Introduction

- Original image
- Represented by pixels
- Dimensions: (C, H, W)...color, height, width

```
3 for color image
1 for grayscale
number of
horizontal pixels
vertical pixels
```

- Pixels are represented as numerical values with [0, ..., 255]
- Image conversion required by PyTorch
- Augmentations can improve model performance



Original Image

Resize

Scales an image (usually down); identical tensor shapes required for all images



Original Image

Processed Image

CenterCrop

crops an image at the center



Original Image





Processed Image

Grayscale

creates grayscale image, reduces color channel dimension from 3 to 1



Original Image



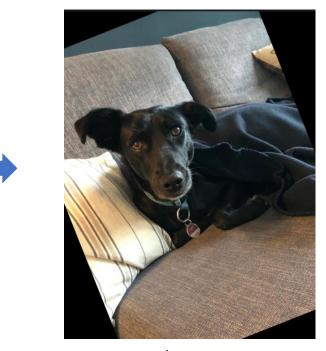
Processed Image

RandomRotation

randomly rotates image within bounds, usually combined with crop.



Original Image



Processed Image

Random Vertial Flip

flips an image with given probability



Original Image



Processed Image

ToTensor

converts a PIL image to tensor with dimensions (C, H, W) and value range [0.0, 1.0]





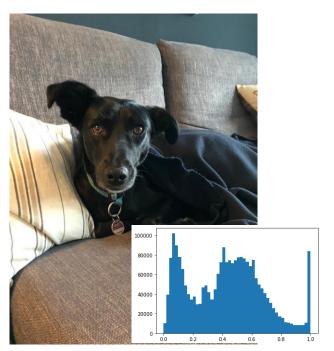


```
tensor([[[0.7647, 0.7882, 0.6235, ..., 0.2549, 0.2510, 0.2471],
        [0.7412, 0.8000, 0.7255, ..., 0.2549, 0.2510, 0.2510],
        [0.7098, 0.7725, 0.8118, ..., 0.2549, 0.2549, 0.2549],
         [0.1961, 0.1961, 0.2039, \ldots, 0.6510, 0.6078, 0.5765],
        [0.2314, 0.2078, 0.1922, ..., 0.6078, 0.6078, 0.6392],
        [0.2745, 0.2196, 0.1765, ..., 0.5725, 0.5725, 0.6392]],
        [[0.6902, 0.7137, 0.5490, ..., 0.3686, 0.3647, 0.3608],
        [0.6667, 0.7255, 0.6510, ..., 0.3686, 0.3647, 0.3647],
        [0.6353, 0.6980, 0.7373, ..., 0.3686, 0.3686, 0.3686],
        [0.1765, 0.1765, 0.1843, \ldots, 0.5961, 0.5529, 0.5216],
        [0.2118, 0.1882, 0.1725, \ldots, 0.5608, 0.5608, 0.5922],
        [0.2549, 0.2000, 0.1569, \ldots, 0.5255, 0.5255, 0.5922]],
        [[0.6235, 0.6471, 0.4824, ..., 0.3922, 0.3882, 0.3843],
        [0.6000, 0.6588, 0.5843, \ldots, 0.3922, 0.3882, 0.3882],
        [0.5686, 0.6314, 0.6706, \ldots, 0.3922, 0.3922, 0.3922],
        [0.1529, 0.1529, 0.1608, ..., 0.5451, 0.5020, 0.4706],
        [0.1882, 0.1647, 0.1490, ..., 0.5059, 0.5059, 0.5373],
        [0.2314, 0.1765, 0.1333, ..., 0.4706, 0.4706, 0.5373]]])
```

Processed Image

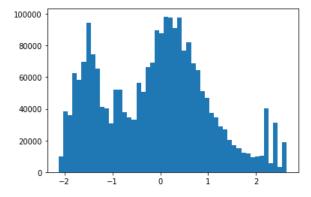
Normalize

normalizes an image with mean and standard deviation



Batch of images e.g. ImageNet mean = (0.485, 0.456, 0.406) Sd = (0.229, 0.224, 0.225)

Image is centered around given mean and has given standard deviation.



Processed Image

Original Image (created from tensor)

Compose

- Performs several transformations at once
- composed steps are applied to all images



Let's find out in coding lecture.

```
preprocess_steps = transforms.Compose([
    transforms.Resize(300), # better (300, 300)
    transforms.RandomRotation(50),
    transforms.CenterCrop(500),
    transforms.Grayscale(),
    transforms.RandomVerticalFlip(),
    transforms.ToTensor(),
    transforms.Normalize((0.485, 0.456, 0.406), (0.229, 0.224, 0.225)),
])
x = preprocess_steps(img)
```