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2.1 imshow

在显示图片的时候，需要先将图片读取，转换为特定句柄。可以使用 PIL 包的 Image 对图片采取打开操作，然后再将图片显示出来。

```python
from PIL import Image
import matplotlib.pyplot as plt
img = Imgae.open('actor.png')
plt.imshow(img)
plt.show()
```

torchvision.transforms.ToTensor() 可以将数据转换为 Tensor，PyTorch 中默认是以 $C \times H \times W$ 的格式存储的。但是在 imshow 中，输入的 X 为 array-like 或者是 PIL image。其支持的数组格式为 $H \times W \times C$，可以通过 torch.permute 来将图片数组维度进行转换。

- (M, N): an image with scalar data.

- (M, N, 3): an image with RGB values(0-1 float or 0-255 int).

- (M, N, 4): an image with RGBA values, i.e. including transparency.

```python
import torchvision
#PIL image object img
img_torch = torchvision.transforms.ToTensor()(img)
print(img_torch.shape) #torch.Size([3, 2160, 3840])
imt_torch_t = img_torch.permute(1, 2, 0)
print(img_torch_t.shape)
#torch.Size([2160, 3840, 3])
```

使用 ToTensor() 将图片转换为 Tensor 时会自动对图片执行归一化。

3   PyTorch

3.1   Tensors Manipulation

3.2   Output Shape after Convolutional Layers

$$n_{out} = floor\left(\frac{n_{in} + 2p - k}{s} + 1\right)$$

3.3   dropout

If dropout is implemented, during the training, some of the elements of the input tensor will be set to zero randomly with probability p using samples from a Bernoulli distribution.

3.4   Optimizer

The optimizer will hold the current state and will update the parameters based on the computed gradients. *For binary classification tasks*, **SGD and Adam** optimizers are used most.

The most important parameters of the optimizer class are the model's parameters and the learning rate.

4   torchvision

4.1   torchvision.utils.make_grid()

Make a grid of images

```
make_grid(tensor, nrow=8, padding=2, normalize=False, range=None, scale_each
    =False, pad_value=0)
```

- tensor: a 4D mini-batch Tensor of shape $(B \times C \times H \times W)$ or a list of images all of the same size.

- nrow: Number of images displayed in each row of the grid.

make_grid 实际上是将输入的多个图像数组，根据给定的行、列和 padding，**转换为一幅大的图像**。

4.2   Transforming Data

Image transformation and image augmentation are necessary for training deep learning moedls. By using image transformations, we can **expand the dataset** of resize and normalize it to achieve better model performance.