the resizing, which would affect \( W \) and \( H \)). Not all voronoi cells are replaced by their average color, only around 90 percent of them. The remaining 10 percent’s pixels remain unchanged.

Methods

- __call__(self, *args, **kwargs) Alias for augment().
- augment(self[, return_batch, hooks]) Augment a batch.
- augment_batch(self[, batch[, hooks]]) Deprecated.
- augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
- augment_batches(self, batches[, hooks, ...]) Augment multiple batches.
- augment_bounding_boxes(self, ...[, parents, ...]) Augment a batch of bounding boxes.
- augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>augment_image(self, image[, hooks])</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td>augment_images(self, images[, parents, hooks])</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td>augment_keypoints(self, keypoints_on_images)</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings(self, ...[, parents, hooks])</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td>augment_polygons(self, polygons_on_images[, ...])</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation_maps(self, segmaps[, ...])</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state(self, source[, recursive,...])</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td>copy_random_state_(self, source[, ...])</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy(self)</td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td>draw_grid(self, images, rows, cols)</td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td>find_augmenters(self, func[, parents, flat])</td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td>find_augmenters_by_name(self, name[, regex,...])</td>
<td>Find augmenter(s) by name.</td>
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<tr>
<td>find_augmenters_by_names(self, names[, ...])</td>
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<tr>
<td>get_all_children(self[, flat])</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td>get_children_lists(self)</td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td>get_parameters(self)</td>
<td>See get_parameters().</td>
</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td>pool(self[, processes, maxtasksperchild, seed])</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters(self, func[, copy,...])</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_tool])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**get_parameters(self)**

See **get_parameters()**.

`imgaug.augmenters.segmentation.segment_voronoi(image, cell_coordinates, replace_mask=None)`

Average colors within voronoi cells of an image.

**Parameters**

- **image (ndarray)** – The image to convert to a voronoi image. May be HxW or HxWxC. Note
that for RGBA images the alpha channel will currently also be averaged.

- **cell_coordinates** *(ndarray)* – A $N \times 2$ float array containing the center coordinates of voronoi cells on the image. Values are expected to be in the interval $[0.0, \text{height}-1.0]$ for the y-axis (x-axis analogous). If this array contains no coordinate, the image will not be changed.

- **replace_mask** *(None or ndarray, optional)* – Boolean mask of the same length as *cell_coordinates*, denoting for each cell whether its pixels are supposed to be replaced by the cell’s average color (True) or left untouched (False). If this is set to None, all cells will be replaced.

**Returns** Voronoi image.

**Return type** ndarray

### 13.35 imgaug.augmenters.size

Augmenters that somehow change the size of the images.

**List of augmenters:**

- **Resize**
- **CropAndPad**
- **Crop**
- **Pad**
- **PadToFixedSize**
- **CenterPadToFixedSize**
- **CropToFixedSize**
- **CenterCropToFixedSize**
- **CropToMultiplesOf**
- **CenterCropToMultiplesOf**
- **PadToMultiplesOf**
- **CenterPadToMultiplesOf**
- **CropToPowersOf**
- **CenterCropToPowersOf**
- **PadToPowersOf**
- **CenterPadToPowersOf**
- **CropToAspectRatio**
- **CenterCropToAspectRatio**
- **PadToAspectRatio**
- **CenterPadToAspectRatio**
- **CropToSquare**
- **CenterCropToSquare**
• PadToSquare
• CenterPadToSquare
• KeepSizeByResize

class imgaug.augmenters.size.CenterCropToAspectRatio:

Bases: imgaug.augmenters.size.CropToAspectRatio

Crop images equally on all sides until they reach an aspect ratio.

This is the same as CropToAspectRatio, but uses position="center" by default, which spreads the crop amounts equally over all image sides, while CropToAspectRatio by default spreads them randomly.

Added in 0.4.0.

Supported dtypes:
See CropToFixedSize.

Parameters

• aspect_ratio (number) – See CropToAspectRatio.__init__().
• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().
• name (None or str, optional) – See __init__().
• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CenterCropToAspectRatio(2.0)
```

Create an augmenter that crops each image until its aspect ratio is as close as possible to 2.0 (i.e. two times as many pixels along the x-axis than the y-axis). The rows to be cropped will be spread equally over the top and bottom sides (analogous for the left/right sides).

Methods

```python
__call__(self, *args, **kwargs)   # Alias for augment().

augment(self[, return_batch, hooks])   # Augment a batch.

augment_batch(self, batch[, hooks])   # Deprecated.

augment_batch_(self, batch[, parents, hooks])   # Augment a single batch in-place.
```

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- `augment_batches(self, batches[, hooks, ...])` Augment multiple batches.
- `augment_bounding_boxes(self, ...[, parents, ...])` Augment a batch of bounding boxes.
- `augment_heatmaps(self, heatmaps[, parents, ...])` Augment a batch of heatmaps.
- `augment_image(self, image[, hooks])` Augment a single image.
- `augment_images(self, images[, parents, hooks])` Augment a batch of images.
- `augment_keypoints(self, keypoints_on_images)` Augment a batch of keypoints/landmarks.
- `augment_line_strings(self, ...[, parents, hooks])` Augment a batch of line strings.
- `augment_polygons(self, polygons_on_images[, ...])` Augment a batch of polygons.
- `augment_segmentation_maps(self, segmaps[, ...])` Augment a batch of segmentation maps.
- `copy(self)` Create a shallow copy of this Augmenter instance.
- `copy_random_state(self[, source[, recursive, ...]])` Copy the RNGs from a source augmenter sequence.
- `copy_random_state_(self[, source[, ...]])` Copy the RNGs from a source augmenter sequence (in-place).
- `deepcopy(self)` Create a deep copy of this Augmenter instance.
- `draw_grid(self, images, rows, cols)` Augment images and draw the results as a single grid-like image.
- `find_augmenters(self, func[, parents, flat])` Find augmenters that match a condition.
- `find_augmenters_by_name(self, name[, regex,...])` Find augmenter(s) by name.
- `find_augmenters_by_names(self, names[, ...])` Find augmenter(s) by names.
- `get_all_children(self[, flat])` Get all children of this augmenter as a list.
- `get_children_lists(self)` Get a list of lists of children of this augmenter.
- `get_parameters(self)` See `get_parameters()`.
- `localize_random_state(self[, recursive])` Assign augmenter-specific RNGs to this augmenter and its children.
- `localize_random_state_(self[, recursive])` Assign augmenter-specific RNGs to this augmenter and its children.
- `pool(self[, processes, maxtasksperchild, seed])` Create a pool used for multicore augmentation.
- `remove_augmenters(self, func[, copy,...])` Remove this augmenter or children that match a condition.
- `remove_augmenters_(self, func[, parents])` Remove in-place children of this augmenter that match a condition.
- `remove_augmenters_inplace(self, func[, parents])` Deprecated.
- `reseed(self[, random_state, deterministic_too])` Deprecated.
- `seed_(self[, entropy, deterministic_too])` Seed this augmenter and all of its children.
- `show_grid(self, images, rows, cols)` Augment images and plot the results as a single grid-like image.
- `to_deterministic(self[, n])` Convert this augmenter from a stochastic to a deterministic one.
class `imgaug.augmenters.size.CenterCropToFixedSize`(width, height, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: `imgaug.augmenters.size.CropToFixedSize`

Take a crop from the center of each image.

This is an alias for `CropToFixedSize` with `position="center"`.

**Note:** If images already have a width and/or height below the provided width and/or height then this augmenter will do nothing for the respective axis. Hence, resulting images can be smaller than the provided axis sizes.

Added in 0.4.0.

**Supported dtypes:**

See `CropToFixedSize`.

**Parameters**

- `width` (*int or None*) – See `CropToFixedSize.__init__()`.
- `height` (*int or None*) – See `CropToFixedSize.__init__()`.
- `seed` (*None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional*) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
- `name` (*None or str, optional*) – See `__init__()`.
- `random_state` (*None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional*) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
- `deterministic` (*bool, optional*) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> crop = iaa.CenterCropToFixedSize(height=20, width=10)
```

Create an augmenter that takes 20x10 sized crops from the center of images.

**Methods**

```python
__call__(self, *args, **kwargs) Alias for `augment()`.
```

```python
augment(self[, return_batch, hooks]) Augment a batch.
```

```python
augment_batch(self, batch[, hooks]) Deprecated.
```

```python
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
```

```python
augment_batches(self, batches[, hooks, ...]) Augment multiple batches.
```
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>augment_bounding_boxes</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td>augment_heatmaps</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td>augment_image</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td>augment_images</td>
<td>Augment a batch of images.</td>
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<td>Augment a batch of keypoints/landmarks.</td>
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<tr>
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<tr>
<td>augment_polygons</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation_maps</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>copy</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
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<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
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<tr>
<td>draw_grid</td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td>find_augmenters</td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td>find_augmenters_by_name</td>
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</tr>
<tr>
<td>get_all_children</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td>get_children_lists</td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td>get_parameters</td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td>localize_random_state</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>localize_random_state_</td>
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<tr>
<td>pool</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
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<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>reseed</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
<tr>
<td>seed</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid</td>
<td>Augment images and plot the results as a single grid-like image.</td>
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<tr>
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</tr>
</tbody>
</table>

*Table 226 – continued from previous page*
class imgaug.augmenters.size.CenterCropToMultiplesOf(width_multiple,
    height_multiple, seed=None,
    name=None, random_state='deprecated',
    deterministic='deprecated')

Bases: imgaug.augmenters.size.CropToMultiplesOf

Crop images equally on all sides until H/W are multiples of given values.

This is the same as CropToMultiplesOf, but uses position="center" by default, which spreads the crop amounts equally over all image sides, while CropToMultiplesOf by default spreads them randomly.

Added in 0.4.0.

Supported dtypes:
See CropToFixedSize.

Parameters

- **width_multiple** (int or None) – See CropToMultiplesOf.__init__().
- **height_multiple** (int or None) – See CropToMultiplesOf.__init__().
- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().
- **name** (None or str, optional) – See __init__().
- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CenterCropToMultiplesOf(height_multiple=10, width_multiple=6)
```

Create an augmenter that crops images to multiples of 10 along the y-axis (i.e. 10, 20, 30, ... ) and to multiples of 6 along the x-axis (i.e. 6, 12, 18, ... ). The rows to be cropped will be spread equally over the top and bottom sides (analogous for the left/right sides).

Methods

```python
__call__(self, *args, **kwargs)  # Alias for augment().
augment(self[, return_batch, hooks])  # Augment a batch.
augment_batch(self[, batch[, hooks]])  # Deprecated.
```
<table>
<thead>
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<tbody>
<tr>
<td><code>augment_bounding_boxes</code></td>
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</tr>
<tr>
<td><code>augment_heatmaps</code></td>
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</tr>
<tr>
<td><code>augment_image</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images</code></td>
<td>Augment a batch of images.</td>
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<tr>
<td><code>augment_polygons</code></td>
<td>Augment a batch of polygons.</td>
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<tr>
<td><code>augment_segmentation_maps</code></td>
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<tr>
<td><code>draw_grid</code></td>
<td>Augment and plot the results as a single grid-like image.</td>
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<tr>
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<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
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<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
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<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
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<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid</code></td>
<td>Augment and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>
class imgaug.augmenters.size.CenterCropToPowersOf(width_base, height_base, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.size.CropToPowersOf

Crop images equally on all sides until H/W is a power of a base.

This is the same as CropToPowersOf, but uses position="center" by default, which spreads the crop amounts equally over all image sides, while CropToPowersOf by default spreads them randomly.

Added in 0.4.0.

Supported dtypes:

See CropToFixedSize.

Parameters

- **width_base** (int or None) – See CropToPowersOf.__init__().
- **height_base** (int or None) – See CropToPowersOf.__init__().
- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().
- **name** (None or str, optional) – See __init__().
- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CropToPowersOf(height_base=3, width_base=2)
```

Create an augmenter that crops each image down to powers of 3 along the y-axis (i.e. 3, 9, 27, ...) and powers of 2 along the x-axis (i.e. 2, 4, 8, 16, ...). The rows to be cropped will be spread equally over the top and bottom sides (analogous for the left/right sides).

Methods

```python
__call__(self, *args, **kwargs)  # Alias for augment().
augment(self[, return_batch, hooks])  # Augment a batch.
augment_batch(self[, batch[, hooks]])  # Deprecated.
augment_batch_(self, batch[, parents, hooks])  # Augment a single batch in-place.
augment_batches(self, batches[, hooks, ...])  # Augment multiple batches.
augment_bounding_boxes(self, ...[, parents, ...])  # Augment a batch of bounding boxes.
```

Continued on next page
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<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>augment_heatmaps(self, heatmaps[, parents, ...])</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(self, image[, hooks])</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images(self, images[, parents, hooks])</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints(self, keypoints_on_images)</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings(self, ...[, parents, hooks])</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons(self, polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps(self, segmaps[, ...])</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy(self)</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state(self, source[, recursive, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.size.CenterCropToSquare(seed=None, name=None, random_state=None, deterministic_too=None):

Bases: imgaug.augmenters.size.CropToSquare
```

Crop images equally on all sides until their height/width are identical.
In contrast to `CropToSquare`, this augmenter always tries to spread the columns/rows to remove equally over both sides of the respective axis to be cropped. `CropToAspectRatio` by default spreads the cropings randomly.

This augmenter is identical to `CropToSquare` with `position="center"`, and thereby the same as `CropToAspectRatio` with `aspect_ratio=1.0, position="center"`. Images with axis sizes of 0 will not be altered.

Added in 0.4.0.

**Supported dtypes:**

See `CropToFixedSize`.

**Parameters**

- `seed` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.
- `name` *(None or str, optional)* – See `__init__()`.
- `random_state` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
- `deterministic` *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CenterCropToSquare()
```

Create an augmenter that crops each image until its square, i.e. height and width match. The rows to be cropped will be spread *equally* over the top and bottom sides (analogous for the left/right sides).

**Methods**

```python
__call__(self, *args, **kwargs) Alias for `augment()`.
augment(self, return_batch, hooks) Augment a batch.
augment_batch(self, batch[, hooks]) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self, batches[, hooks, ...]) Augment multiple batches.
augment_bounding_boxes(self, ...[, parents, ...]) Augment a batch of bounding boxes.
augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
augment_image(self, image[, hooks]) Augment a single image.
augment_images(self, images[, parents, hooks]) Augment a batch of images.
```
<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>augment_keypoints</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
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<td>to_deterministic</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.size.CenterPadToAspectRatio(aspect_ratio, pad_mode='constant', pad_cval=0, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases:** `imgaug.augmenters.size.PadToAspectRatio`

Pad images equally on all sides until H/W matches an aspect ratio.

This is the same as `PadToAspectRatio`, but uses `position="center"` by default, which spreads the
pad amounts equally over all image sides, while `PadToAspectRatio` by default spreads them randomly.

Added in 0.4.0.

**Supported dtypes:**

See `PadToFixedSize`.

**Parameters**

- `aspect_ratio (number)` – See `PadToAspectRatio.__init__()`.
- `name (None or str, optional)` – See `__init__()`.
- `pad_mode (imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional)` – See `__init__()`.
- `pad_cval (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)` – See `__init__()`.
- `deterministic (bool, optional)` – See `__init__()`.
- `random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)` – See `__init__()`.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.PadToAspectRatio(2.0)
```

Create am augmenter that pads each image until its aspect ratio is as close as possible to 2.0 (i.e. two times as many pixels along the x-axis than the y-axis). The rows to be padded will be spread equally over the top and bottom sides (analogous for the left/right sides).

**Methods**

- `__call__ (self, *args, **kwargs) Alias for augment().`
- `augment(self[, return_batch, hooks]) Augment a batch.`
- `augment_batch(self[, return_batch, hooks]) Deprecated.`
- `augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.`
- `augment_batches(self, batch[, parents, hooks]) Augment multiple batches.`
- `augment_bounding_boxes(self[, return_batch, hooks]) Augment a batch of bounding boxes.`
- `augment_heatmaps(self[, return_batch, hooks]) Augment a batch of heatmaps.`
- `augment_image(self[, return_batch, hooks]) Augment a single image.`
- `augment_images(self[, return_batch, hooks]) Augment a batch of images.`
- `augment_keypoints(self[, return_batch, hooks]) Augment a batch of keypoints/landmarks.`
- `augment_line_strings(self[, return_batch, hooks]) Augment a batch of line strings.`
- `augment_polygons(self[, return_batch, hooks]) Augment a batch of polygons.`

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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>augment_segmentation_maps(self, segmaps[...])</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state(self, source[, recursive, ...])</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td>copy_random_state_(self, source[, ...])</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy(self)</td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td>draw_grid(self, images, rows, cols)</td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td>find_augmenters(self, func[, parents, flat])</td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td>find_augmenters_by_name(self, name[, regex, ...])</td>
<td>Find augmenter(s) by name.</td>
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<tr>
<td>find_augmenters_by_names(self, names[, ...])</td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td>get_all_children(self[, flat])</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td>get_children_lists(self)</td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td>get_parameters(self)</td>
<td>See get_parameters().</td>
</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td>localize_random_state_(self[, recursive])</td>
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<td>pool(self[, processes, maxtasksperchild, seed])</td>
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<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.size.CenterPadToFixedSize(width, height, pad_mode='constant', pad_cval=0, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.size.PadToFixedSize`

Pad images equally on all sides up to given minimum heights/widths.

This is an alias for `PadToFixedSize` with `position="center"`. It spreads the pad amounts equally over all image sides, while `PadToFixedSize` by defaults spreads them randomly.

Added in 0.4.0.

**Supported dtypes:**

See `PadToFixedSize`.

**Parameters**
• **width** (*int or None*) – See `PadToFixedSize.__init__()`.  
• **height** (*int or None*) – See `PadToFixedSize.__init__()`.  
• **pad_mode** *(imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional)* – See `PadToFixedSize.__init__()`.  
• **pad_cval** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – See `PadToFixedSize.__init__()`.  
• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.  
• **name** *(None or str, optional)* – See `__init__()`.  
• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.  
• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CenterPadToFixedSize(height=20, width=30)
```

Create an augmenter that pads images up to 20x30, with the padded rows added *equally* on the top and bottom (analogous for the padded columns).

**Methods**

<table>
<thead>
<tr>
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<tr>
<td><code>__call__</code>(self, *args, **kwargs)</td>
<td>Alias for <code>augment()</code>.</td>
</tr>
<tr>
<td><code>augment(self, return_batch, hooks)</code></td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><code>augment_batch(self, batch[, hooks])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>augment_batch_(self, batch[, parents, hooks])</code></td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><code>augment_batches(self, batches[, hooks, ...])</code></td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td><code>augment_bounding_boxes(self, ...[, parents, ...])</code></td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps(self, heatmaps[, parents, ...])</code></td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image(self, image[, hooks])</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images(self, images[, parents, hooks])</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints(self, keypoints_on_images)</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings(self, ...[, parents, hooks])</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons(self, polygons_on_images[, ...])</code></td>
<td>Augment a batch of polygons.</td>
</tr>
</tbody>
</table>

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<td>Augment a batch of segmentation maps.</td>
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<td>Create a shallow copy of this Augmenter instance.</td>
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<td>Copy the RNGs from a source augmenter sequence.</td>
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<tr>
<td><code>copy_random_state_(self, source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
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<td><code>deepcopy(self)</code></td>
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<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
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<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
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<tr>
<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
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<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
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<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
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<td>See <code>get_parameters()</code>.</td>
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<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
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<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.size.CenterPadToMultiplesOf(
    width_multiple, height_multiple,
    pad_mode='constant',
    pad_cval=0, seed=None,
    name=None,
    random_state='deprecated',
    deterministic='deprecated')
```

**Bases:** `imgaug.augmenters.size.PadToMultiplesOf`

Pad images equally on all sides until H/W are multiples of given values.

This is the same as `PadToMultiplesOf`, but uses `position='center'` by default, which spreads the pad amounts equally over all image sides, while `PadToMultiplesOf` by default spreads them randomly.

Added in 0.4.0.

**Supported dtypes:**

See `PadToFixedSize`. 
Parameters

- **width_multiple** *(int or None)* – See `PadToMultiplesOf.__init__()`.  
- **height_multiple** *(int or None)* – See `PadToMultiplesOf.__init__()`.  
- **pad_mode** *(imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional)* – See `__init__()`.  
- **pad_cval** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – See `__init__()`.  
- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.  
- **name** *(None or str, optional)* – See `__init__()`.  
- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.  
- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CenterPadToMultiplesOf(height_multiple=10, width_multiple=6)
```

Create an augmenter that pads images to multiples of 10 along the y-axis (i.e. 10, 20, 30, ...) and to multiples of 6 along the x-axis (i.e. 6, 12, 18, ...). The rows to be padded will be spread equally over the top and bottom sides (analogous for the left/right sides).

Methods

```python
__call__ (self, *args, **kwargs) Alias for `augment()`.  
augment(self[, return_batch, hooks]) Augment a batch.  
augment_batch(self[, batch[, hooks]]) Deprecated.  
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.  
augment_batches(self[, batch[, parents, hooks]]) Augment multiple batches.  
augment_bounding_boxes(self, ...[, parents, ...]) Augment a batch of bounding boxes.  
augment_heatmaps(self[, heatmaps[, parents, ...]]) Augment a batch of heatmaps.  
augment_image(self[, image[, hooks]]) Augment a single image.  
augment_images(self[, images[, parents, hooks]]) Augment a batch of images.  
augment_keypoints(self[, keypoints_on_images]) Augment a batch of keypoints/landmarks.  
augment_line_strings(self, ...[, parents, hooks]) Augment a batch of line strings.
```

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<thead>
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<th>Method</th>
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</tr>
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<tbody>
<tr>
<td><code>augment_polygons</code></td>
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</tr>
<tr>
<td><code>augment_segmentation_maps</code></td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
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<td><code>copy_random_state</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_</code></td>
<td>Copy the RNGs from a source augmenter sequence</td>
</tr>
<tr>
<td></td>
<td>(in-place).</td>
</tr>
<tr>
<td><code>deepcopy</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid</code></td>
<td>Augment images and draw the results as a single</td>
</tr>
<tr>
<td></td>
<td>grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name</code></td>
<td>Find augmenter(s) by name.</td>
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<td><code>get_parameters</code></td>
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<tr>
<td><code>localize_random_state</code></td>
<td>Assign augmenter-specific RNGs to this augmenter</td>
</tr>
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<td></td>
<td>and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_</code></td>
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<tr>
<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters</code></td>
<td>Remove this augmenter or children that match a</td>
</tr>
<tr>
<td></td>
<td>condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace</code></td>
<td>Remove in-place children of this augmenter that</td>
</tr>
<tr>
<td></td>
<td>match a condition.</td>
</tr>
<tr>
<td><code>reseed</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_</code></td>
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<tr>
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<td>deterministic one.</td>
</tr>
</tbody>
</table>

```python

class imgaug.augmenters.size.CenterPadToPowersOf(width_base, height_base, pad_mode='constant', pad_cval=0, seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.size.PadToPowersOf`

Pad images equally on all sides until H/W is a power of a base.

This is the same as `PadToPowersOf`, but uses `position='center'` by default, which spreads the pad amounts equally over all image sides, while `PadToPowersOf` by default spreads them randomly.

Added in 0.4.0.

**Supported dtypes:**

See `PadToFixedSize`.  

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Parameters

- `width_base` *(int or None)* – See `PadToPowersOf.__init__()`.  
- `height_base` *(int or None)* – See `PadToPowersOf.__init__()`.  
- `pad_mode` *(imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional)* – See `__init__()`.  
- `pad_cval` *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – See `__init__()`.
- `seed` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.
- `name` *(None or str, optional)* – See `__init__()`.
- `random_state` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.
- `deterministic` *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CenterPadToPowersOf(height_base=5, width_base=2)
```

Create an augmenter that pads each image to powers of 3 along the y-axis (i.e. 3, 9, 27, ... ) and powers of 2 along the x-axis (i.e. 2, 4, 8, 16, ... ). The rows to be padded will be spread *equally* over the top and bottom sides (analogous for the left/right sides).

Methods

```python
__call__ (self, *args, **kwargs) Alias for augment().
augment(self[, return_batch, hooks]) Augment a batch.
augment_batch(self[, return_batch, hooks]) Deprecated.
augment_batch (self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches (self, batches[, parents, hooks]) Augment multiple batches.
augment_bounding_boxes (self, ...[, parents, hooks]) Augment a batch of bounding boxes.
augment_heatmaps (self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
augment_image (self, image[, hooks]) Augment a single image.
augment_images (self, images[, parents, hooks]) Augment a batch of images.
augment_keypoints (self, ...[, parents, hooks]) Augment a batch of keypoints/landmarks.
augment_line_strings (self, ...[, parents, hooks]) Augment a batch of line strings.
```

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<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td><strong>Deprecated.</strong></td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td><strong>Deprecated.</strong></td>
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<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
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**class** `imgaug.augmenters.size.CenterPadToSquare` (pad_mode='constant', pad_cval=0, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: `imgaug.augmenters.size.PadToSquare`

Pad images equally on all sides until their height & width are identical.

This is the same as `PadToSquare`, but uses position="center" by default, which spreads the pad amounts equally over all image sides, while `PadToSquare` by default spreads them randomly. This augmenter is thus also identical to `PadToAspectRatio` with aspect_ratio=1.0, position="center".

Added in 0.4.0.

**Supported dtypes:**

See `PadToFixedSize`. 
Parameters

- **name** *(None or str, optional)* – See `__init__()*.  
- **pad_mode** *(imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional)* – See `__init__()*.  
- **pad_cval** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – See `__init__()*.  
- **deterministic** *(bool, optional)* – See `__init__()*.  
- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()*.  

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CenterPadToSquare()
```

Create an augmenter that pads each image until its square, i.e. height and width match. The rows to be padded will be spread equally over the top and bottom sides (analogous for the left/right sides).

Methods

```
__call__ (self, *args, **kwargs) Alias for augment().
augment(self[, return_batch, hooks]) Augment a batch.
augment_batch(self[, batch[, hooks]]) Deprecated.
augment_batch__ (self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches (self, batches[, hooks, ...]) Augment multiple batches.
augment_bounding_boxes (self[, ...[, parents, ...]]) Augment a batch of bounding boxes.
augment_heatmaps (self[, heatmaps[, parents, ...]]) Augment a batch of heatmaps.
augment_image (self[, image[, hooks]]) Augment a single image.
augment_images (self, images[, parents, hooks]) Augment a batch of images.
augment_keypoints (self[, keypoints_on_images]) Augment a batch of keypoints/landmarks.
augment_line_strings (self[, ...[, parents, hooks]]) Augment a batch of line strings.
augment_polygons (self, polygons_on_images[, ...]) Augment a batch of polygons.
augment_segmentation_maps (self, segmaps[, ...]) Augment a batch of segmentation maps.
copy(self) Create a shallow copy of this Augmenter instance.
copy_random_state (self[, source[, recursive, ...]]) Copy the RNGs from a source augmenter sequence.
copy_random_state__ (self, source[, ...]) Copy the RNGs from a source augmenter sequence (in-place).
deprecated (self) Create a deep copy of this Augmenter instance.
draw_grid (self, images, rows, cols) Augment images and draw the results as a single grid-like image.
```

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<table>
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**class** `imgaug.augmenters.size.Crop` *(px=None, percent=None, keep_size=True, sample_independently=True, seed=None, name=None, random_state='deprecated', deterministic='deprecated')*

**Bases:** `imgaug.augmenters.size.CropAndPad`

Crop images, i.e. remove columns/rows of pixels at the sides of images.

This augmenter allows to extract smaller-sized subimages from given full-sized input images. The number of pixels to cut off may be defined in absolute values or as fractions of the image sizes.

This augmenter will never crop images below a height or width of 1.

**Supported dtypes:**

See `CropAndPad`.

**Parameters**

- **px** *(None or int or imgaug.parameters.StochasticParameter or tuple, optional)* – The number of pixels to crop on each side of the image. Expected value range is `[0, inf)`. Either this or the parameter `percent` may be set, not both at the same time.
  - If `None`, then pixel-based cropping will not be used.
  - If `int`, then that exact number of pixels will always be cropped.
  - If `StochasticParameter`, then that parameter will be used for each image. Four samples will be drawn per image (top, right, bottom, left), unless `sample_independently` is set to `False`, as then only one value will be sampled per image and used for all sides.
  - If a tuple of two `int`s with values `a` and `b`, then each side will be cropped by a random amount sampled uniformly per image and side from the interval `[a, b]`. If however
**sample_independently** is set to False, only one value will be sampled per image and used for all sides.

- If a tuple of four entries, then the entries represent top, right, bottom, left. Each entry may be a single int (always crop by exactly that value), a tuple of two ints a and b (crop by an amount within [a, b]), a list of ints (crop by a random value that is contained in the list) or a StochasticParameter (sample the amount to crop from that parameter).

**percent** (None or int or float or imgaug.parameters.StochasticParameter or tuple, optional)

- The number of pixels to crop on each side of the image given as a fraction of the image height/width. E.g. if this is set to 0.1, the augmenter will always crop 10% of the image’s height at both the top and the bottom (both 10% each), as well as 10% of the width at the right and left. Expected value range is [0.0, 1.0). Either this or the parameter px may be set, not both at the same time.

- If None, then fraction-based cropping will not be used.

- If number, then that fraction will always be cropped.

- If StochasticParameter, then that parameter will be used for each image. Four samples will be drawn per image (top, right, bottom, left). If however sample_independently is set to False, only one value will be sampled per image and used for all sides.

- If a tuple of two floats with values a and b, then each side will be cropped by a random fraction sampled uniformly per image and side from the interval [a, b]. If however sample_independently is set to False, only one value will be sampled per image and used for all sides.

- If a tuple of four entries, then the entries represent top, right, bottom, left. Each entry may be a single float (always crop by exactly that fraction), a tuple of two floats a and b (crop by a fraction from [a, b]), a list of floats (crop by a random value that is contained in the list) or a StochasticParameter (sample the percentage to crop from that parameter).

**keep_size** (bool, optional) – After cropping, the result image will usually have a different height/width compared to the original input image. If this parameter is set to True, then the cropped image will be resized to the input image’s size, i.e. the augmenter’s output shape is always identical to the input shape.

**sample_independently** (bool, optional) – If False and the values for px/percent result in exactly one probability distribution for all image sides, only one single value will be sampled from that probability distribution and used for all sides. I.e. the crop amount then is the same for all sides. If True, four values will be sampled independently, one per side.

**seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

**name** (None or str, optional) – See __init__().

**random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

**deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic
mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Crop(px=(0, 10))
```

Crop each side by a random pixel value sampled uniformly per image and side from the discrete interval [0..10].

```python
>>> aug = iaa.Crop(px=(0, 10), sample_independently=False)
```

Crop each side by a random pixel value sampled uniformly once per image from the discrete interval [0..10]. Each sampled value is used for all sides of the corresponding image.

```python
>>> aug = iaa.Crop(px=(0, 10), keep_size=False)
```

Crop each side by a random pixel value sampled uniformly per image and side from the discrete interval [0..10]. Afterwards, do not resize the cropped image back to the input image’s size. This will decrease the image’s height and width by a maximum of 20 pixels.

```python
>>> aug = iaa.Crop(px=((0, 10), (0, 5), (0, 10), (0, 5)))
```

Crop the top and bottom by a random pixel value sampled uniformly from the discrete interval [0..10]. Crop the left and right analogously by a random value sampled from [0..5]. Each value is always sampled independently.

```python
>>> aug = iaa.Crop(percent=(0, 0.1))
```

Crop each side by a random fraction sampled uniformly from the continuous interval [0.0, 0.10]. The fraction is sampled once per image and side. E.g. a sampled fraction of 0.1 for the top side would crop by 0.1*H, where H is the height of the input image.

```python
>>> aug = iaa.Crop(
  ...     percent=((0.05, 0.1), [0.05, 0.1], [0.05, 0.1], [0.05, 0.1]))
```

Crops each side by either 5% or 10%. The values are sampled once per side and image.

Methods

- `__call__` (self, *args, **kwargs)  
  Alias for `augment()`.
- `augment` (self, return_batch, hooks)  
  Augment a batch.
- `augment_batch` (self, batch[, hooks])  
  Augment a single batch in-place.
- `augment_batch_(self, batch[, parents, hooks])`  
  Deprecated.
- `augment_bounding_boxes` (self[, parents, hooks, ...])  
  Augment a batch of bounding boxes.
- `augment_heatmaps` (self[, heatmaps[, parents, ...]])  
  Augment a batch of heatmaps.
- `augment_image` (self[, image[, hooks]])  
  Augment a single image.
- `augment_images` (self[, images[, parents, hooks]])  
  Augment a batch of images.
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<tr>
<td><code>deepcopy(self)</code></td>
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**class** `imgaug.augmenters.size.CropAndPad(px=None, percent=None, pad_mode='constant', pad_cval=0, keep_size=True, sample_independently=True, seed=None, name=None, random_state='deprecated', deterministic='deprecated')`

**Bases:** `imgaug.augmenters.meta.Augmenter`

Crop/pad images by pixel amounts or fractions of image sizes.

Cropping removes pixels at the sides (i.e. extracts a subimage from a given full image). Padding adds pixels to the sides (e.g. black pixels).
This augmenter will never crop images below a height or width of 1.

**Note:** This augmenter automatically resizes images back to their original size after it has augmented them. To deactivate this, add the parameter `keep_size=False`.

**Supported dtypes:**

if (keep_size=False):

- uint8: yes; fully tested
- uint16: yes; tested
- uint32: yes; tested
- uint64: yes; tested
- int8: yes; tested
- int16: yes; tested
- int32: yes; tested
- int64: yes; tested
- float16: yes; tested
- float32: yes; tested
- float64: yes; tested
- float128: yes; tested
- bool: yes; tested

if (keep_size=True):

    minimum of ( imgaug.augmenters.size.CropAndPad(keep_size=False),
                   imresize_many_images() )

**Parameters**

- **px** *(None or int or imgaug.parameters.StochasticParameter or tuple, optional)* – The number of pixels to crop (negative values) or pad (positive values) on each side of the image. Either this or the parameter `percent` may be set, not both at the same time.
  - If `None`, then pixel-based cropping/padding will not be used.
  - If `int`, then that exact number of pixels will always be cropped/padded.
  - If `StochasticParameter`, then that parameter will be used for each image. Four samples will be drawn per image (top, right, bottom, left), unless `sample_independently` is set to `False`, as then only one value will be sampled per image and used for all sides.
  - If a tuple of two `int`s with values `a` and `b`, then each side will be cropped/padded by a random amount sampled uniformly per image and side from the interval `[a, b]`. If however `sample_independently` is set to `False`, only one value will be sampled per image and used for all sides.
  - If a tuple of four entries, then the entries represent top, right, bottom, left. Each entry may be a single `int` (always crop/pad by exactly that value), a tuple of two `int`s `a` and `b` (crop/pad by an amount within `[a, b]`), a list of `int`s (crop/pad by a random
value that is contained in the list) or a StochasticParameter (sample the amount to crop/pad from that parameter).

- **percent** (None or number or imgaug.parameters.StochasticParameter or tuple, optional)
  - The number of pixels to crop (negative values) or pad (positive values) on each side of the image given as a fraction of the image height/width. E.g. if this is set to -0.1, the augmenter will always crop away 10% of the image’s height at both the top and the bottom (both 10% each), as well as 10% of the width at the right and left. Expected value range is (-1.0, inf). Either this or the parameter px may be set, not both at the same time.
  - If None, then fraction-based cropping/padding will not be used.
  - If number, then that fraction will always be cropped/padded.
  - If StochasticParameter, then that parameter will be used for each image. Four samples will be drawn per image (top, right, bottom, left). If however sample_independently is set to False, only one value will be sampled per image and used for all sides.
  - If a tuple of two floats with values a and b, then each side will be cropped/padded by a random fraction sampled uniformly per image and side from the interval [a, b]. If however sample_independently is set to False, only one value will be sampled per image and used for all sides.
  - If a tuple of four entries, then the entries represent top, right, bottom, left. Each entry may be a single float (always crop/pad by exactly that percent value), a tuple of two floats a and b (crop/pad by a fraction from [a, b]), a list of floats (crop/pad by a random value that is contained in the list) or a StochasticParameter (sample the percentage to crop/pad from that parameter).

- **pad_mode** (imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional) – Padding mode to use. The available modes match the numpy padding modes, i.e. constant, edge, linear_ramp, maximum, median, minimum, reflect, symmetric, wrap. The modes constant and linear_ramp use extra values, which are provided by pad_cval when necessary. See pad() for more details.
  - If imgaug.ALL, then a random mode from all available modes will be sampled per image.
  - If a str, it will be used as the pad mode for all images.
  - If a list of str, a random one of these will be sampled per image and used as the mode.
  - If StochasticParameter, a random mode will be sampled from this parameter per image.

- **pad_cval** (number or tuple of number list of number or imgaug.parameters.StochasticParameter, optional) – The constant value to use if the pad mode is constant or the end value to use if the mode is linear_ramp. See pad() for more details.
  - If number, then that value will be used.
  - If a tuple of two numbers and at least one of them is a float, then a random number will be uniformly sampled per image from the continuous interval [a, b] and used as the value. If both numbers are ints, the interval is discrete.
  - If a list of numbers, then a random value will be chosen from the elements of the list and used as the value.
If StochasticParameter, a random value will be sampled from that parameter per image.

- keep_size (bool, optional) – After cropping and padding, the result image will usually have a different height/width compared to the original input image. If this parameter is set to True, then the cropped/padded image will be resized to the input image’s size, i.e. the augmenter’s output shape is always identical to the input shape.

- sample_independently (bool, optional) – If False and the values for px/percent result in exactly one probability distribution for all image sides, only one single value will be sampled from that probability distribution and used for all sides. I.e. the crop/pad amount then is the same for all sides. If True, four values will be sampled independently, one per side.

- seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

- name (None or str, optional) – See __init__().

- random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

- deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CropAndPad(px=(-10, 0))
```

Crop each side by a random pixel value sampled uniformly per image and side from the discrete interval \([-10.\ 0]\).

```python
>>> aug = iaa.CropAndPad(px=(0, 10))
```

Pad each side by a random pixel value sampled uniformly per image and side from the discrete interval \([0.\ 10]\). The padding happens by zero-padding, i.e. it adds black pixels (default setting).

```python
>>> aug = iaa.CropAndPad(px=(0, 10), pad_mode="edge")
```

Pad each side by a random pixel value sampled uniformly per image and side from the discrete interval \([0.\ 10]\). The padding uses the edge mode from numpy’s pad function, i.e. the pixel colors around the image sides are repeated.

```python
>>> aug = iaa.CropAndPad(px=(0, 10), pad_mode=["constant", "edge"])
```

Similar to the previous example, but uses zero-padding (constant) for half of the images and edge padding for the other half.

```python
>>> aug = iaa.CropAndPad(px=(0, 10), pad_mode=ia.ALL, pad_cval=(0, 255))
```

Similar to the previous example, but uses any available padding mode. In case the padding mode ends up being constant or linear_ramp, and random intensity is uniformly sampled (once per image) from the discrete interval \([0.\ 255]\) and used as the intensity of the new pixels.
>>> aug = iaa.CropAndPad(px=(0, 10), sample_independently=False)

Pad each side by a random pixel value sampled uniformly once per image from the discrete interval [0..10]. Each sampled value is used for all sides of the corresponding image.

>>> aug = iaa.CropAndPad(px=(0, 10), keep_size=False)

Pad each side by a random pixel value sampled uniformly per image and side from the discrete interval [0..10]. Afterwards, do not resize the padded image back to the input image’s size. This will increase the image’s height and width by a maximum of 20 pixels.

>>> aug = iaa.CropAndPad(px=((0, 10), (0, 5), (0, 10), (0, 5)))

Pad the top and bottom by a random pixel value sampled uniformly from the discrete interval [0..10]. Pad the left and right analogously by a random value sampled from [0..5]. Each value is always sampled independently.

>>> aug = iaa.CropAndPad(percent=(0, 0.1))

Pad each side by a random fraction sampled uniformly from the continuous interval [0.0, 0.10]. The fraction is sampled once per image and side. E.g. a sampled fraction of 0.1 for the top side would pad by 0.1*H, where H is the height of the input image.

>>> aug = iaa.CropAndPad(
>>>     percent=((0.05, 0.1], [0.05, 0.1], [0.05, 0.1], [0.05, 0.1]))

Pads each side by either 5% or 10%. The values are sampled once per side and image.

>>> aug = iaa.CropAndPad(px=(-10, 10))

Sample uniformly per image and side a value $v$ from the discrete range [-10..10]. Then either crop (negative sample) or pad (positive sample) the side by $v$ pixels.

**Methods**

```python
>>> aug = iaa.CropAndPad(px=(0, 10), sample_independently=False)

Pad each side by a random pixel value sampled uniformly once per image from the discrete interval [0..10]. Each sampled value is used for all sides of the corresponding image.

>>> aug = iaa.CropAndPad(px=(0, 10), keep_size=False)

Pad each side by a random pixel value sampled uniformly per image and side from the discrete interval [0..10]. Afterwards, do not resize the padded image back to the input image’s size. This will increase the image’s height and width by a maximum of 20 pixels.

>>> aug = iaa.CropAndPad(px=((0, 10), (0, 5), (0, 10), (0, 5)))

Pad the top and bottom by a random pixel value sampled uniformly from the discrete interval [0..10]. Pad the left and right analogously by a random value sampled from [0..5]. Each value is always sampled independently.

>>> aug = iaa.CropAndPad(percent=(0, 0.1))

Pad each side by a random fraction sampled uniformly from the continuous interval [0.0, 0.10]. The fraction is sampled once per image and side. E.g. a sampled fraction of 0.1 for the top side would pad by 0.1*H, where H is the height of the input image.

>>> aug = iaa.CropAndPad(
>>>     percent=((0.05, 0.1], [0.05, 0.1], [0.05, 0.1], [0.05, 0.1]))

Pads each side by either 5% or 10%. The values are sampled once per side and image.

>>> aug = iaa.CropAndPad(px=(-10, 10))

Sample uniformly per image and side a value $v$ from the discrete range [-10..10]. Then either crop (negative sample) or pad (positive sample) the side by $v$ pixels.

**Methods**

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<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
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<tr>
<td>copy_random_state(self, source[, recursive, ...])</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
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<td>copy_random_state_(self, source[, ...])</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
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<td>deepcopy(self)</td>
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<td>draw_grid(self, images, rows, cols)</td>
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<tr>
<td>get_parameters(self)</td>
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</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
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<td>pool(self[, processes, maxtasksperchild, seed])</td>
<td>Create a pool used for multicore augmentation.</td>
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<tr>
<td>remove_augmenters(self, func[, copy, ...])</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_(self, func[, parents])</td>
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<td>remove_augmenters_inplace(self, func[, parents])</td>
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</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
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</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
get_parameters(self)
See get_parameters().
```

**class imgaug.augmenters.size.CropToAspectRatio**

```python
aspect_ratio, position='uniform', seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases:** imgaug.augmenters.size.CropToFixedSize

Crop images until their width/height matches an aspect ratio.

This augmenter removes either rows or columns until the image reaches the desired aspect ratio given in width / height. The cropping operation is stopped once the desired aspect ratio is reached or the image side to crop reaches a size of 1. If any side of the image starts with a size of 0, the image will not be changed.

Added in 0.4.0.

**Supported dtypes:**
See `CropToFixedSize`.

**Parameters**

- **aspect_ratio** *(number)* – The desired aspect ratio, given as width/height. E.g., a ratio of 2.0 denotes an image that is twice as wide as it is high.


- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.RandomState, optional)* – See `__init__()`.  

- **name** *(None or str, optional)* – See `__init__()`.  

- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.  

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CropToAspectRatio(2.0)
```

Create an augmenter that crops each image until its aspect ratio is as close as possible to 2.0 (i.e., two times as many pixels along the x-axis than the y-axis). The rows to be cropped will be spread randomly over the top and bottom sides (analogous for the left/right sides).

**Methods**

```python
__call__(self, *args, **kwargs) Alias for augment().
augment(self[, return_batch, hooks]) Augment a batch.
augment_batch(self[, batch[, hooks]]) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self, batches[, parents, hooks]) Augment multiple batches.
augment_bounding_boxes(self, ...[, parents, ...]) Augment a batch of bounding boxes.
augment_heatmaps(self, ...[, parents, ...]) Augment a batch of heatmaps.
augment_image(self[, image[, hooks]]) Augment a single image.
augment_images(self, ...[, parents, hooks]) Augment a batch of images.
augment_keypoints(self, key-points_on_images) Augment a batch of keypoints/landmarks.
augment_line_strings(self, ...[, parents, hooks]) Augment a batch of line strings.
```
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<td>Augment a batch of polygons.</td>
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<td><code>augment_segmentation_maps(...)</code></td>
<td>Augment a batch of segmentation maps.</td>
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<td><code>copy()</code></td>
<td>Create a shallow copy of this Augmenter instance.</td>
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<td>Remove in-place children of this augmenter that match a condition.</td>
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<td><code>reseed(...)</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
get_parameters(self)
    See get_parameters().
```

```python
class imgaug.augmenters.size.CropToFixedSize(
    width, height, position='uniform',
    seed=None, name=None, random_state='deprecated',
    deterministic='deprecated')
```

Bases: `imgaug.augmenters.meta.Augmenter`

Crop images down to a predefined maximum width and/or height.

If images are already at the maximum width/height or are smaller, they will not be cropped. Note that this also means that images will not be padded if they are below the required width/height.

The augmenter randomly decides per image how to distribute the required cropping amounts over the image axis. E.g. if 2px have to be cropped on the left or right to reach the required width, the augmenter will sometimes
remove 2px from the left and 0px from the right, sometimes remove 2px from the right and 0px from the left and sometimes remove 1px from both sides. Set position to center to prevent that.

**Supported dtypes:**

- uint8: yes; fully tested
- uint16: yes; tested
- uint32: yes; tested
- uint64: yes; tested
- int8: yes; tested
- int16: yes; tested
- int32: yes; tested
- int64: yes; tested
- float16: yes; tested
- float32: yes; tested
- float64: yes; tested
- float128: yes; tested
- bool: yes; tested

**Parameters**

- **width (int or None)** – Crop images down to this maximum width. If None, image widths will not be altered.

- **height (int or None)** – Crop images down to this maximum height. If None, image heights will not be altered.

- **position (‘uniform’, ‘normal’, ‘center’, ‘left-top’, ‘left-center’, ‘left-bottom’, ‘center-top’, ‘center-center’, ‘center-bottom’, ‘right-top’, ‘right-center’, ‘right-bottom’ or tuple of float or StochasticParameter or tuple of StochasticParameter, optional)** – Sets the center point of the cropping, which determines how the required cropping amounts are distributed to each side. For a tuple (a, b), both a and b are expected to be in range [0.0, 1.0] and describe the fraction of cropping applied to the left/right (low/high values for a) and the fraction of cropping applied to the top/bottom (low/high values for b). A cropping position at (0.5, 0.5) would be the center of the image and distribute the cropping equally over all sides. A cropping position at (1.0, 0.0) would be the right-top and would apply 100% of the required cropping to the right and top sides of the image.
  - If string uniform then the share of cropping is randomly and uniformly distributed over each side. Equivalent to \((\text{Uniform}(0.0, 1.0), \text{Uniform}(0.0, 1.0))\).
  - If string normal then the share of cropping is distributed based on a normal distribution, leading to a focus on the center of the images. Equivalent to \((\text{Clip} (\text{Normal}(0.5, 0.45/2), 0, 1)), \text{Clip}(\text{Normal}(0.5, 0.45/2), 0, 1))\).
  - If string center then center point of the cropping is identical to the image center. Equivalent to \((0.5, 0.5)\).
  - If a string matching regex `^\[(left|center|right)\)-(top|center|bottom)\]$`, e.g. left-top or center-bottom then sets the center point of the cropping to the X-Y position matching that description.
If a tuple of float, then expected to have exactly two entries between 0.0 and 1.0, which will always be used as the combination the position matching (x, y) form.

- If a StochasticParameter, then that parameter will be queried once per call to augment_*() to get Nx2 center positions in (x, y) form (with N the number of images).

- If a tuple of StochasticParameter, then expected to have exactly two entries that will both be queried per call to augment_*(), each for (N,) values, to get the center positions. First parameter is used for x coordinates, second for y coordinates.

• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

• name (None or str, optional) – See __init__().

• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CropToFixedSize(width=100, height=100)
```

For image sides larger than 100 pixels, crop to 100 pixels. Do nothing for the other sides. The cropping amounts are randomly (and uniformly) distributed over the sides of the image.

```python
>>> aug = iaa.CropToFixedSize(width=100, height=100, position="center")
```

For sides larger than 100 pixels, crop to 100 pixels. Do nothing for the other sides. The cropping amounts are always equally distributed over the left/right sides of the image (and analogously for top/bottom).

```python
>>> aug = iaa.Sequential([        iaa.PadToFixedSize(width=100, height=100),        iaa.CropToFixedSize(width=100, height=100)    ])
```

Pad images smaller than 100x100 until they reach 100x100. Analogously, crop images larger than 100x100 until they reach 100x100. The output images therefore have a fixed size of 100x100.

Methods

- __call__(self, *args, **kwargs) Alias for augment().
- augment(self[, return_batch, hooks]) Augment a batch.
- augment_batch(self, batch[, hooks]) Deprecated.
- augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.

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<td>augment_image(self, image[, hooks])</td>
<td>Augment a single image.</td>
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<td>augment_images(self, images[, parents, hooks])</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td>augment_keypoints(self, keypoints_on_images)</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
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<td>augment_line_strings(self, ...[, parents, hooks])</td>
<td>Augment a batch of line strings.</td>
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<td>augment_polygons(self, polygons_on_images[, ...])</td>
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<td>remove_augmenters_inplace(self, func[, parents])</td>
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<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
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<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
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<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
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<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>

get_parameters(self)

See get_parameters().

13.35. imgaug.augmenters.size
```python
class imgaug.augmenters.size.CropToMultiplesOf(width_multiple, height_multiple, position='uniform', seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.size.CropToFixedSize`

Crop images down until their height/width is a multiple of a value.

**Note:** For a given axis size $A$ and multiple $M$, if $A$ is in the interval $[0 .. M]$, the axis will not be changed. As a result, this augmenter can still produce axis sizes that are not multiples of the given values.

Added in 0.4.0.

**Supported dtypes:**
See `CropToFixedSize`.

**Parameters**

- `width_multiple (int or None)` – Multiple for the width. Images will be cropped down until their width is a multiple of this value. If `None`, image widths will not be altered.

- `height_multiple (int or None)` – Multiple for the height. Images will be cropped down until their height is a multiple of this value. If `None`, image heights will not be altered.

- `position ({'uniform', 'normal', 'center', 'left-top', 'left-center', 'left-bottom', 'center-top', 'center-center', 'center-bottom', 'right-top', 'right-center', 'right-bottom'} or tuple of float or StochasticParameter or tuple of StochasticParameter, optional)` – See `CropToFixedSize.__init__()`.

- `seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)` – See `__init__()`.

- `name (None or str, optional)` – See `__init__()`.

- `random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)` – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- `deterministic (bool, optional)` – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CropToMultiplesOf(height_multiple=10, width_multiple=6)
```

Create an augmenter that crops images to multiples of 10 along the y-axis (i.e. 10, 20, 30, ...) and to multiples of 6 along the x-axis (i.e. 6, 12, 18, ...). The rows to be cropped will be spread randomly over the top and bottom sides (analogous for the left/right sides).
## Methods

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<td>Alias for <code>augment()</code>.</td>
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<td>augment(self, return_batch, hooks)</td>
<td>Augment a batch.</td>
</tr>
<tr>
<td>augment_batch(self, batch[, hooks])</td>
<td>Augment a single batch in-place.</td>
</tr>
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<td>augment_batch_(self, batch[, parents, hooks])</td>
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</tr>
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<td>augment_heatmaps(self, heatmaps[, parents, ...])</td>
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<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state(self, source[, recursive, ...])</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td>copy_random_state_(self, source[, ...])</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy(self)</td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td>draw_grid(images, rows, cols)</td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td>find_augmenters(self, func[, parents, flat])</td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td>find_augmenters_by_name(self, name[, regex, ...])</td>
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<td>find_augmenters_by_names(self, names[, ...])</td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td>get_all_children(self[, flat])</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
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<td>get_children_lists(self)</td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td>get_parameters(self)</td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
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<td>localize_random_state_(self[, recursive])</td>
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<td>pool(self[, processes, maxtasksperchild, seed])</td>
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<td>remove_augmenters(self, func[, copy, ...])</td>
<td>Remove this augmenter or children that match a condition.</td>
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<tr>
<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
def get_parameters(self):
    See get_parameters().
```

```python
class imgaug.augmenters.size.CropToPowersOf(width_base, height_base, position='uniform', seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Crop images until their height/width is a power of a base.

This augmenter removes pixels from an axis with size $S$ leading to the new size $S'$ until $S' = B^E$ is fulfilled, where $B$ is a provided base (e.g. 2) and $E$ is an exponent from the discrete interval $[1 .. \infty)$.

**Note:** This augmenter does nothing for axes with size less than $B^1 = B$. If you have images with $S < B^1$, it is recommended to combine this augmenter with a padding augmenter that pads each axis up to $B$.

Added in 0.4.0.

**Supported dtypes:**

See `CropToFixedSize`.

**Parameters**

- **width_base (int or None)** – Base for the width. Images will be cropped down until their width fulfills $width' = width_base ^ E$ with $E$ being any natural number. If None, image widths will not be altered.

- **height_base (int or None)** – Base for the height. Images will be cropped down until their height fulfills $height' = height_base ^ E$ with $E$ being any natural number. If None, image heights will not be altered.


- **seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)** – See `__init__()`.  

- **name (None or str, optional)** – See `__init__()`.  

- **random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)** – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- **deterministic (bool, optional)** – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.
Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CropToPowersOf(height_base=3, width_base=2)
```

Create an augmenter that crops each image down to powers of 3 along the y-axis (i.e. 3, 9, 27, ...) and powers of 2 along the x-axis (i.e. 2, 4, 8, 16, ...). The rows to be cropped will be spread randomly over the top and bottom sides (analogous for the left/right sides).

Methods

```python
__call__(self, *args, **kwargs) Alias for augment().

augment(self[, return_batch, hooks]) Augment a batch.

augment_batch(self[, batch[, hooks]]) Deprecated.

augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.

augment_batches(self, batch[, hooks]) Deprecated.

augment_bounding_boxes(self[, ...[, parents, ...]]) Augment a batch of bounding boxes.

augment_heatmaps(self[, ...[, parents, ...]]) Augment a batch of heatmaps.

augment_image(self[, image[, hooks]]) Augment a single image.

augment_images(self, images[, hooks]) Augment a batch of images.

augment_keypoints(self[, key-points_on_images]) Augment a batch of keypoints/landmarks.

augment_line_strings(self[, ...[, parents, hooks]]) Augment a batch of line strings.

augment_polygons(self, polygons_on_images[, ...]) Augment a batch of polygons.

augment_segmentation_maps(self[, segmaps[, ...]]) Augment a batch of segmentation maps.

copy(self) Create a shallow copy of this Augmenter instance.

copy_random_state(self[, source[, recursive, ...]]) Copy the RNGs from a source augmenter sequence.

copy_random_state_(self[, source[, ...]]) Copy the RNGs from a source augmenter sequence (in-place).

deprecated

deprecated_copy(self) Create a deep copy of this Augmenter instance.

draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.

find_augmenters(self, func[, parents, flat]) Find augmenters that match a condition.

find_augmenters_by_name(self, name[, regex, ...]) Find augmenter(s) by name.

find_augmenters_by_names(self[, names[, ...]]) Find augmenter(s) by names.

get_all_children(self[, flat]) Get all children of this augmenter as a list.

get_children_lists(self) Get a list of lists of children of this augmenter.

get_parameters(self) See get_parameters().

localize_random_state(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.

localize_random_state_(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
```

13.35. `imgaug.augmenters.size`
### Table 240 – continued from previous page

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy,...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
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<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td><strong>Deprecated.</strong></td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td><strong>Deprecated.</strong></td>
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<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
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<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

### get_parameters

```python
get_parameters(self)
```

See `get_parameters()`.

### `class` `imgaug.augmenters.size.CropToSquare` (position=`'uniform'`, seed=None, name=None, random_state=`'deprecated'`, deterministic=`'deprecated'`)

Bases: `imgaug.augmenters.size.CropToAspectRatio`

Crop images until their width and height are identical.

This is identical to `CropToAspectRatio` with `aspect_ratio=1.0`.

Images with axis sizes of 0 will not be altered.

Added in 0.4.0.

**Supported dtypes:**

See `CropToFixedSize`.

**Parameters**

- **position** (`'uniform'`, `normal`, `center`, `left-top`, `left-center`, `left-bottom`, `center-top`, `center-center`, `center-bottom`, `right-top`, `right-center`, `right-bottom`) or tuple of float or StochasticParameter or tuple of StochasticParameter, optional – See `CropToFixedSize.__init__()`.

- **seed** (None or int or `imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or `numpy.random.RandomState`, optional) – See `__init__()`.

- **name** (None or str, optional) – See `__init__()`.

- **random_state** (None or int or `imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or `numpy.random.RandomState`, optional) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.
Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.CropToSquare()
```

Create an augmenter that crops each image until its square, i.e. height and width match. The rows to be cropped will be spread randomly over the top and bottom sides (analogous for the left/right sides).

Methods

```python
__call__(self, *args, **kwargs) Alias for augment().
augment(self, return_batch, hooks) Augment a batch.
augment_batch(self, batch[, hooks]) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self, batches[, hooks]) Augment multiple batches.
augment_bounding_boxes(self, ..., [parents, ...]) Augment a batch of bounding boxes.
augment_heatmaps(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
augment_image(self, image[, hooks]) Augment a single image.
augment_images(self, images[, parents, hooks]) Augment a batch of images.
augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
augment_line_strings(self, ..., [parents, hooks]) Augment a batch of line strings.
augment_polygons(self, polygons_on_images[, ...]) Augment a batch of polygons.
augment_segmentation_maps(self, segmaps[, ...]) Augment a batch of segmentation maps.
copy(self) Create a shallow copy of this Augmenter instance.
copy_random_state(self, source[, recursive, ...]) Copy the RNGs from a source augmenter sequence.
copy_random_state_(self, source[, ...]) Copy the RNGs from a source augmenter sequence (in-place).
deepcopy(self) Create a deep copy of this Augmenter instance.
draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.
find_augmenters(self, func[, parents, flat]) Find augmenters that match a condition.
find_augmenters_by_name(self, name[, regex, ...]) Find augmenter(s) by name.
find_augmenters_by_names(self, names[, ...]) Find augmenter(s) by names.
get_all_children(self[, flat]) Get all children of this augmenter as a list.
get_children_lists(self) Get a list of lists of children of this augmenter.
get_params(self) See get_parameters().
localize_random_state(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
localize_random_state_(self[, recursive]) Assign augmenter-specific RNGs to this augmenter and its children.
pool(self, processes, maxtasksperchild, seed) Create a pool used for multicore augmentation.
```
### Table 241 – continued from previous page

<table>
<thead>
<tr>
<th>Method</th>
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</tr>
</thead>
<tbody>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
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<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
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<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
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<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.size.KeepSizeByResize(children, interpolation='cubic', interpolation_heatmaps='SAME_AS_IMAGES', interpolation_segmentmaps='nearest', seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases:** `imgaug.augmenters.meta.Augmenter`

Resize images back to their input sizes after applying child augmenters.

Combining this with e.g. a cropping augmenter as the child will lead to images being resized back to the input size after the crop operation was applied. Some augmenters have a keep_size argument that achieves the same goal (if set to True), though this augmenter offers control over the interpolation mode and which augmentables to resize (images, heatmaps, segmentation maps).

**Supported dtypes:**

See `imresize_many_images()`.

**Parameters**

- **children** (*Augmenter or list of imgaug.augmenters.meta.Augmenter or None, optional*) – One or more augmenters to apply to images. These augmenters may change the image size.

- **interpolation** (*KeepSizeByResize.NO_RESIZE or {'nearest', 'linear', 'area', 'cubic'} or {cv2.INTER_NEAREST, cv2.INTER_LINEAR, cv2.INTER_AREA, cv2.INTER_CUBIC} or list of str or list of int or StochasticParameter, optional*) – The interpolation mode to use when resizing images. Can take any value that `imresize_single_image()` accepts, e.g. cubic.

  - If this is `KeepSizeByResize.NO_RESIZE` then images will not be resized.

  - If this is a single str, it is expected to have one of the following values: nearest, linear, area, cubic.

  - If this is a single integer, it is expected to have a value identical to one of: `cv2.INTER_NEAREST`, `cv2.INTER_LINEAR`, `cv2.INTER_AREA`, `cv2.INTER_CUBIC`.

  - If this is a list of str or int, it is expected that each str/int is one of the above mentioned valid ones. A random one of these values will be sampled per image.

  - If this is a StochasticParameter, it will be queried once per call to `_augment_images()` and must return N str s or int s (matching the above mentioned ones) for N images.
• **interpolation_heatmaps** *(KeepSizeByResize.SAME_AS_IMAGES or KeepSizeByResize.NO_RESIZE or ['nearest', 'linear', 'area', 'cubic'] or [cv2.INTER_NEAREST, cv2.INTER_LINEAR, cv2.INTER_AREA, cv2.INTER_CUBIC] or list of str or list of int or StochasticParameter, optional)* – The interpolation mode to use when resizing heatmaps. Meaning and valid values are similar to interpolation. This parameter may also take the value KeepSizeByResize.SAME_AS_IMAGES, which will lead to copying the interpolation modes used for the corresponding images. The value may also be returned on a per-image basis if interpolation_heatmaps is provided as a StochasticParameter or may be one possible value if it is provided as a list of str.

• **interpolation_segmaps** *(KeepSizeByResize.SAME_AS_IMAGES or KeepSizeByResize.NO_RESIZE or ['nearest', 'linear', 'area', 'cubic'] or [cv2.INTER_NEAREST, cv2.INTER_LINEAR, cv2.INTER_AREA, cv2.INTER_CUBIC] or list of str or list of int or StochasticParameter, optional)* – The interpolation mode to use when resizing segmentation maps. Similar to interpolation_heatmaps. **Note**: For segmentation maps, only NO_RESIZE or nearest neighbour interpolation (i.e. nearest) make sense in the vast majority of all cases.

• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See __init__().

• **name** *(None or str, optional)* – See __init__().

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.KeepSizeByResize(
>>>     iaa.Crop((20, 40), keep_size=False)
>>> )
```

Apply random cropping to input images, then resize them back to their original input sizes. The resizing is done using this augmenter instead of the corresponding internal resizing operation in Crop.

```python
>>> aug = iaa.KeepSizeByResize(
>>>     iaa.Crop((20, 40), keep_size=False),
>>>     interpolation="nearest"
>>> )
```

Same as in the previous example, but images are now always resized using nearest neighbour interpolation.

```python
>>> aug = iaa.KeepSizeByResize(
>>>     iaa.Crop((20, 40), keep_size=False),
>>>     interpolation="["nearest", "cubic"]",
>>>     interpolation_heatmaps=iaa.KeepSizeByResize.SAME_AS.Images,
>>>     interpolation_segmaps=iaa.KeepSizeByResize.NO_RESIZE
>>> )
```
Similar to the previous example, but images are now sometimes resized using linear interpolation and sometimes using nearest neighbour interpolation. Heatmaps are resized using the same interpolation as was used for the corresponding image. Segmentation maps are not resized and will therefore remain at their size after cropping.

**Methods**

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><code>__call__</code>(self, *args, **kwargs)</td>
<td>Alias for <code>augment()</code>.</td>
</tr>
<tr>
<td><code>augment</code>(self, return_batch, hooks)</td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><code>augment_batch</code>(self, batch[, hooks])</td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><code>augment_batch</code>(self, batch[, parents, hooks])</td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td><code>augment_bounding_boxes</code>(self, ...[, parents, ...])</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><code>augment_heatmaps</code>(self, heatmaps[, parents, ...])</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><code>augment_image</code>(self, image[, hooks])</td>
<td>Augment a single image.</td>
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<td><code>augment_images</code>(self, images[, parents, hooks])</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints</code>(self, keypoints_on_images)</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><code>augment_line_strings</code>(self, ...[, parents, hooks])</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons</code>(self, polygons_on_images[, ...])</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><code>augment_segmentation_maps</code>(self, segmaps[, ...])</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><code>copy</code>(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>copy_random_state</code>(self, source[, recursive, ...])</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>copy_random_state_</code>(self, source[, ...])</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
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<tr>
<td><code>deepcopy</code>(self)</td>
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<td><code>draw_grid</code>(self, images, rows, cols)</td>
<td>Augment images and draw the results as a single grid-like image.</td>
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<tr>
<td><code>find_augmenters</code>(self, func[, parents, flat])</td>
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<td><code>find_augmenters_by_name</code>(self, name[, regex, ...])</td>
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<tr>
<td><code>get_all_children</code>(self[, flat])</td>
<td>Get all children of this augmenter as a list.</td>
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<td><code>get_children_lists</code>(self)</td>
<td>See <code>get_children_lists()</code>.</td>
</tr>
<tr>
<td><code>get_parameters</code>(self)</td>
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</tr>
<tr>
<td><code>localize_random_state</code>(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
<td><code>pool</code>(self, processes, maxtasksperchild, seed)</td>
<td>Create a pool used for multicore augmentation.</td>
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<td><code>remove_augmenters</code>(self, func[, copy, ...])</td>
<td>Remove this augmenter or children that match a condition.</td>
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<td><code>remove_augmenters_</code>(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
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</table>
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<table>
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<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
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<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
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<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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</table>

NO_RESIZE = 'NO_RESIZE'
SAME_AS_IMAGES = 'SAME_AS_IMAGES'

get_children_lists(self)
See `get_children_lists()`.

get_parameters(self)
See `get_parameters()`.

class imgaug.augmenters.size.Pad(px=None, percent=None, pad_mode='constant', pad_cval=0, keep_size=True, sample_independently=True, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: `imgaug.augmenters.size.CropAndPad`

Pad images, i.e. adds columns/rows of pixels to them.

Supported dtypes:
See `CropAndPad`.

Parameters

- **px** (None or int or `imgaug.parameters.StochasticParameter` or tuple, optional) – The number of pixels to pad on each side of the image. Expected value range is $[0, \infty)$. Either this or the parameter `percent` may be set, not both at the same time.
  - If None, then pixel-based padding will not be used.
  - If int, then that exact number of pixels will always be padded.
  - If `StochasticParameter`, then that parameter will be used for each image. Four samples will be drawn per image (top, right, bottom, left), unless `sample_independently` is set to False, as then only one value will be sampled per image and used for all sides.
  - If a tuple of two ints with values $a$ and $b$, then each side will be padded by a random amount sampled uniformly per image and side from the interval $[a, b]$. If however `sample_independently` is set to False, only one value will be sampled per image and used for all sides.
  - If a tuple of four entries, then the entries represent top, right, bottom, left. Each entry may be a single int (always pad by exactly that value), a tuple of two ints $a$ and $b$ (pad by an amount within $[a, b]$), a list of ints (pad by a random value that is contained in the list) or a `StochasticParameter` (sample the amount to pad from that parameter).

- **percent** (None or int or float or `imgaug.parameters.StochasticParameter` or tuple, optional) – The number of pixels to pad on each side of the image given as a fraction of the image height/width. E.g. if this is set to 0.1, the augmenter will always pad 10% of the image’s height at both the top and the bottom (both 10% each), as well as 10% of the width at the
right and left. Expected value range is \([0.0, \inf)\). Either this or the parameter \(px\) may be set, not both at the same time.

- If None, then fraction-based padding will not be used.
- If number, then that fraction will always be padded.
- If StochasticParameter, then that parameter will be used for each image. Four samples will be drawn per image (top, right, bottom, left). If however \(sample\_independently\) is set to False, only one value will be sampled per image and used for all sides.

- If a tuple of two float s with values \(a\) and \(b\), then each side will be padded by a random fraction sampled uniformly per image and side from the interval \([a, b]\). If however \(sample\_independently\) is set to False, only one value will be sampled per image and used for all sides.

- If a tuple of four entries, then the entries represent top, right, bottom, left. Each entry may be a single float (always pad by exactly that fraction), a tuple of two floats \(a\) and \(b\) (pad by a fraction from \([a, b]\)), a list of floats (pad by a random value that is contained in the list) or a StochasticParameter (sample the percentage to pad from that parameter).

- \(pad\_mode\) (imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional) – Padding mode to use. The available modes match the numpy padding modes, i.e. constant, edge, linear_ramp, maximum, median, minimum, reflect, symmetric, wrap. The modes constant and linear_ramp use extra values, which are provided by \(pad\_cval\) when necessary. See \(pad()\) for more details.

  - If imgaug.ALL, then a random mode from all available modes will be sampled per image.
  - If a str, it will be used as the pad mode for all images.
  - If a list of str, a random one of these will be sampled per image and used as the mode.
  - If StochasticParameter, a random mode will be sampled from this parameter per image.

- \(pad\_cval\) (number or tuple of number list of number or imgaug.parameters.StochasticParameter, optional) – The constant value to use if the pad mode is constant or the end value to use if the mode is linear_ramp. See \(pad()\) for more details.

  - If number, then that value will be used.
  - If a tuple of two numbers and at least one of them is a float, then a random number will be uniformly sampled per image from the continuous interval \([a, b]\) and used as the value. If both numbers are ints, the interval is discrete.

  - If a list of number, then a random value will be chosen from the elements of the list and used as the value.
  - If StochasticParameter, a random value will be sampled from that parameter per image.

- \(keep\_size\) (bool, optional) – After padding, the result image will usually have a different height/width compared to the original input image. If this parameter is set to True, then the padded image will be resized to the input image’s size, i.e. the augmenter’s output shape is always identical to the input shape.
• **sample_independently** (*bool, optional*) – If `False` and the values for `px/percent` result in exactly one probability distribution for all image sides, only one single value will be sampled from that probability distribution and used for all sides. I.e. the pad amount then is the same for all sides. If `True`, four values will be sampled independently, one per side.

• **seed** (``None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional``) – See `__init__()`.  

• **name** (*None or str, optional*) – See `__init__()`.  

• **random_state** (*None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional*) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed now. Outdated since 0.4.0.  

• **deterministic** (*bool, optional*) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Pad(px=(0, 10))
```

Pad each side by a random pixel value sampled uniformly per image and side from the discrete interval `[0..10]`. The padding happens by zero-padding, i.e. it adds black pixels (default setting).

```python
>>> aug = iaa.Pad(px=(0, 10), pad_mode="edge")
```

Pad each side by a random pixel value sampled uniformly per image and side from the discrete interval `[0..10]`. The padding uses the `edge` mode from numpy’s pad function, i.e. the pixel colors around the image sides are repeated.

```python
>>> aug = iaa.Pad(px=(0, 10), pad_mode=["constant", "edge"])
```

Similar to the previous example, but uses zero-padding (`constant`) for half of the images and `edge` padding for the other half.

```python
>>> aug = iaa.Pad(px=(0, 10), pad_mode=ia.ALL, pad_cval=(0, 255))
```

Similar to the previous example, but uses any available padding mode. In case the padding mode ends up being `constant` or `linear_ramp`, and random intensity is uniformly sampled (once per image) from the discrete interval `[0..255]` and used as the intensity of the new pixels.

```python
>>> aug = iaa.Pad(px=(0, 10), sample_independently=False)
```

Pad each side by a random pixel value sampled uniformly once per image from the discrete interval `[0..10]`. Each sampled value is used for all sides of the corresponding image.

```python
>>> aug = iaa.Pad(px=(0, 10), keep_size=False)
```

Pad each side by a random pixel value sampled uniformly per image and side from the discrete interval `[0..10]`. Afterwards, do **not** resize the padded image back to the input image’s size. This will increase the image’s height and width by a maximum of 20 pixels.
Pad the top and bottom by a random pixel value sampled uniformly from the discrete interval \([0..10]\). Pad the left and right analogously by a random value sampled from \([0..5]\). Each value is always sampled independently.

Pad each side by a random fraction sampled uniformly from the continuous interval \([0.0, 0.10]\). The fraction is sampled once per image and side. E.g. a sampled fraction of 0.1 for the top side would pad by \(0.1\times H\), where \(H\) is the height of the input image.

Pads each side by either 5% or 10%. The values are sampled once per side and image.

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<td><code>draw_grid(self[, images, rows, cols])</code></td>
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<td><code>localize_random_state(self[, recursive])</code></td>
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<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
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</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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**class** `imgaug.augmenters.size.PadToAspectRatio` (``aspect_ratio, pad_mode='constant', pad_cval=0, position='uniform', seed=None, name=None, random_state='deprecated', deterministic='deprecated'``)

**Bases:** `imgaug.augmenters.size.PadToFixedSize`

Pad images until their width/height matches an aspect ratio.

This augmenter adds either rows or columns until the image reaches the desired aspect ratio given in `width / height`.

Added in 0.4.0.

**Supported dtypes:**

`See PadToFixedSize`.

**Parameters**

- **`aspect_ratio` (number)** – The desired aspect ratio, given as `width/height`. E.g. a ratio of 2.0 denotes an image that is twice as wide as it is high.

- **`position`** (``{'uniform', 'normal', 'center', 'left-center', 'left-bottom', 'center-top', 'center-bottom', 'right-top', 'right-center', 'right-bottom'} or tuple of float or StochasticParameter or tuple of StochasticParameter, optional``) – `See PadToFixedSize.__init__()`.  

- **`pad_mode`** (``imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional``) – `See __init__()`.  

- **`pad_cval`** (``number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional``) – `See __init__()`.  

- **`seed`** (``None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional``) – `See __init__()`.  

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• **name** (*None or str; optional*) – See `__init__()`.  
• **random_state** (*None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState; optional*) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.  
• **deterministic** (*bool; optional*) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.PadToAspectRatio(2.0)
```

Create an augmenter that pads each image until its aspect ratio is as close as possible to 2.0 (i.e. two times as many pixels along the x-axis than the y-axis). The rows to be padded will be spread randomly over the top and bottom sides (analogous for the left/right sides).

### Methods

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<tr>
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</table>
| `__call__` | Alias for `augment()`.
| `augment(self[, return_batch, hooks])` | Augment a batch. |
| `augment_batch(self[, batch[, hooks]])` | Deprecated. |
| `augment_batch_(self[, batch[, parents, hooks]])` | Augment a single batch in-place. |
| `augment_bounding_boxes(self[, ...[, parents, ...]])` | Augment a batch of bounding boxes. |
| `augment_heatmaps(self[, heatmaps[, parents, ...]])` | Augment a batch of heatmaps. |
| `augment_image(self[, image[, hooks]])` | Augment a single image. |
| `augment_images(self[, images[, parents, hooks]])` | Augment a batch of images. |
| `augment_keypoints(self[, keypoints_on_images])` | Augment a batch of keypoints/landmarks. |
| `augment_line_strings(self[, ...[, parents, hooks]])` | Augment a batch of line strings. |
| `augment_polygons(self[, polygons_on_images[, ...]])` | Augment a batch of polygons. |
| `augment_segmentation_maps(self[, segmaps[, ...]])` | Augment a batch of segmentation maps. |
| `copy(self)` | Create a shallow copy of this Augmenter instance. |
| `copy_random_state(self[, source[, recursive, ...]])` | Copy the RNGs from a source augmenter sequence. |
| `copy_random_state_(self[, source[, ...]])` | Copy the RNGs from a source augmenter sequence (in-place). |
| `deepcopy(self)` | Create a deep copy of this Augmenter instance. |
| `draw_grid(self[, images, rows, cols])` | Augment images and draw the results as a single grid-like image. |
| `find_augmenters(self[, func[, parents, flat]])` | Find augmenters that match a condition. |

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```python
get_parameters(self)
See get_parameters().
```

```python
class imgaug.augmenters.size.PadToFixedSize(width, height, pad_mode='constant', pad_cval=0, position='uniform', seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.meta.Augmenter`

Pad images to a predefined minimum width and/or height.

If images are already at the minimum width/height or are larger, they will not be padded. Note that this also means that images will not be cropped if they exceed the required width/height.

The augmenter randomly decides per image how to distribute the required padding amounts over the image axis. E.g. if 2px have to be padded on the left or right to reach the required width, the augmenter will sometimes add 2px to the left and 0px to the right, sometimes add 2px to the right and 0px to the left and sometimes add 1px to both sides. Set `position` to `center` to prevent that.

Supported dtypes:

See `pad()`.

Parameters

- **width** *(int or None)* – Pad images up to this minimum width. If `None`, image widths will not be altered.
- **height** *(int or None)* – Pad images up to this minimum height. If `None`, image heights will not be altered.
• **pad_mode** *(imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional)* – See *__init__()__.

• **pad_cval** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – See *__init__()__.

• **position** *(‘uniform’, ‘normal’, ‘center’, ‘left-top’, ‘left-center’, ‘left-bottom’, ‘center-top’, ‘center-center’, ‘center-bottom’, ‘right-top’, ‘right-center’, ‘right-bottom’) or tuple of float or StochasticParameter or tuple of StochasticParameter, optional)* – Sets the center point of the padding, which determines how the required padding amounts are distributed to each side. For a tuple \((a, b)\), both \(a\) and \(b\) are expected to be in range \([0.0, 1.0]\) and describe the fraction of padding applied to the left/right (low/high values for \(a\)) and the fraction of padding applied to the top/bottom (low/high values for \(b\)). A padding position at \((0.5, 0.5)\) would be the center of the image and distribute the padding equally to all sides. A padding position at \((0.0, 1.0)\) would be the left-bottom and would apply 100% of the required padding to the bottom and left sides of the image so that the bottom left corner becomes more and more the new image center (depending on how much is padded).

  – If string \(\text{uniform}\) then the share of padding is randomly and uniformly distributed over each side. Equivalent to \((\text{Uniform}(0.0, 1.0), \text{Uniform}(0.0, 1.0))\).

  – If string \(\text{normal}\) then the share of padding is distributed based on a normal distribution, leading to a focus on the center of the images. Equivalent to \((\text{Clip}(\text{Normal}(0.5, 0.45/2), 0, 1), \text{Clip}(\text{Normal}(0.5, 0.45/2), 0, 1))\).

  – If string \(\text{center}\) then center point of the padding is identical to the image center. Equivalent to \((0.5, 0.5)\).

  – If a string matching regex \(^{(left|center|right)-(top|center|bottom)}\)\$, e.g. \(\text{left-top}\) or \(\text{center-bottom}\) then sets the center point of the padding to the X-Y position matching that description.

  – If a tuple of float, then expected to have exactly two entries between \(0.0\) and \(1.0\), which will always be used as the combination the position matching \((x, y)\) form.

  – If a StochasticParameter, then that parameter will be queried once per call to augment_*() to get \(N\times2\) center positions in \((x, y)\) form (with \(N\) the number of images).

  – If a tuple of StochasticParameter, then expected to have exactly two entries that will both be queried per call to augment_*(), each for \((N, )\) values, to get the center positions. First parameter is used for \(x\) coordinates, second for \(y\) coordinates.

• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter *seed*. Its usage will not yet cause a deprecation warning, but it is still recommended to use *seed* now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.
Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.PadToFixedSize(width=100, height=100)
```

For image sides smaller than 100 pixels, pad to 100 pixels. Do nothing for the other edges. The padding is randomly (uniformly) distributed over the sides, so that e.g. sometimes most of the required padding is applied to the left, sometimes to the right (analogous top/bottom).

```python
>>> aug = iaa.PadToFixedSize(width=100, height=100, position="center")
```

For image sides smaller than 100 pixels, pad to 100 pixels. Do nothing for the other image sides. The padding is always equally distributed over the left/right and top/bottom sides.

```python
>>> aug = iaa.PadToFixedSize(width=100, height=100, pad_mode=ia.ALL)
```

For image sides smaller than 100 pixels, pad to 100 pixels and use any possible padding mode for that. Do nothing for the other image sides. The padding is always equally distributed over the left/right and top/bottom sides.

```python
>>> aug = iaa.Sequential([
>>>     iaa.PadToFixedSize(width=100, height=100),
>>>     iaa.CropToFixedSize(width=100, height=100)
>>> ])
```

Pad images smaller than 100x100 until they reach 100x100. Analogously, crop images larger than 100x100 until they reach 100x100. The output images therefore have a fixed size of 100x100.

Methods

```python
__call__(self, *args, **kwargs) Alias for augment().
```

charted the augmenter to augment a batch.

```python
augment_batch(self[, return_batch, hooks]) Augment a batch.
```

charted the augmenter to augment multiple batches.

```python
augment_bounding_boxes(self[, return_batch, hooks]) Augment a batch of bounding boxes.
```

charted the augmenter to augment a batch of heatmaps.

```python
augment_image(self[, return_batch, hooks]) Augment a single image.
```

charted the augmenter to augment a batch of images.

```python
augment_keypoints(self[, return_batch, hooks]) Augment a batch of keypoints/landmarks.
```

charted the augmenter to augment a batch of line strings.

```python
augment_polygons(self[, return_batch, hooks]) Augment a batch of polygons.
```

charted the augmenter to augment a batch of segmentation maps.

```python
copy(self) Create a shallow copy of this Augmenter instance.
```

charted the augmenter to copy the RNGs from a source augmenter sequence.

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<td><code>copy_random_state_(self, source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
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<td><code>draw_grid(self, images, rows, cols)</code></td>
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</tr>
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<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
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<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```
get_parameters(self)
    See `get_parameters()`.
```

class imgaug.augmenters.size.PadToMultiplesOf(
    width_multiple, height_multiple,
    pad_mode='constant', pad_cval=0, position='uniform', seed=None, name=None,
    random_state='deprecated', deterministic='deprecated')

Bases: `imgaug.augmenters.size.PadToFixedSize`

Pad images until their height/width is a multiple of a value.

Added in 0.4.0.

**Supported dtypes:**

See `PadToFixedSize`.

**Parameters**

- `width_multiple` *(int or None)* – Multiple for the width. Images will be padded until their width is a multiple of this value. If `None`, image widths will not be altered.

- `height_multiple` *(int or None)* – Multiple for the height. Images will be padded until their height is a multiple of this value. If `None`, image heights will not be altered.
• **pad_mode** *(imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional) – See **__init__()**.

• **pad_cval** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See **__init__()**.


• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.RandomState, optional) – See **__init__()**.

• **name** *(None or str, optional) – See **__init__()**.

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• **deterministic** *(bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.PadToMultiplesOf(height_multiple=10, width_multiple=6)
```

Create an augmenter that pads images to multiples of 10 along the y-axis (i.e. 10, 20, 30, ...) and to multiples of 6 along the x-axis (i.e. 6, 12, 18, ...). The rows to be padded will be spread **randomly** over the top and bottom sides (analogous for the left/right sides).

**Methods**

```python
__call__ (self, *args, **kwargs)  # Alias for **augment()**.
augment (self, return_batch, hooks)  # Augment a batch.
augment_batch (self, batch[, hooks])  # Deprecated.
augment_batch (self, batch[, parents, hooks])  # Augment a single batch in-place.
augment_batches (self, batches[, parents, hooks])  # Augment multiple batches.
augment_bounding_boxes (self, ...[, parents, ...])  # Augment a batch of bounding boxes.
augment_heatmaps (self, heatmaps[, parents, ...])  # Augment a batch of heatmaps.
augment_image (self, image[, hooks])  # Augment a single image.
augment_images (self, images[, parents, hooks])  # Augment a batch of images.
augment_keypoints (self, keypoints_on_images)  # Augment a batch of keypoints/landmarks.
augment_line_strings (self, ...[, parents, hooks])  # Augment a batch of line strings.
```

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<table>
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</tr>
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<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
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<td><code>seed_(self[, entropy, deterministic_too])</code></td>
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<td><code>show_grid(self, images, rows, cols)</code></td>
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<td><code>to_deterministic(self, n)</code></td>
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</table>

```
get_parameters(self)
    See get_parameters().
```

```
class imgaug.augmenters.size.PadToPowersOf(
    width_base, height_base, pad_mode='constant', pad_cval=0, position='uniform', seed=None, name=None, random_state=None, deterministic='deprecated',
)
```

**Bases:** `imgaug.augmenters.size.PadToFixedSize`

Pad images until their height/width is a power of a base.

This augmenter adds pixels to an axis with size \( S \) leading to the new size \( S' \) until \( S' = B^E \) is fulfilled, where \( B \) is a provided base (e.g. 2) and \( E \) is an exponent from the discrete interval \([1 .. \infty)\).

Added in 0.4.0.
Supported dtypes:

See `PadToFixedSize`.

Parameters

- **width_base** (*int or None*) – Base for the width. Images will be padded down until their width fulfills $width' = width_base ^ E$ with $E$ being any natural number. If `None`, image widths will not be altered.

- **height_base** (*int or None*) – Base for the height. Images will be padded until their height fulfills $height' = height_base ^ E$ with $E$ being any natural number. If `None`, image heights will not be altered.

- **pad_mode** (*`imgaug.ALL` or `str` or `list of str` or `imgaug.parameters.StochasticParameter`, `optional`) – See `__init__()`.

- **pad_cval** (*number` or `tuple of number` or `list of number` or `imgaug.parameters.StochasticParameter`, `optional`) – See `__init__()`.

- **position** (*`{'uniform', 'normal', 'center', 'left-top', 'left-center', 'left-bottom', 'center-top', 'center-center', 'center-bottom', 'right-top', 'right-center', 'right-bottom'}` or `tuple of float` or `StochasticParameter` or `tuple of StochasticParameter`, `optional`) – See `PadToFixedSize.__init__()`.

- **seed** (*`None` or `int` or `imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or `numpy.random.RandomState`, `optional`) – See `__init__()`.

- **name** (*`None` or `str`, `optional`) – See `__init__()`.

- **random_state** (*`None` or `int` or `imgaug.random.RNG` or `numpy.random.Generator` or `numpy.random.BitGenerator` or `numpy.random.SeedSequence` or `numpy.random.RandomState`, `optional`) – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- **deterministic** (*`bool`, `optional`) – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.PadToPowersOf(height_base=3, width_base=2)
```

Create an augmenter that pads each image to powers of 3 along the y-axis (i.e. 3, 9, 27, ...) and powers of 2 along the x-axis (i.e. 2, 4, 8, 16, ...). The rows to be padded will be spread randomly over the top and bottom sides (analogous for the left/right sides).

Methods

- **__call__**(self, *args, **kwargs) Alias for `augment()`.

- **augment**(self[, return_batch, hooks]) Augment a batch.

- **augment_batch**(self, batch[, parents, hooks]) Deprecated.

- **augment_batch_(self, batch[, parents, hooks])** Augment a single batch in-place.

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</tr>
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<tbody>
<tr>
<td>augment_batches(self, batches[, hooks, ...])</td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td>augment_bounding_boxes(self, ...[, parents, ...])</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td>augment_heatmaps(self, heatmaps[, parents, ...])</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td>augment_image(self, image[, hooks])</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td>augment_images(self, images[, parents, hooks])</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td>augment_keypoints(self, keypoints_on_images)</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings(self, ...[, parents, hooks])</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td>augment_polygons(self, polygons_on_images[, ...])</td>
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<td>Copy the RNGs from a source augmenter sequence.</td>
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<td>find_augmenters(self, func[, parents, flat])</td>
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<td>get_all_children(self[, flat])</td>
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<tr>
<td>get_parameters(self)</td>
<td>See get_parameters().</td>
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<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<td>remove_augmenters(self, func[, copy, ...])</td>
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<td>remove_augmenters_inplace(self, func[, parents])</td>
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<td>reseed(self[, random_state, deterministic_too])</td>
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<td>seed_(self[, entropy, deterministic_too])</td>
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<td>show_grid(self, images, rows, cols)</td>
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<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

**get_parameters(self)**

See get_parameters().
class imgaug.augmenters.size.PadToSquare(pad_mode='constant', pad_cval=0, position='uniform', seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.size.PadToAspectRatio

Pad images until their height and width are identical.

This augmenter is identical to PadToAspectRatio with aspect_ratio=1.0.

Added in 0.4.0.

Supported dtypes:
See PadToFixedSize.

Parameters

- **pad_mode** (imgaug.ALL or str or list of str or imgaug.parameters.StochasticParameter, optional) – See __init__().
- **pad_cval** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional) – See __init__().
- **seed** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().
- **name** (None or str, optional) – See __init__().
- **random_state** (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.PadToSquare()
```

Create an augmenter that pads each image until its square, i.e. height and width match. The rows to be padded will be spread randomly over the top and bottom sides (analogous for the left/right sides).

Methods

```python
__call__(self, *args, **kwargs) Alias for augment().
augment(self[, return_batch, hooks]) Augment a batch.
```

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<table>
<thead>
<tr>
<th>Function</th>
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</thead>
<tbody>
<tr>
<td><code>augment_batch(self, batch[, hooks])</code></td>
<td>Deprecated. Augment a single batch in-place.</td>
</tr>
<tr>
<td><code>augment_batch(self, batch[, parents, hooks])</code></td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td><code>augment_bounding_boxes(self, ...[, parents, ...])</code></td>
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<td><code>augment_heatmaps(self, heatmaps[, parents, ...])</code></td>
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class imgaug.augmenters.size.Resize(size, interpolation='cubic', seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.meta.Augmenter

Augmenter that resizes images to specified heights and widths.

Supported dtypes:

See imresize_many_images().

Parameters

- **size** (`'keep'` or int or float or tuple of int or tuple of float or list of int or list of float or imgaug.parameters.StochasticParameter or dict) –
  
The new size of the images.
  
  - If this has the string value `keep`, the original height and width values will be kept (image is not resized).
  
  - If this is an int, this value will always be used as the new height and width of the images.
  
  - If this is a float `v`, then per image the image’s height \( H \) and width \( W \) will be changed to \( H \times v \) and \( W \times v \).
  
  - If this is a tuple, it is expected to have two entries \((a, b)\). If at least one of these are float `s`, a value will be sampled from range \([a, b]\) and used as the float value to resize the image (see above). If both are int `s`, a value will be sampled from the discrete range \([a..b]\) and used as the integer value to resize the image (see above).
  
  - If this is a list, a random value from the list will be picked to resize the image. All values in the list must be int `s` or float `s` (no mixture is possible).
  
  - If this is a StochasticParameter, then this parameter will first be queried once per image. The resulting value will be used for both height and width.
  
  - If this is a dict, it may contain the keys `height` and `width` or the keys `shorter-side` and `longer-side`. Each key may have the same datatypes as above and describes the scaling on x and y-axis or the shorter and longer axis, respectively. Both axis are sampled independently. Additionally, one of the keys may have the value `keep-aspect-ratio`, which means that the respective side of the image will be resized so that the original aspect ratio is kept. This is useful when only resizing one image size by a pixel value (e.g. resize images to a height of 64 pixels and resize the width so that the overall aspect ratio is maintained).

- **interpolation** (imgaug.ALL or int or str or list of int or list of str or imgaug.parameters.StochasticParameter, optional) –
  
  Interpolation to use.
  
  - If imgaug.ALL, then a random interpolation from nearest, linear, area or cubic will be picked (per image).
  
  - If int, then this interpolation will always be used. Expected to be any of the following: cv2.INTER_NEAREST, cv2.INTER_LINEAR, cv2.INTER_AREA, cv2. INTER_CUBIC
  
  - If string, then this interpolation will always be used. Expected to be any of the following: nearest, linear, area, cubic
  
  - If list of int / str, then a random one of the values will be picked per image as the interpolation.
If a StochasticParameter, then this parameter will be queried per image and is expected to return an int or str.

- **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See **init**().
- **name** *(None or str, optional)* – See **init**().
- **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter *seed*. Its usage will not yet cause a deprecation warning, but it is still recommended to use *seed* now. Outdated since 0.4.0.
- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Resize(32)
```

Resize all images to 32x32 pixels.

```python
>>> aug = iaa.Resize(0.5)
```

Resize all images to 50 percent of their original size.

```python
>>> aug = iaa.Resize((16, 22))
```

Resize all images to a random height and width within the discrete interval [16..22] (uniformly sampled per image).

```python
>>> aug = iaa.Resize((0.5, 0.75))
```

Resize all any input image so that its height (h) and width (w) become h*v and w*v, where v is uniformly sampled from the interval [0.5, 0.75].

```python
>>> aug = iaa.Resize((16, 32, 64))
```

Resize all images either to 16x16, 32x32 or 64x64 pixels.

```python
>>> aug = iaa.Resize({"height": 32})
```

Resize all images to a height of 32 pixels and keeps the original width.

```python
>>> aug = iaa.Resize({"height": 32, "width": 48})
```

Resize all images to a height of 32 pixels and a width of 48.

```python
>>> aug = iaa.Resize({"height": 32, "width": "keep-aspect-ratio"})
```

Resize all images to a height of 32 pixels and resizes the x-axis (width) so that the aspect ratio is maintained.
```
>>> aug = iaa.Resize({
    "shorter-side": 224,
    "longer-side": "keep-aspect-ratio"
})
```

Resize all images to a height/width of 224 pixels, depending on which axis is shorter and resize the other axis so that the aspect ratio is maintained.

```
>>> aug = iaa.Resize({
    "height": (0.5, 0.75),
    "width": [16, 32, 64]
})
```

Resize all images to a height of \(H \times v\), where \(H\) is the original height and \(v\) is a random value sampled from the interval \([0.5, 0.75]\). The width/x-axis of each image is resized to either 16 or 32 or 64 pixels.

```
>>> aug = iaa.Resize(32, interpolation=["linear", "cubic"])
```

Resize all images to 32x32 pixels. Randomly use either linear or cubic interpolation.

## Methods

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#### `get_parameters(self)`
See `get_parameters()`.

#### `imgaug.augmenters.size.Scale(*args, **kwargs)`
Deprecated. Use `Resize` instead. `Resize` has the exactly same interface as `Scale`.

Augmenter that resizes images to specified heights and widths.

#### `imgaug.augmenters.size.compute_croppings_to_reach_aspect_ratio(arr, aspect_ratio)`

Compute crop amounts required to fulfill an aspect ratio.

“Crop amounts” here denotes the number of pixels that have to be removed from each side to fulfill the desired constraint.

The aspect ratio is given as \( \text{ratio} = \text{width} / \text{height} \). Depending on which dimension is smaller (height or width), only the corresponding sides (top/bottom or left/right) will be cropped.

The axis-wise padding amounts are always distributed equally over the sides of the respective axis (i.e. left and right, top and bottom). For odd pixel amounts, one pixel will be left over after the equal distribution and could be added to either side of the axis. This function will always add such a left over pixel to the bottom (y-axis) or right (x-axis) side.

If an aspect ratio cannot be reached exactly, this function will return rather one pixel too few than one pixel too many.

Added in 0.4.0.

#### Parameters

- `arr` *(H,W)* ndarray or *(H,W,C)* ndarray or tuple of int – Image-like array or shape tuple for which to compute crop amounts.

- `aspect_ratio` (float) – Target aspect ratio, given as width/height. E.g. `2.0` denotes the image having twice as much width as height.

#### Returns

Required cropping amounts to reach the target aspect ratio, given as a tuple of the form `(top, right, bottom, left)`. 

#### Return type

tuple of int
Compute croppings to reach multiples of given heights/widths.

See `compute_paddings_for_aspect_ratio()` for an explanation of how the required cropping amounts are distributed per image axis.

Added in 0.4.0.

**Parameters**

- **arr** *(ndarray or tuple of int)* – Image-like array or shape tuple for which to compute crop amounts.
- **height_multiple** *(None or int)* – The desired multiple of the height. The computed croppings will reflect a crop operation that decreases the y axis size until it is a multiple of this value.
- **width_multiple** *(None or int)* – The desired multiple of the width. The computed croppings amount will reflect a crop operation that decreases the x axis size until it is a multiple of this value.

**Returns**

Required cropping amounts to reach multiples of the provided values, given as a tuple of the form *(top, right, bottom, left).*

**Return type**

tuple of int

Compute croppings to reach powers of given base values.

For given axis size \( S \), cropped size \( S' \) (\( S' \leq S \)) and base \( B \) this function computes croppings that fulfill \( S' = B^E \), where \( E \) is any exponent from the discrete interval \([0 .. \infty)\).

See `compute_paddings_for_aspect_ratio()` for an explanation of how the required cropping amounts are distributed per image axis.

**Note:** For axes where \( S == 0 \), this function always returns zeros as croppings.

For axes where \( 1 \leq S < B \) see parameter `allow_zero_exponent`.

Added in 0.4.0.

**Parameters**

- **arr** *(ndarray or tuple of int)* – Image-like array or shape tuple for which to compute crop amounts.
- **height_base** *(None or int)* – The desired base of the height.
- **width_base** *(None or int)* – The desired base of the width.
- **allow_zero_exponent** *(bool)* – Whether \( E=0 \) in \( S' = B^E \) is a valid value. If True, axes with size \( 1 \leq S < B \) will be cropped to size \( B^0 = 1 \). If False, axes with sizes \( S < B \) will not be changed.

**Returns**

Required cropping amounts to fulfill \( S' = B^E \) given as a tuple of the form *(top, right, bottom, left).*

**Return type**

tuple of int

13.35. imgaug.augmenters.size
Compute pad amounts required to fulfill an aspect ratio.

“Pad amounts” here denotes the number of pixels that have to be added to each side to fulfill the desired constraint.

The aspect ratio is given as \( \text{ratio} = \text{width} / \text{height} \). Depending on which dimension is smaller (height or width), only the corresponding sides (top/bottom or left/right) will be padded.

The axis-wise padding amounts are always distributed equally over the sides of the respective axis (i.e. left and right, top and bottom). For odd pixel amounts, one pixel will be left over after the equal distribution and could be added to either side of the axis. This function will always add such a left over pixel to the bottom (y-axis) or right (x-axis) side.

Added in 0.4.0. (Previously named `imgaug.imgaug.compute_paddings_to_reach_aspect_ratio()`.)

Parameters

- `arr` ((H,W) ndarray or (H,W,C) ndarray or tuple of int) – Image-like array or shape tuple for which to compute pad amounts.
- `aspect_ratio` (float) – Target aspect ratio, given as width/height. E.g. 2.0 denotes the image having twice as much width as height.

Returns

Required padding amounts to reach the target aspect ratio, given as a tuple of the form (top, right, bottom, left).

Return type
tuple of int

Compute pad amounts until img height/width are multiples of given values.

See `compute_paddings_for_aspect_ratio()` for an explanation of how the required padding amounts are distributed per image axis.

Added in 0.4.0. (Previously named `imgaug.imgaug.compute_paddings_to_reach_multiples_of()`.)

Parameters

- `arr` ((H,W) ndarray or (H,W,C) ndarray or tuple of int) – Image-like array or shape tuple for which to compute pad amounts.
- `height_multiple` (None or int) – The desired multiple of the height. The computed padding amount will reflect a padding that increases the y axis size until it is a multiple of this value.
- `width_multiple` (None or int) – The desired multiple of the width. The computed padding amount will reflect a padding that increases the x axis size until it is a multiple of this value.

Returns

Required padding amounts to reach multiples of the provided values, given as a tuple of the form (top, right, bottom, left).

Return type
tuple of int

Compute paddings to reach powers of given base values.

For given axis size \( S \), padded size \( S' (S' \geq S) \) and base \( B \) this function computes paddings that fulfill \( S' = B^E \), where \( E \) is any exponent from the discrete interval \([0 .. \inf)\).
See `compute_paddings_for_aspect_ratio()` for an explanation of how the required padding amounts are distributed per image axis.

Added in 0.4.0. (Previously named `imgaug.imgaug.compute_paddings_to_reach_exponents_of()`)

**Parameters**

- **arr ((H,W) ndarray or (H,W,C) ndarray or tuple of int)** – Image-like array or shape tuple for which to compute pad amounts.
- **height_base (None or int)** – The desired base of the height.
- **width_base (None or int)** – The desired base of the width.
- **allow_zero_exponent (bool, optional)** – Whether \( E=0 \) in \( S'=B^E \) is a valid value. If True, axes with size 0 or 1 will be padded up to size \( B^0=1 \) and axes with size \( 1 < S \leq B \) will be padded up to \( B^1=B \). If False, the minimum output axis size is always at least \( B \).

**Returns**

Required padding amounts to fulfill \( S' = B^E \) given as a tuple of the form \((\text{top}, \text{right}, \text{bottom}, \text{left})\).

**Return type**

tuple of int

`imgaug.augmenters.size.pad(arr, top=0, right=0, bottom=0, left=0, mode='constant', cval=0)`

Pad an image-like array on its top/right/bottom/left side.

This function is a wrapper around `numpy.pad()`.

Added in 0.4.0. (Previously named `imgaug.imgaug.pad()`)

**Supported dtypes:**

- **uint8**: yes; fully tested (1)
- **uint16**: yes; fully tested (1)
- **uint32**: yes; fully tested (2) (3)
- **uint64**: yes; fully tested (2) (3)
- **int8**: yes; fully tested (1)
- **int16**: yes; fully tested (1)
- **int32**: yes; fully tested (1)
- **int64**: yes; fully tested (2) (3)
- **float16**: yes; fully tested (2) (3)
- **float32**: yes; fully tested (1)
- **float64**: yes; fully tested (1)
- **float128**: yes; fully tested (2) (3)
- **bool**: yes; tested (2) (3)

(1) Uses cv2 if `mode` is one of: "constant", "edge", "reflect", "symmetric". Otherwise uses `numpy`.

(2) Uses `numpy`.

(3) Rejected by cv2.

**Parameters**

- **arr ((H,W) ndarray or (H,W,C) ndarray)** – Image-like array to pad.
• **top** (*int*, *optional*) – Amount of pixels to add to the top side of the image. Must be 0 or greater.

• **right** (*int*, *optional*) – Amount of pixels to add to the right side of the image. Must be 0 or greater.

• **bottom** (*int*, *optional*) – Amount of pixels to add to the bottom side of the image. Must be 0 or greater.

• **left** (*int*, *optional*) – Amount of pixels to add to the left side of the image. Must be 0 or greater.

• **mode** (*str*, *optional*) – Padding mode to use. See `numpy.pad()` for details. In case of mode `constant`, the parameter `cval` will be used as the `constant_values` parameter to `numpy.pad()`. In case of mode `linear_ramp`, the parameter `cval` will be used as the `end_values` parameter to `numpy.pad()`.

• **cval** (*number or iterable of number*, *optional*) – Value to use for padding if `mode` is `constant`. See `numpy.pad()` for details. The `cval` is expected to match the input array’s dtype and value range. If an iterable is used, it is expected to contain one value per channel. The number of values and number of channels are expected to match.

**Returns**

Padded array with height \( H' = H + \text{top} + \text{bottom} \) and width \( W' = W + \text{left} + \text{right} \).

**Return type**

(*H', W')* ndarray or (*H', W', C*) ndarray

---

### imgaug.augmenters.size.pad_to_aspect_ratio(arr, aspect_ratio, mode='constant', cval=0, return_pad_amounts=False)

Pad an image array on its sides so that it matches a target aspect ratio.

See `compute_paddings_for_aspect_ratio()` for an explanation of how the required padding amounts are distributed per image axis.

Added in 0.4.0. (Previously named `imgaug.imgaug.pad_to_aspect_ratio()`.)

**Supported dtypes:**

See `pad()`.

**Parameters**

- **arr** (*((H, W) ndarray or (H, W, C) ndarray)* – Image-like array to pad.

- **aspect_ratio** (*float*) – Target aspect ratio, given as width/height. E.g. 2.0 denotes the image having twice as much width as height.

- **mode** (*str*, *optional*) – Padding mode to use. See `pad()` for details.

- **cval** (*number*, *optional*) – Value to use for padding if `mode` is `constant`. See `numpy.pad()` for details.

- **return_pad_amounts** (*bool*, *optional*) – If `False`, then only the padded image will be returned. If `True`, a tuple with two entries will be returned, where the first entry is the padded image and the second entry are the amounts by which each image side was padded. These amounts are again a tuple of the form (*top*, *right*, *bottom*, *left*), with each value being an int.

**Returns**

- (*H', W')* ndarray or (*H', W', C*) ndarray – Padded image as (*H', W*) or (*H', W', C*) ndarray, fulfilling the given `aspect_ratio`. 
• tuple of int – Amounts by which the image was padded on each side, given as a tuple (top, right, bottom, left). This tuple is only returned if return_pad_amounts was set to True.

**imiaug.augmenters.size.pad_to_multiples_of**

`pad_to_multiples_of(arr, height_multiple, width_multiple, mode='constant', cval=0, return_pad_amounts=False)`

Pad an image array until its side lengths are multiples of given values.

See `compute_paddings_for_aspect_ratio()` for an explanation of how the required padding amounts are distributed per image axis.

Added in 0.4.0. (Previously named `imiaug.imiaug.pad_to_multiples_of()`.)

**Supported dtypes:**

See `pad()`.

**Parameters**

- `arr` ((H,W) ndarray or (H,W,C) ndarray) – Image-like array to pad.
- `height_multiple` (`None or int`) – The desired multiple of the height. The computed padding amount will reflect a padding that increases the y axis size until it is a multiple of this value.
- `width_multiple` (`None or int`) – The desired multiple of the width. The computed padding amount will reflect a padding that increases the x axis size until it is a multiple of this value.
- `mode` (`str, optional`) – Padding mode to use. See `pad()` for details.
- `cval` (`number, optional`) – Value to use for padding if `mode` is `constant`. See `numpy.pad()` for details.
- `return_pad_amounts` (`bool, optional`) – If `False`, then only the padded image will be returned. If `True`, a tuple with two entries will be returned, where the first entry is the padded image and the second entry are the amounts by which each image side was padded. These amounts are again a tuple of the form (top, right, bottom, left), with each value being an integer.

**Returns**

- `(H',W') ndarray or (H',W',C) ndarray` – Padded image as `(H',W')` or `(H',W',C)` ndarray.
- `tuple of int` – Amounts by which the image was padded on each side, given as a tuple (top, right, bottom, left). This tuple is only returned if `return_pad_amounts` was set to True.

### 13.36 imiaug.augmenters.weather

Augmenters that create weather effects.

List of augmenters:

- `FastSnowyLandscape`
- `CloudLayer`
- `Clouds`
- `Fog`
- `SnowflakesLayer`
• Snowflakes
• RainLayer
• Rain

class imgaug.augmenters.weather.CloudLayer(intensity_mean, intensity_freq_exponent, intensity_coarse_scale, alpha_min, alpha_multiplier, alpha_size_px_max, alpha_freq_exponent, sparsity, density_multiplier, seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.meta.Augmenter

Add a single layer of clouds to an image.

Supported dtypes:

• uint8: yes; indirectly tested (1)
  • uint16: no
  • uint32: no
  • uint64: no
  • int8: no
  • int16: no
  • int32: no
  • int64: no
  • float16: yes; not tested
  • float32: yes; not tested
  • float64: yes; not tested
  • float128: yes; not tested (2)
  • bool: no

• (1) Indirectly tested via tests for Clouds` and Fog
• (2) Note that random values are usually sampled as int64 or float64, which float128 images would exceed. Note also that random values might have to upscaled, which is done via imresize_many_images() and has its own limited dtype support (includes however floats up to 64bit).

Parameters

• intensity_mean (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Mean intensity of the clouds (i.e. mean color). Recommended to be in the interval [190, 255].
  – If a number, then that value will always be used.
  – If a tuple (a, b), then a value will be uniformly sampled per image from the interval [a, b].
  – If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, then a value will be sampled per image from that parameter.

**intensity_freq_exponent** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Exponent of the frequency noise used to add fine intensity to the mean intensity. Recommended to be in the interval \([-2.5, -1.5]\]. See `__init__()` for details.

**intensity_coarse_scale** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Standard deviation of the gaussian distribution used to add more localized intensity to the mean intensity. Sampled in low resolution space, i.e. affects final intensity on a coarse level. Recommended to be in the interval \((0, 10]\).

- If a number, then that value will always be used.
- If a tuple \((a, b)\), then a value will be uniformly sampled per image from the interval \([a, b]\).
- If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, then a value will be sampled per image from that parameter.

**alpha_min** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Minimum alpha when blending cloud noise with the image. High values will lead to clouds being “everywhere”. Recommended to usually be at around 0.0 for clouds and >0 for fog.

- If a number, then that value will always be used.
- If a tuple \((a, b)\), then a value will be uniformly sampled per image from the interval \([a, b]\).
- If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, then a value will be sampled per image from that parameter.

**alpha_multiplier** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Multiplier for the sampled alpha values. High values will lead to denser clouds wherever they are visible. Recommended to be in the interval \([0.3, 1.0]\). Note that this parameter currently overlaps with `density_multiplier`, which is applied a bit later to the alpha mask.

- If a number, then that value will always be used.
- If a tuple \((a, b)\), then a value will be uniformly sampled per image from the interval \([a, b]\).
- If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, then a value will be sampled per image from that parameter.

**alpha_size_px_max** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Controls the image size at which the alpha mask is sampled. Lower values will lead to coarser alpha masks and hence larger clouds (and empty areas). See `__init__()` for details.

**alpha_freq_exponent** (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Exponent of the frequency noise used to sample the alpha mask. Similarly to `alpha_size_max_px`, lower values will lead to coarser alpha...
patterns. Recommended to be in the interval \([-4.0, -1.5]\). See \texttt{\_\_init\_()} for details.

- **sparsity** (number or tuple of number or list of number or \texttt{imgaug.parameters.StochasticParameter}) – Exponent applied late to the alpha mask. Lower values will lead to coarser cloud patterns, higher values to finer patterns. Recommended to be somewhere around 1.0. Do not deviate far from that value, otherwise the alpha mask might get weird patterns with sudden fall-offs to zero that look very unnatural.

  - If a number, then that value will always be used.
  - If a tuple \((a, b)\), then a value will be uniformly sampled per image from the interval \([a, b]\).
  - If a list, then a random value will be sampled from that list per image.
  - If a \texttt{StochasticParameter}, then a value will be sampled per image from that parameter.

- **density_multiplier** (number or tuple of number or list of number or \texttt{imgaug.parameters.StochasticParameter}) – Late multiplier for the alpha mask, similar to \texttt{alpha_multiplier}. Set this higher to get “denser” clouds wherever they are visible. Recommended to be around \([0.5, 1.5]\).

  - If a number, then that value will always be used.
  - If a tuple \((a, b)\), then a value will be uniformly sampled per image from the interval \([a, b]\).
  - If a list, then a random value will be sampled from that list per image.
  - If a \texttt{StochasticParameter}, then a value will be sampled per image from that parameter.

- **seed** (None or int or \texttt{imgaug.random.RNG} or \texttt{numpy.random.Generator} or \texttt{numpy.random.BitGenerator} or \texttt{numpy.random.SeedSequence} or \texttt{numpy.random.RandomState}, optional) – See \texttt{\_\_init\_()}.

- **name** (None or str, optional) – See \texttt{\_\_init\_()}.  

- **random_state** (None or int or \texttt{imgaug.random.RNG} or \texttt{numpy.random.Generator} or \texttt{numpy.random.BitGenerator} or \texttt{numpy.random.SeedSequence} or \texttt{numpy.random.RandomState}, optional) – Old name for parameter \texttt{seed}. Its usage will not yet cause a deprecation warning, but it is still recommended to use \texttt{seed} now. Outdated since 0.4.0.

- **deterministic** (bool, optional) – Deprecated since 0.4.0. See method \texttt{to\_deterministic()} for an alternative and for details about what the “deterministic mode” actually does.

### Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
</table>
| \_\_call\_ | Alias for \texttt{augment()}.
| \texttt{augment}(self[, return_batch, hooks]) | Augment a batch. |
| \texttt{augment\_batch}(self[, batch[, hooks]]) | \texttt{Deprecated}.
| \texttt{augment\_batch\_}(self, batch[, parents, hooks]) | Augment a single batch in-place. |
| \texttt{augment\_batches}(self, batches[, hooks,...]) | Augment multiple batches. |

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<table>
<thead>
<tr>
<th>Method</th>
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<tbody>
<tr>
<td>augment_bounding_boxes(self, ...[, parents, ...])</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td>augment_heatmaps(self, heatmaps[, parents, ...])</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td>augment_image(self, image[, hooks])</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td>augment_images(self, images[, parents, hooks])</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td>augment_keypoints(self, keypoints_on_images)</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td>augment_line_strings(self, ...[, parents, hooks])</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td>augment_polygons(self, polygons_on_images[, ...])</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td>augment_segmentation_maps(self, segmaps[, ...])</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td>copy(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td>copy_random_state(self, source[, recursive, ...])</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td>copy_random_state_(self, source[, ...])</td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td>deepcopy(self)</td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td>draw_grid(self, images, rows, cols)</td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td>find_augmenters(self, func[, parents, flat])</td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td>find_augmenters_by_name(self, name[, name], regex[, ...])</td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td>find_augmenters_by_names(self, names[, ...])</td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td>get_all_children(self[, flat])</td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td>get_children_lists(self)</td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td>get_parameters(self)</td>
<td>See get_parameters().</td>
</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>localize_random_state_(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>pool(self[, processes, maxtasksperchild, seed])</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>remove_augmenters(self, func[, copy, ...])</td>
<td>Remove this augmentor or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>draw_on_image</td>
<td></td>
</tr>
<tr>
<td>generate_maps</td>
<td></td>
</tr>
</tbody>
</table>
draw_on_image (self, image, random_state)
generate_maps (self, image, random_state)
get_parameters (self)
    See get_parameters ().

class imgaug.augmenters.weather.Clouds (seed=None, name=None, random_state='deprecated', deterministic='deprecated')
Bases: imgaug.augmenters.meta.SomeOf

Add clouds to images.

This is a wrapper around CloudLayer. It executes 1 to 2 layers per image, leading to varying densities and frequency patterns of clouds.

This augmenter seems to be fairly robust w.r.t. the image size. Tested with 96x128, 192x256 and 960x1280.

Supported dtypes:

* uint8: yes; tested
* uint16: no (1)
* uint32: no (1)
* uint64: no (1)
* int8: no (1)
* int16: no (1)
* int32: no (1)
* int64: no (1)
* float16: no (1)
* float32: no (1)
* float64: no (1)
* float128: no (1)
* bool: no (1)

* (1) Parameters of this augmenter are optimized for the value range of uint8. While other dtypes may be accepted, they will lead to images augmented in ways inappropriate for the respective dtype.

Parameters

- seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().
- name (None or str, optional) – See __init__().
- random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.Random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Clouds()
```

Create an augmenter that adds clouds to images.

**Methods**

```python
__call__(self, *args, **kwargs) Alias for augment().
add(self, augmenter) Add an augmenter to the list of child augmenters.
append(self, object, /) Append object to the end of the list.
```

```python
augment(self[, return_batch, hooks]) Augment a batch.
augment_batch(self, batch[, hooks]) Deprecated.
augment_batch_(self, batch[, parents, hooks]) Augment a single batch in-place.
augment_batches(self[, batches[, hooks]]) Augment multiple batches.
augment_bounding_boxes(self[, ...[, parents, ...]]) Augment a batch of bounding boxes.
augment_heatmaps(self[, heatmaps[, parents, ...]]) Augment a batch of heatmaps.
augment_image(self[, image[, hooks]]) Augment a single image.
augment_images(self[, images[, parents, hooks]]) Augment a batch of images.
augment_keypoints(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
augment_line_strings(self[, ...[, parents, hooks]]) Augment a batch of line strings.
augment_polygons(self[, polygons_on_images[, ...]]) Augment a batch of polygons.
augment_segmentation_maps(self[, segmaps[, ...]]) Augment a batch of segmentation maps.
clear(self, /) Remove all items from list.
copy(self) Create a shallow copy of this Augmenter instance.
copy_random_state(self[, source[, recursive,...]]) Copy the RNGs from a source augmenter sequence.
copy_random_state_(self, source[, ...]) Copy the RNGs from a source augmenter sequence (in-place).
count(self, value, /) Return number of occurrences of value.
deepcopy(self) Create a deep copy of this Augmenter instance.
draw_grid(self, images, rows, cols) Augment images and draw the results as a single grid-like image.
extend(self, iterable, /) Extend list by appending elements from the iterable.
find_augmenters(self[, func[, parents, flat]]) Find augmenters that match a condition.
find_augmenters_by_name(self[, name[, regex,...]]) Find augmenter(s) by name.
find_augmenters_by_names(self[, names[, ...]]) Find augmenter(s) by names.
```
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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><code>get_all_children(self, flat)</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>See <code>get_children_lists()</code>.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>index(self, value[, start, stop])</code></td>
<td>Return first index of value.</td>
</tr>
<tr>
<td><code>insert(self, index, object, /)</code></td>
<td>Insert object before index.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>pop(self[, index])</code></td>
<td>Remove and return item at index (default last).</td>
</tr>
<tr>
<td><code>remove(self, value, /)</code></td>
<td>Remove first occurrence of value.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td><strong>Deprecated</strong>.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td><strong>Deprecated</strong>.</td>
</tr>
<tr>
<td><code>reverse(self, /)</code></td>
<td>Reverse <strong>IN PLACE</strong>.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>sort(self, /, *[key, reverse])</code></td>
<td>Stable sort <strong>IN PLACE</strong>.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

class `imgaug.augmenters.weather.FastSnowyLandscape` *(lightness_threshold=(100, 255), lightness_multiplier=(1.0, 4.0), from_colorspace='RGB', seed=None, name=None, random_state='deprecated', deterministic='deprecated')*

Bases: `imgaug.augmenters.meta.Augmenter`

Convert non-snowy landscapes to snowy ones.

This augmenter expects to get an image that roughly shows a landscape.

This augmenter is based on the method proposed in [https://medium.freecodecamp.org/image-augmentation-make-it-rain-make-it-snow-how-to-modify-a-photo-with-machine-learning-163c0eb3843f?gi=bc4a13e634c](https://medium.freecodecamp.org/image-augmentation-make-it-rain-make-it-snow-how-to-modify-a-photo-with-machine-learning-163c0eb3843f?gi=bc4a13e634c)

Supported dtypes:

- `uint8`: yes; fully tested
- `uint16`: no (1)
- `uint32`: no (1)
- `uint64`: no (1)
- `int8`: no (1)
- `int16`: no (1)
- `int32`: no (1)
• int64: no (1)
• float16: no (1)
• float32: no (1)
• float64: no (1)
• float128: no (1)
• bool: no (1)

• (1) This augmenter is based on a colorspace conversion to HLS. Hence, only RGB uint8 inputs are sensible.

Parameters

• **lightness_threshold** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – All pixels with lightness in HLS colorspace that is below this value will have their lightness increased by **lightness_multiplier**.
  - If a **number**, then that value will always be used.
  - If a **tuple** *(a, b)*, then a value will be uniformly sampled per image from the discrete interval *[a..b]*.
  - If a **list**, then a random value will be sampled from that list per image.
  - If a **StochasticParameter**, then a value will be sampled per image from that parameter.

• **lightness_multiplier** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter, optional)* – Multiplier for pixel’s lightness value in HLS colorspace. Affects all pixels selected via **lightness_threshold**.
  - If a **number**, then that value will always be used.
  - If a **tuple** *(a, b)*, then a value will be uniformly sampled per image from the discrete interval *[a..b]*.
  - If a **list**, then a random value will be sampled from that list per image.
  - If a **StochasticParameter**, then a value will be sampled per image from that parameter.

• **from_colorspace** *(str, optional)* – The source colorspace of the input images. See **_init_**().

• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See **_init_**().

• **name** *(None or str, optional)* – See **_init_**().

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter **seed**. Its usage will not yet cause a deprecation warning, but it is still recommended to use **seed** now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method **to_deterministic()** for an alternative and for details about what the “deterministic mode” actually does.
**Examples**

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.FastSnowyLandscape(
    lightness_threshold=140,
    lightness_multiplier=2.5
)
```

Search for all pixels in the image with a lightness value in HLS colorspace of less than 140 and increase their lightness by a factor of 2.5.

```python
>>> aug = iaa.FastSnowyLandscape(
    lightness_threshold=[128, 200],
    lightness_multiplier=(1.5, 3.5)
)
```

Search for all pixels in the image with a lightness value in HLS colorspace of less than 128 or less than 200 (one of these values is picked per image) and multiply their lightness by a factor of $x$ with $x$ being sampled from $\text{uniform}(1.5, 3.5)$ (once per image).

```python
>>> aug = iaa.FastSnowyLandscape(
    lightness_threshold=(100, 255),
    lightness_multiplier=(1.0, 4.0)
)
```

Similar to the previous example, but the lightness threshold is sampled from $\text{uniform}(100, 255)$ (per image) and the multiplier from $\text{uniform}(1.0, 4.0)$ (per image). This seems to produce good and varied results.

**Methods**

- `__call__`(self, *args, **kwargs) Alias for `augment()`.
- `augment`(self[, return_batch, hooks]) Augment a batch.
- `augment_batch`(self[, batch[, hooks]]) Deprecated.
- `augment_batch__(self, batch[, parents, hooks])` Augment a single batch in-place.
- `augment_batches`(self, batches[, hooks, ...]) Augment multiple batches.
- `augment_bounding_boxes`(self, ...[, parents, ...]) Augment a batch of bounding boxes.
- `augment_heatmaps`(self, heatmaps[, parents, ...]) Augment a batch of heatmaps.
- `augment_image`(self, image[, hooks]) Augment a single image.
- `augment_images`(self, images[, parents, hooks]) Augment a batch of images.
- `augment_keypoints`(self, keypoints_on_images) Augment a batch of keypoints/landmarks.
- `augment_line_strings`(self, ...[, parents, hooks]) Augment a batch of line strings.
- `augment_polygons`(self, polygons_on_images[, ...]) Augment a batch of polygons.
- `augment_segmentation_maps`(self, segmaps[, ...]) Augment a batch of segmentation maps.
- `copy`(self) Create a shallow copy of this Augmenter instance.
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<table>
<thead>
<tr>
<th>Method</th>
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</tr>
</thead>
<tbody>
<tr>
<td><code>copy_random_state(self, source[, ...])</code></td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code>.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
get_parameters(self)
```

See `get_parameters()`.  

**class imgaug.augmenters.weather.Fog**

```python
class imgaug.augmenters.weather.Fog(seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.weather.CloudLayer`

Add fog to images.

This is a wrapper around `CloudLayer`. It executes a single layer per image with a configuration leading to fairly dense clouds with low-frequency patterns.

This augmenter seems to be fairly robust w.r.t. the image size. Tested with 96x128, 192x256 and 960x1280.

**Supported dtypes:**

- `uint8`: yes; tested
- `uint16`: no (1)
- `uint32`: no (1)
- `uint64`: no (1)
• int8: no (1)  
• int16: no (1)  
• int32: no (1)  
• int64: no (1)  
• float16: no (1)  
• float32: no (1)  
• float64: no (1)  
• float128: no (1)  
• bool: no (1)  

• (1) Parameters of this augmenter are optimized for the value range of uint8. While other dtypes may be accepted, they will lead to images augmented in ways inappropriate for the respective dtype.

Parameters

• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().
• name (None or str, optional) – See __init__().
• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.
• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Fog()
```

Create an augmenter that adds fog to images.

Methods

```python
def __call__(self, *args, **kwargs)
    Alias for augment().

daugment(self, return_batch, hooks)
    Augment a batch.

daugment_batch(self, batch[, hooks])
    Deprecated.

daugment_batch_(self, batch[, parents, hooks])
    Augment a single batch in-place.

daugment_batches(self, batch[, parents, hooks])
    Augment multiple batches.

daugment_bounding_boxes(self, batch[, parents, hooks])
    Augment a batch of bounding boxes.
```

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<td><code>augment_heatmaps</code></td>
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<td><code>augment_image</code></td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><code>augment_images</code></td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><code>augment_keypoints</code></td>
<td>Augment a batch of keypoints/landmarks.</td>
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<td><code>augment_line_strings</code></td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><code>augment_polygons</code></td>
<td>Augment a batch of polygons.</td>
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<td><code>augment_segmentation_maps</code></td>
<td>Augment a batch of segmentation maps.</td>
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<td><code>copy</code></td>
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<td><code>copy_random_state</code></td>
<td>Copy the RNGs from a source Augmenter instance.</td>
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<td><code>deepcopy</code></td>
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<td><code>find_augmenters</code></td>
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<tr>
<td><code>get_all_children</code></td>
<td>Get all children of this augmenter as a list.</td>
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<tr>
<td><code>get_children_lists</code></td>
<td>Get a list of lists of children of this augmenter.</td>
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<td><code>get_parameters</code></td>
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<tr>
<td><code>localize_random_state</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
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<tr>
<td><code>localize_random_state_</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool</code></td>
<td>Create a pool used for multicore augmentation.</td>
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<tr>
<td><code>remove_augmenters</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
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<tr>
<td><code>reseed</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
<tr>
<td><code>seed_</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>resample</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>show_grid</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
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<tr>
<td><code>to_deterministic</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
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<tr>
<td><code>draw_on_image</code></td>
<td>Draw on image.</td>
</tr>
<tr>
<td><code>generate_maps</code></td>
<td>Generate maps.</td>
</tr>
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</table>
Add falling snowflakes to images.

This is a wrapper around `RainLayer`. It executes 1 to 3 layers per image.

**Note:** This augmenter currently seems to work best for medium-sized images around 192x256. For smaller images, you may want to increase the `speed` value to e.g. (0.1, 0.3), otherwise the drops tend to look like snowflakes. For larger images, you may want to increase the `drop_size` to e.g. (0.10, 0.20).

Added in 0.4.0.

**Supported dtypes:**

- `uint8`: yes; tested
- `uint16`: no (1)
- `uint32`: no (1)
- `uint64`: no (1)
- `int8`: no (1)
- `int16`: no (1)
- `int32`: no (1)
- `int64`: no (1)
- `float16`: no (1)
- `float32`: no (1)
- `float64`: no (1)
- `float128`: no (1)
- `bool`: no (1)

(1) Parameters of this augmenter are optimized for the value range of `uint8`. While other dtypes may be accepted, they will lead to images augmented in ways inappropriate for the respective dtype.

**Parameters**

- `drop_size` *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter)* – See `RainLayer`.
- `speed` *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter)* – See `RainLayer`.
- `seed` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.
- `name` *(None or str, optional)* – See `__init__()`.
- `random_state` *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage
will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

- **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

### Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Rain(speed=(0.1, 0.3))
```

Add rain to small images (around 96x128).

```python
>>> aug = iaa.Rain()
```

Add rain to medium sized images (around 192x256).

```python
>>> aug = iaa.Rain(drop_size=(0.10, 0.20))
```

Add rain to large images (around 960x1280).

### Methods

- `__call__`(self, *args, **kwargs) Alias for `augment()`.
- `add`(self, augmenter) Add an augmenter to the list of child augmenters.
- `append`(self, object, /) Append object to the end of the list.
- `augment`(self[, return_batch, hooks]) Augment a batch.
- `augment_batch`(self[, batch[, hooks]]) Deprecated.
- `augment_batch_(self, batch[, parents, hooks])` Augment a single batch in-place.
- `augment_bounding_boxes`(self[, ...[, parents, ...]]) Augment a batch of bounding boxes.
- `augment_heatmaps`(self[, heatmaps[, parents, ...]]) Augment a batch of heatmaps.
- `augment_image`(self[, image[, hooks]]) Augment a single image.
- `augment_images`(self[, images[, parents, hooks]]) Augment a batch of images.
- `augment_keypoints`(self[, keypoints_on_images]) Augment a batch of keypoints/landmarks.
- `augment_line_strings`(self[, ...[, parents, hooks]]) Augment a batch of line strings.
- `augment_polygons`(self[, polygons_on_images[, ...]]) Augment a batch of polygons.
- `augment_segmentation_maps`(self[, segmaps[, ...]]) Augment a batch of segmentation maps.
- `clear`(self, /) Remove all items from list.
- `copy`(self) Create a shallow copy of this Augmenter instance.
- `copy_random_state`(self[, source[, recursive, ...]]) Copy the RNGs from a source augmenter sequence.
- `copy_random_state_(self, source[, ...])` Copy the RNGs from a source augmenter sequence (in-place).

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<td><code>count(self, value, /)</code></td>
<td>Return number of occurrences of value.</td>
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<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>extend(self, iterable, /)</code></td>
<td>Extend list by appending elements from the iterable.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
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<tr>
<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
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<td><code>get_children_lists(self)</code></td>
<td>See <code>get_children_lists()</code> .</td>
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<tr>
<td><code>get_parameters(self)</code></td>
<td>See <code>get_parameters()</code> .</td>
</tr>
<tr>
<td><code>index(self, value[, start, stop])</code></td>
<td>Return first index of value.</td>
</tr>
<tr>
<td><code>insert(self, index, object, /)</code></td>
<td>Insert object before index.</td>
</tr>
<tr>
<td><code>localize_random_state(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>pop(self[, index])</code></td>
<td>Remove and return item at index (default last).</td>
</tr>
<tr>
<td><code>remove(self, value, /)</code></td>
<td>Remove first occurrence of value.</td>
</tr>
<tr>
<td><code>remove_augmenters(self, func[, copy, ...])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Deprecated.</td>
</tr>
<tr>
<td><code>reverse(self[, random_state, deterministic_too])</code></td>
<td>Reverse IN PLACE.</td>
</tr>
<tr>
<td><code>seed_(self[, entropy, deterministic_too])</code></td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td><code>show_grid(self, images, rows, cols)</code></td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>sort(self, /, *[, key, reverse])</code></td>
<td>Stable sort IN PLACE.</td>
</tr>
<tr>
<td><code>to_deterministic(self[, n])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.weather.RainLayer(density, density_uniformity, drop_size, drop_size_uniformity, angle, speed, blur_sigma_fraction, blur_sigma_limits=(0.5, 3.75), seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

Bases: `imgaug.augmenters.weather.SnowflakesLayer`

Add a single layer of falling raindrops to images.

Added in 0.4.0.

**Supported dtypes:**
- `uint8`: yes; indirectly tested (1)
- `uint16`: no
• uint32: no
• uint64: no
• int8: no
• int16: no
• int32: no
• int64: no
• float16: no
• float32: no
• float64: no
• float128: no
• bool: no

(1) indirectly tested via tests for Rain

Parameters

• density (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Same as in SnowflakesLayer.

• density_uniformity (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Same as in SnowflakesLayer.

• drop_size (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Same as flake_size in SnowflakesLayer.

• drop_size_uniformity (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Same as flake_size_uniformity in SnowflakesLayer.

• angle (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Same as in SnowflakesLayer.

• speed (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Same as in SnowflakesLayer.

• blur_sigma_fraction (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Same as in SnowflakesLayer.

• blur_sigma_limits (tuple of float, optional) – Same as in SnowflakesLayer.

• seed (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – See __init__().

• name (None or str, optional) – See __init__().

• random_state (None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional) – Old name for parameter seed. Its usage will not yet cause a deprecation warning, but it is still recommended to use seed now. Outdated since 0.4.0.

• deterministic (bool, optional) – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.
Methods

__call__(self, *args, **kwargs)  
Alias for augment().

augment(self, return_batch, hooks))  
Augment a batch.

augment_batch(self, batch[, hooks])  
Deprecated.

augment_batch_(self, batch, parents, hooks))  
Augment a single batch in-place.

augment_batches(self, batches[, hooks, ...])  
Augment multiple batches.

augment_bounding_boxes(self, ...[, parents, ...])  
Augment a batch of bounding boxes.

augment_heatmaps(self, heatmaps[, parents, ...])  
Augment a batch of heatmaps.

augment_image(self, image[, hooks])  
Augment a single image.

augment_images(self, images[, parents, hooks])  
Augment a batch of images.

augment_keypoints(self, keypoints_on_images)  
Augment a batch of keypoints/landmarks.

augment_line_strings(self, ...[, parents, hooks])  
Augment a batch of line strings.

augment_polygons(self, polygons_on_images[, ...])  
Augment a batch of polygons.

augment_segmentation_maps(self, segmaps[, ...])  
Augment a batch of segmentation maps.

copy(self)  
Create a shallow copy of this Augmenter instance.

copy_random_state(self, source[, recursive, ...])  
Copy the RNGs from a source augmenter sequence.

copy_random_state_(self, source[, ...])  
Copy the RNGs from a source augmenter sequence in-place.

deprecated(self)  
Create a deep copy of this Augmenter instance.

draw_grid(self, images, rows, cols)  
Augment images and draw the results as a single grid-like image.

find_augmenters(self, func[, parents, flat])  
Find augmenters that match a condition.

find_augmenters_by_name(self, name[, regex, ...])  
Find augmenter(s) by name.

find_augmenters_by_names(self, names[, ...])  
Find augmenter(s) by names.

get_all_children(self[, flat])  
Get all children of this augmenter as a list.

get_children_lists(self)  
Get a list of lists of children of this augmenter.

get_parameters(self)  
See get_parameters().

localize_random_state(self[, recursive])  
Assign augmenter-specific RNGs to this augmenter and its children.

localize_random_state_(self[, recursive])  
Assign augmenter-specific RNGs to this augmenter and its children.

pool(self[, processes, maxtasksperchild, seed])  
Create a pool used for multicore augmentation.

remove_augmenters(self, func[, copy, ...])  
Remove this augmenter or children that match a condition.

remove_augmenters_(self, func[, parents])  
Remove in-place children of this augmenter that match a condition.

remove_augmenters_inplace(self, func[, parents])  
Deprecated.

reseed(self[, random_state, deterministic_too])  
Deprecated.

seed_(self[, entropy, deterministic_too])  
Seed this augmenter and all of its children.
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<th>Method</th>
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<tbody>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
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</table>

class imgaug.augmenters.weather.Snowflakes(density=(0.005, 0.075), density_uniformity=(0.3, 0.9), flake_size=(0.2, 0.7), flake_size_uniformity=(0.4, 0.8), angle=(-30, 30), speed=(0.007, 0.03), seed=None, name=None, random_state='deprecated', deterministic='deprecated')

Bases: imgaug.augmenters.meta.SomeOf

Add falling snowflakes to images.

This is a wrapper around SnowflakesLayer. It executes 1 to 3 layers per image.

Supported dtypes:

- uint8: yes; tested
- uint16: no (1)
- uint32: no (1)
- uint64: no (1)
- int8: no (1)
- int16: no (1)
- int32: no (1)
- int64: no (1)
- float16: no (1)
- float32: no (1)
- float64: no (1)
- float128: no (1)
- bool: no (1)

- (1) Parameters of this augmenter are optimized for the value range of uint8. While other dtypes may be accepted, they will lead to images augmented in ways inappropriate for the respective dtype.

Parameters

- density (number or tuple of number or list of number or imgaug.parameters.StochasticParameter) – Density of the snowflake layer, as a probability of each pixel in low resolution space to be a snowflake. Valid values are in the interval [0.0, 1.0]. Recommended to be in the interval [0.01, 0.075].
  - If a number, then that value will always be used.
- If a tuple \((a, b)\), then a value will be uniformly sampled per image from the interval \([a, b]\).
- If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, then a value will be sampled per image from that parameter.

**density_uniformity** \((\text{number or tuple of number or list of number or imgaug.parameters.StochasticParameter})\) – Size uniformity of the snowflakes. Higher values denote more similarly sized snowflakes. Valid values are in the interval \([0.0, 1.0]\). Recommended to be around 0.5.

- If a number, then that value will always be used.
- If a tuple \((a, b)\), then a value will be uniformly sampled per image from the interval \([a, b]\).
- If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, then a value will be sampled per image from that parameter.

**flake_size** \((\text{number or tuple of number or list of number or imgaug.parameters.StochasticParameter})\) – Size of the snowflakes. This parameter controls the resolution at which snowflakes are sampled. Higher values mean that the resolution is closer to the input image’s resolution and hence each sampled snowflake will be smaller (because of the smaller pixel size).

Valid values are in the interval \((0.0, 1.0]\). Recommended values:

- On 96x128 a value of \((0.1, 0.4)\) worked well.
- On 192x256 a value of \((0.2, 0.7)\) worked well.
- On 960x1280 a value of \((0.7, 0.95)\) worked well.

Datatype behaviour:

- If a number, then that value will always be used.
- If a tuple \((a, b)\), then a value will be uniformly sampled per image from the interval \([a, b]\).
- If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, then a value will be sampled per image from that parameter.

**flake_size_uniformity** \((\text{number or tuple of number or list of number or imgaug.parameters.StochasticParameter})\) – Controls the size uniformity of the snowflakes. Higher values mean that the snowflakes are more similarly sized. Valid values are in the interval \([0.0, 1.0]\). Recommended to be around 0.5.

- If a number, then that value will always be used.
- If a tuple \((a, b)\), then a value will be uniformly sampled per image from the interval \([a, b]\).
- If a list, then a random value will be sampled from that list per image.
- If a StochasticParameter, then a value will be sampled per image from that parameter.
• **angle** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter)* – Angle in degrees of motion blur applied to the snowflakes, where 0.0 is motion blur that points straight upwards. Recommended to be in the interval \([-30, 30]\). See also `__init__()`.  
  - If a number, then that value will always be used.  
  - If a tuple \((a, b)\), then a value will be uniformly sampled per image from the interval \([a, b]\).  
  - If a list, then a random value will be sampled from that list per image.  
  - If a StochasticParameter, then a value will be sampled per image from that parameter.

• **speed** *(number or tuple of number or list of number or imgaug.parameters.StochasticParameter)* – Perceived falling speed of the snowflakes. This parameter controls the motion blur’s kernel size. It follows roughly the form 

  \[
  \text{kernel} \_\text{size} = \text{image} \_\text{size} \times \text{speed}
  \]

  Hence, values around 1.0 denote that the motion blur should “stretch” each snowflake over the whole image. Valid values are in the interval \([0.0, 1.0]\). Recommended values:

  - On 96x128 a value of \((0.01, 0.05)\) worked well.  
  - On 192x256 a value of \((0.007, 0.03)\) worked well.  
  - On 960x1280 a value of \((0.001, 0.03)\) worked well.

Datatype behaviour:

  - If a number, then that value will always be used.  
  - If a tuple \((a, b)\), then a value will be uniformly sampled per image from the interval \([a, b]\).  
  - If a list, then a random value will be sampled from that list per image.  
  - If a StochasticParameter, then a value will be sampled per image from that parameter.

• **seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See `__init__()`.  

• **name** *(None or str, optional)* – See `__init__()`.  

• **random_state** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter `seed`. Its usage will not yet cause a deprecation warning, but it is still recommended to use `seed` now. Outdated since 0.4.0.

• **deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method `to_deterministic()` for an alternative and for details about what the “deterministic mode” actually does.

## Examples

```python
>>> import imgaug.augmenters as iaa
>>> aug = iaa.Snowflakes(flake_size=(0.1, 0.4), speed=(0.01, 0.05))
```
Add snowflakes to small images (around 96x128).

```python
>>> aug = iaa.Snowflakes(flake_size=(0.2, 0.7), speed=(0.007, 0.03))
```

Add snowflakes to medium-sized images (around 192x256).

```python
>>> aug = iaa.Snowflakes(flake_size=(0.7, 0.95), speed=(0.001, 0.03))
```

Add snowflakes to large images (around 960x1280).

Methods

```python
def __call__(self, *args, **kwargs):
    Alias for `augment()`.
def add(self, augmenter):
    Add an augmenter to the list of child augmenters.
def append(self, object, /):
    Append object to the end of the list.
def augment(self, return_batch, hooks):
    Augment object to the end of the list.
def augment_batch(self, batch, hooks):
    Augment a batch.
def augment_batch_(self, batch, parents, hooks):
    Augment a single batch in-place.
def augment_batches(self, batches, hooks):
    Augment multiple batches.
def augment_bounding_boxes(self, parents, hooks):
    Augment a batch of bounding boxes.
def augment_heatmaps(self, heatmaps, parents, hooks):
    Augment a batch of heatmaps.
def augment_image(self, image, hooks):
    Augment a single image.
def augment_images(self, images, parents, hooks):
    Augment a batch of images.
def augment_keypoints(self, keypoints_on_images, parents, hooks):
    Augment a batch of keypoints/landmarks.
def augment_line_strings(self, line_strings, parents, hooks):
    Augment a batch of line strings.
def augment_polygons(self, polygons_on_images, parents, hooks):
    Augment a batch of polygons.
def augment_segmentation_maps(self, segmaps, parents, hooks):
    Augment a batch of segmentation maps.
def clear(self, /):
    Remove all items from list.
def copy(self):
    Create a shallow copy of this Augmenter instance.
def copy_random_state(self, source, recursive, parents, hooks):
    Copy the RNGs from a source augmenter sequence.
def copy_random_state_(self, source, parents, hooks):
    Copy the RNGs from a source augmenter sequence (in-place).
def count(self, value, /):
    Return number of occurrences of value.
def deepcopy(self):
    Create a deep copy of this Augmenter instance.
def draw_grid(self, images, rows, cols):
    Augment images and draw the results as a single grid-like image.
def extend(self, iterable, /):
    Extend list by appending elements from the iterable.
def find_augmenters(self, func, parents, flat):
    Find augmenters that match a condition.
def find_augmenters_by_name(self, name, regex, parents, flat):
    Find augmenter(s) by name.
def find_augmenters_by_names(self, names, parents, flat):
    Find augmenter(s) by names.
def get_all_children(self, flat):
    Get all children of this augmenter as a list.
def get_children_lists(self):
    See `get_children_lists()`.
```

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<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>get_parameters(self)</td>
<td>See <code>get_parameters()</code></td>
</tr>
<tr>
<td>index(self, value[, start, stop])</td>
<td>Return first index of value.</td>
</tr>
<tr>
<td>insert(self, index, object, /)</td>
<td>Insert object before index.</td>
</tr>
<tr>
<td>localize_random_state(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>localize_random_state_(self[, recursive])</td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td>pool(self[, processes, maxtasksperchild, seed])</td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td>pop(self[, index])</td>
<td>Remove and return item at index (default last).</td>
</tr>
<tr>
<td>remove(self, value, /)</td>
<td>Remove first occurrence of value.</td>
</tr>
<tr>
<td>remove_augmenters(self, func[, copy, ...])</td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_(self, func[, parents])</td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td>remove_augmenters_inplace(self, func[, parents])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reseed(self[, random_state, deterministic_too])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>reverse(self, /)</td>
<td>Reverse IN PLACE.</td>
</tr>
<tr>
<td>seed_(self[, entropy, deterministic_too])</td>
<td>Seed this augmenter and all of its children.</td>
</tr>
<tr>
<td>show_grid(self, images, rows, cols)</td>
<td>Augment images and plot the results as a single grid-like image.</td>
</tr>
<tr>
<td>sort(self, /, *[key, reverse])</td>
<td>Stable sort IN PLACE.</td>
</tr>
<tr>
<td>to_deterministic(self[, n])</td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

```python
class imgaug.augmenters.weather.SnowflakesLayer(density, density_uniformity, flake_size, flake_size_uniformity, angle, speed, blur_sigma_fraction, blur_sigma_limits=(0.5, 3.75), seed=None, name=None, random_state='deprecated', deterministic='deprecated')
```

**Bases:** `imgaug.augmenters.meta.Augmenter`

Add a single layer of falling snowflakes to images.

**Supported dtypes:**

- `uint8`: yes; indirectly tested (1)
- `uint16`: no
- `uint32`: no
- `uint64`: no
- `int8`: no
- `int16`: no
- `int32`: no
- `int64`: no
- `float16`: no
- `float32`: no
- `float64`: no
• float128: no
• bool: no

• (1) indirectly tested via tests for Snowflakes

Parameters

• density (number or tuple of number or list of number or imagenetgaug.parameters.StochasticParameter) – Density of the snowflake layer, as a probability of each pixel in low resolution space to be a snowflake. Valid values are in the interval [0.0, 1.0]. Recommended to be in the interval [0.01, 0.075].
  – If a number, then that value will always be used.
  – If a tuple (a, b), then a value will be uniformly sampled per image from the interval [a, b].
  – If a list, then a random value will be sampled from that list per image.
  – If a StochasticParameter, then a value will be sampled per image from that parameter.

• density_uniformity (number or tuple of number or list of number or imagenetgaug.parameters.StochasticParameter) – Size uniformity of the snowflakes. Higher values denote more similarly sized snowflakes. Valid values are in the interval [0.0, 1.0]. Recommended to be around 0.5.
  – If a number, then that value will always be used.
  – If a tuple (a, b), then a value will be uniformly sampled per image from the interval [a, b].
  – If a list, then a random value will be sampled from that list per image.
  – If a StochasticParameter, then a value will be sampled per image from that parameter.

• flake_size (number or tuple of number or list of number or imagenetgaug.parameters.StochasticParameter) – Size of the snowflakes. This parameter controls the resolution at which snowflakes are sampled. Higher values mean that the resolution is closer to the input image’s resolution and hence each sampled snowflake will be smaller (because of the smaller pixel size).
  Valid values are in the interval (0.0, 1.0]. Recommended values:
  – On 96x128 a value of (0.1, 0.4) worked well.
  – On 192x256 a value of (0.2, 0.7) worked well.
  – On 960x1280 a value of (0.7, 0.95) worked well.

Datatype behaviour:
  – If a number, then that value will always be used.
  – If a tuple (a, b), then a value will be uniformly sampled per image from the interval [a, b].
  – If a list, then a random value will be sampled from that list per image.
  – If a StochasticParameter, then a value will be sampled per image from that parameter.
• **flake_size_uniformity** (*number or tuple of number or list of number or imgaug.parameters.StochasticParameter*) – Controls the size uniformity of the snowflakes. Higher values mean that the snowflakes are more similarly sized. Valid values are in the interval [0.0, 1.0]. Recommended to be around 0.5.
  
  - If a number, then that value will always be used.
  - If a tuple (a, b), then a value will be uniformly sampled per image from the interval [a, b].
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled per image from that parameter.

• **angle** (*number or tuple of number or list of number or imgaug.parameters.StochasticParameter*) – Angle in degrees of motion blur applied to the snowflakes, where 0.0 is motion blur that points straight upwards. Recommended to be in the interval [-30, 30]. See also `__init__()`.
  
  - If a number, then that value will always be used.
  - If a tuple (a, b), then a value will be uniformly sampled per image from the interval [a, b].
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled per image from that parameter.

• **speed** (*number or tuple of number or list of number or imgaug.parameters.StochasticParameter*) – Perceived falling speed of the snowflakes. This parameter controls the motion blur’s kernel size. It follows roughly the form \( \text{kernel size} = \text{image size} \times \text{speed} \). Hence, values around 1.0 denote that the motion blur should “stretch” each snowflake over the whole image.

  Valid values are in the interval [0.0, 1.0]. Recommended values:
  
  - On 96x128 a value of (0.01, 0.05) worked well.
  - On 192x256 a value of (0.007, 0.03) worked well.
  - On 960x1280 a value of (0.001, 0.03) worked well.

  Datatype behaviour:
  
  - If a number, then that value will always be used.
  - If a tuple (a, b), then a value will be uniformly sampled per image from the interval [a, b].
  - If a list, then a random value will be sampled from that list per image.
  - If a StochasticParameter, then a value will be sampled per image from that parameter.

• **blur_sigma_fraction** (*number or tuple of number or list of number or imgaug.parameters.StochasticParameter*) – Standard deviation (as a fraction of the image size) of gaussian blur applied to the snowflakes. Valid values are in the interval [0.0, 1.0]. Recommended to be in the interval [0.0001, 0.001]. May still require tinkering based on image size.
  
  - If a number, then that value will always be used.
- If a **tuple** \((a, b)\), then a value will be uniformly sampled per image from the interval \([a, b]\).
- If a **list**, then a random value will be sampled from that list per image.
- If a **StochasticParameter**, then a value will be sampled per image from that parameter.

**blurSigmaLimits** *(tuple of float, optional)* – Controls allowed min and max values of blurSigmaFraction after(!) multiplication with the image size. First value is the minimum, second value is the maximum. Values outside of that range will be clipped to be within that range. This prevents extreme values for very small or large images.

**seed** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – See **init()**.

**name** *(None or str, optional)* – See **init()**.

**randomState** *(None or int or imgaug.random.RNG or numpy.random.Generator or numpy.random.BitGenerator or numpy.random.SeedSequence or numpy.random.RandomState, optional)* – Old name for parameter **seed**. Its usage will not yet cause a deprecation warning, but it is still recommended to use **seed** now. Outdated since 0.4.0.

**deterministic** *(bool, optional)* – Deprecated since 0.4.0. See method to_deterministic() for an alternative and for details about what the “deterministic mode” actually does.

### Methods

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<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>call</strong>**(self, *args, <strong>kwargs)</strong></td>
<td>Alias for <strong>augment()</strong>.</td>
</tr>
<tr>
<td><strong>augment</strong>(self[, return_batch, hooks])</td>
<td>Augment a batch.</td>
</tr>
<tr>
<td><strong>augment_batch</strong>(self[, batch[, hooks]])</td>
<td>Deprecated.</td>
</tr>
<tr>
<td><strong>augment_batch</strong>(self[, batch[, parents, hooks]])</td>
<td>Augment a single batch in-place.</td>
</tr>
<tr>
<td><strong>augment_batches</strong>(self[, batches[, hooks,...]])</td>
<td>Augment multiple batches.</td>
</tr>
<tr>
<td><strong>augment_bounding_boxes</strong>(self[,...[, parents,...]])</td>
<td>Augment a batch of bounding boxes.</td>
</tr>
<tr>
<td><strong>augment_heatmaps</strong>(self[, heatmaps[, parents,…]])</td>
<td>Augment a batch of heatmaps.</td>
</tr>
<tr>
<td><strong>augment_image</strong>(self[, image[, hooks]])</td>
<td>Augment a single image.</td>
</tr>
<tr>
<td><strong>augment_images</strong>(self[, images[, parents, hooks]])</td>
<td>Augment a batch of images.</td>
</tr>
<tr>
<td><strong>augment_keypoints</strong>(self[, keypoints_on_images])</td>
<td>Augment a batch of keypoints/landmarks.</td>
</tr>
<tr>
<td><strong>augment_line_strings</strong>(self[,...[, parents,...]])</td>
<td>Augment a batch of line strings.</td>
</tr>
<tr>
<td><strong>augment_polygons</strong>(self[, polygons_on_images[,...]])</td>
<td>Augment a batch of polygons.</td>
</tr>
<tr>
<td><strong>augment_segmentation_maps</strong>(self[, segmaps[,...]])</td>
<td>Augment a batch of segmentation maps.</td>
</tr>
<tr>
<td><strong>copy</strong>(self)</td>
<td>Create a shallow copy of this Augmenter instance.</td>
</tr>
<tr>
<td><strong>copy_random_state</strong>(self[, source[, recursive,…]])</td>
<td>Copy the RNGs from a source augmenter sequence.</td>
</tr>
<tr>
<td>Function</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td><code>copy_random_state_(self, source[,...])</code></td>
<td>Copy the RNGs from a source augmenter sequence (in-place).</td>
</tr>
<tr>
<td><code>deepcopy(self)</code></td>
<td>Create a deep copy of this Augmenter instance.</td>
</tr>
<tr>
<td><code>draw_grid(self, images, rows, cols)</code></td>
<td>Augment images and draw the results as a single grid-like image.</td>
</tr>
<tr>
<td><code>find_augmenters(self, func[, parents, flat])</code></td>
<td>Find augmenters that match a condition.</td>
</tr>
<tr>
<td><code>find_augmenters_by_name(self, name[, regex, ...])</code></td>
<td>Find augmenter(s) by name.</td>
</tr>
<tr>
<td><code>find_augmenters_by_names(self, names[, ...])</code></td>
<td>Find augmenter(s) by names.</td>
</tr>
<tr>
<td><code>get_all_children(self[, flat])</code></td>
<td>Get all children of this augmenter as a list.</td>
</tr>
<tr>
<td><code>get_children_lists(self)</code></td>
<td>Get a list of lists of children of this augmenter.</td>
</tr>
<tr>
<td><code>localize_random_state_(self[, recursive])</code></td>
<td>Assign augmenter-specific RNGs to this augmenter and its children.</td>
</tr>
<tr>
<td><code>pool(self[, processes, maxtasksperchild, seed])</code></td>
<td>Create a pool used for multicore augmentation.</td>
</tr>
<tr>
<td><code>remove_augmenters_(self, func[, parents])</code></td>
<td>Remove in-place children of this augmenter that match a condition.</td>
</tr>
<tr>
<td><code>remove_augmenters_inplace(self, func[, parents])</code></td>
<td>Remove this augmenter or children that match a condition.</td>
</tr>
<tr>
<td><code>reseed(self[, random_state, deterministic_too])</code></td>
<td>Convert this augmenter from a stochastic to a deterministic one.</td>
</tr>
</tbody>
</table>

See `get_parameters()`.

See modindex for API.
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