

Computer Vision

August 14, 2024

```
[2]: from IPython.display import Image
```

```
[3]: Image(filename = 'example.jpeg')
```

```
[3]:
```



```
[4]: import os  
print(os.path.isfile('example.jpeg'))
```

True

```
[5]: !pip install opencv-python
```

Collecting opencv-python

Using cached opencv_python-4.10.0.84-cp37-abi3-win_amd64.whl.metadata (20 kB)

Requirement already satisfied: numpy>=1.21.2 in

c:\users\user\anaconda3\lib\site-packages (from opencv-python) (1.26.4)

Using cached opencv_python-4.10.0.84-cp37-abi3-win_amd64.whl (38.8 MB)

Installing collected packages: opencv-python

Successfully installed opencv-python-4.10.0.84

```
[11]: import cv2  
image = cv2.imread('example.jpeg')  
print(image)
```

```
[[[ 0  19  15]  
  [ 0  17  16]
```

```

[ 10  13  21]
...
[  0  98  28]
[  0  98  23]
[  0  94  17]]

[[  0  20  14]
 [  0  18  15]
 [ 10  14  19]
...
 [  0  90  24]
 [  1  97  27]
 [  0  96  22]]

[[  0  21  12]
 [  0  19  14]
 [  8  15  18]
...
 [  0  82  24]
 [  1  86  24]
 [  0  84  18]]

...

[[ 40  55  11]
 [101 103  43]
 [211 187  97]
...
 [ 73 185 197]
 [ 78 190 202]
 [ 81 193 205]]

[[ 42  57  13]
 [ 99 101  41]
 [213 189  99]
...
 [ 77 192 203]
 [ 80 195 206]
 [ 83 195 207]]

[[ 42  57  13]
 [ 99 101  41]
 [213 189  99]
...
 [ 77 192 203]
 [ 80 195 206]
 [ 83 195 207]]]

```

```
[13]: height, width = image.shape [:2]
      print(height)
      print(width)
```

154

367

0.0.1 Resizing

```
[15]: new_width = 100
      new_height = 320
      resized_image = cv2.resize(image, (new_width, new_height))
      print(resized_image)
```

```
[[[ 3  16  18]
   [ 4  12  25]
   [ 0  18  16]
   ...
   [ 49 151 126]
   [ 0  92  42]
   [ 0  98  25]]]
```

```
[[ 3  16  17]
 [ 4  12  25]
 [ 1  18  16]
 ...
 [ 50 152 128]
 [ 0  92  43]
 [ 0  97  25]]]
```

```
[[ 3  16  16]
 [ 4  12  25]
 [ 2  19  17]
 ...
 [ 53 156 133]
 [ 0  93  45]
 [ 0  96  26]]]
```

...

```
[[137 130  60]
 [209 171  63]
 [196 163  64]
 ...
 [ 67 172 196]
 [ 69 184 197]
 [ 79 194 205]]]
```

```

[[137 130 60]
 [209 171 63]
 [196 163 64]
 ...
 [ 67 173 196]
 [ 69 184 197]
 [ 79 194 205]]

[[137 130 60]
 [209 171 63]
 [196 163 64]
 ...
 [ 67 173 196]
 [ 69 184 197]
 [ 79 194 205]]]

```

```

[17]: height, width = resized_image.shape[:2]
      print(height)
      print(width)

```

```

320
100

```

0.0.2 Cropping

```

[23]: y = 0
      x = 0
      h = 50
      w = 27
      crop_image = image[x:w, y:h]
      print(crop_image)

```

```

[[[ 0 19 15]
 [ 0 17 16]
 [10 13 21]
 ...
 [212 85 146]
 [208 81 142]
 [206 80 139]]

[[ 0 20 14]
 [ 0 18 15]
 [10 14 19]
 ...
 [210 83 144]
 [211 85 144]
 [207 81 140]]

[[ 0 21 12]

```

```

[  0  19  14]
[  8  15  18]
...
[198  71 132]
[213  87 146]
[209  84 140]]

...

[[  0  38   2]
 [  0  23   0]
 [ 22  34  16]
...
 [204  73 110]
 [212  82 117]
 [210  79 112]]

[[  0  32   0]
 [  3  32   6]
 [ 19  23  11]
...
 [205  75 110]
 [202  71 104]
 [198  68  99]]

[[  0  26   0]
 [ 13  35  11]
 [  9   3   0]
...
 [210  78 114]
 [205  72 105]
 [199  66  98]]]

```

```

[25]: height, width = crop_image.shape[0:2]
      print(height)
      print(width)

```

```

27
50

```

```

[27]: cv2.imwrite('new example image.jpeg', crop_image)

```

```

[27]: True

```

0.0.3 Normalization and Standardization

Normalization

```

[31]: import numpy as np

```

```
[33]: image = cv2.imread('example.jpeg').astype(np.float32)
      print(image)
```

```
[[[ 0.  19.  15.]
   [ 0.  17.  16.]
   [10.  13.  21.]
   ...
   [ 0.  98.  28.]
   [ 0.  98.  23.]
   [ 0.  94.  17.]]

[[[ 0.  20.  14.]
   [ 0.  18.  15.]
   [10.  14.  19.]
   ...
   [ 0.  90.  24.]
   [ 1.  97.  27.]
   [ 0.  96.  22.]]

[[[ 0.  21.  12.]
   [ 0.  19.  14.]
   [ 8.  15.  18.]
   ...
   [ 0.  82.  24.]
   [ 1.  86.  24.]
   [ 0.  84.  18.]]

...

[[[ 40.  55.  11.]
   [101. 103.  43.]
   [211. 187.  97.]
   ...
   [ 73. 185. 197.]
   [ 78. 190. 202.]
   [ 81. 193. 205.]]

[[[ 42.  57.  13.]
   [ 99. 101.  41.]
   [213. 189.  99.]
   ...
   [ 77. 192. 203.]
   [ 80. 195. 206.]
   [ 83. 195. 207.]]

[[[ 42.  57.  13.]
   [ 99. 101.  41.]
   [213. 189.  99.]
```

```
...
[ 77. 192. 203.]
[ 80. 195. 206.]
[ 83. 195. 207.]]]
```

```
[53]: normalized_image = image/255.0
print(normalized_image)
```

```
[[[0.          0.07450981 0.05882353]
  [0.          0.06666667 0.0627451 ]
  [0.03921569 0.05098039 0.08235294]
  ...
  [0.          0.38431373 0.10980392]
  [0.          0.38431373 0.09019608]
  [0.          0.36862746 0.06666667]]

[[[0.          0.07843138 0.05490196]
  [0.          0.07058824 0.05882353]
  [0.03921569 0.05490196 0.07450981]
  ...
  [0.          0.3529412  0.09411765]
  [0.00392157 0.38039216 0.10588235]
  [0.          0.3764706  0.08627451]]

[[[0.          0.08235294 0.04705882]
  [0.          0.07450981 0.05490196]
  [0.03137255 0.05882353 0.07058824]
  ...
  [0.          0.32156864 0.09411765]
  [0.00392157 0.3372549  0.09411765]
  [0.          0.32941177 0.07058824]]

...

[[[0.15686275 0.21568628 0.04313726]
  [0.39607844 0.40392157 0.16862746]
  [0.827451   0.73333335 0.38039216]
  ...
  [0.28627452 0.7254902  0.77254903]
  [0.30588236 0.74509805 0.7921569 ]
  [0.31764707 0.75686276 0.8039216 ]]

[[[0.16470589 0.22352941 0.05098039]
  [0.3882353  0.39607844 0.16078432]
  [0.8352941  0.7411765  0.3882353 ]
  ...
  [0.3019608  0.7529412  0.79607844]
  [0.3137255  0.7647059  0.80784315]]]
```

```

[0.3254902  0.7647059  0.8117647 ]]

[[0.16470589 0.22352941 0.05098039]
 [0.3882353  0.39607844 0.16078432]
 [0.8352941  0.7411765  0.3882353 ]
 ...
 [0.3019608  0.7529412  0.79607844]
 [0.3137255  0.7647059  0.80784315]
 [0.3254902  0.7647059  0.8117647 ]]]

```

Standardization (z-score normalization)

```

[42]: image = cv2.imread('example.jpeg').astype(np.float32)
      print(image)

```

```

[[[ 0.  19.  15.]
   [ 0.  17.  16.]
   [10.  13.  21.]
   ...
   [ 0.  98.  28.]
   [ 0.  98.  23.]
   [ 0.  94.  17.]]

[[[ 0.  20.  14.]
   [ 0.  18.  15.]
   [10.  14.  19.]
   ...
   [ 0.  90.  24.]
   [ 1.  97.  27.]
   [ 0.  96.  22.]]

[[[ 0.  21.  12.]
   [ 0.  19.  14.]
   [ 8.  15.  18.]
   ...
   [ 0.  82.  24.]
   [ 1.  86.  24.]
   [ 0.  84.  18.]]

...

[[[ 40.  55.  11.]
   [101. 103.  43.]
   [211. 187.  97.]
   ...
   [ 73. 185. 197.]
   [ 78. 190. 202.]
   [ 81. 193. 205.]]

```



```

[[ 42.  57.  13.]
 [ 99. 101.  41.]
 [213. 189.  99.]
 ...
 [ 77. 192. 203.]
 [ 80. 195. 206.]
 [ 83. 195. 207.]]

[[ 42.  57.  13.]
 [ 99. 101.  41.]
 [213. 189.  99.]
 ...
 [ 77. 192. 203.]
 [ 80. 195. 206.]
 [ 83. 195. 207.]]]

```

```
[44]: mean = np.mean(image)
      print(mean)
```

108.46383

```
[46]: std = np.std(image)
      print(std)
```

73.24034

```
[48]: standardized_image = (image - mean)/ std
      print(standardized_image)
```

```

[[[-1.4809301  -1.2215103  -1.276125   ]
  [-1.4809301  -1.2488177  -1.2624713   ]
  [-1.3443934  -1.3034323  -1.1942029   ]
 ...
  [-1.4809301  -0.14286974 -1.0986272   ]
  [-1.4809301  -0.14286974 -1.1668955   ]
  [-1.4809301  -0.19748446 -1.2488177   ]]

[[[-1.4809301  -1.2078565  -1.2897787   ]
  [-1.4809301  -1.2351639  -1.276125   ]
  [-1.3443934  -1.2897787  -1.2215103   ]
 ...
  [-1.4809301  -0.25209916 -1.1532419   ]
  [-1.4672765  -0.15652342 -1.1122808   ]
  [-1.4809301  -0.1701771  -1.1805493   ]]

[[[-1.4809301  -1.1942029  -1.317086   ]
  [-1.4809301  -1.2215103  -1.2897787   ]
  [-1.3717008  -1.276125   -1.2351639   ]
 ...

```

```

[-1.4809301 -0.3613286 -1.1532419 ]
[-1.4672765 -0.30671388 -1.1532419 ]
[-1.4809301 -0.33402124 -1.2351639 ]]

```

...

```

[[-0.93478304 -0.7299779 -1.3307397 ]
 [-0.10190871 -0.07460136 -0.893822 ]
 [ 1.3999958 1.0723076 -0.15652342]

```

...

```

[-0.48421168 1.0450002 1.2088443 ]
[-0.4159433 1.1132686 1.2771127 ]
[-0.37498227 1.1542296 1.3180737 ]]

```

```

[[-0.9074757 -0.7026705 -1.3034323 ]
 [-0.12921607 -0.10190871 -0.92112935]
 [ 1.4273032 1.0996149 -0.12921607]

```

...

```

[-0.42959696 1.1405759 1.2907664 ]
[-0.38863593 1.1815369 1.3317274 ]
[-0.3476749 1.1815369 1.3453811 ]]

```

```

[[-0.9074757 -0.7026705 -1.3034323 ]
 [-0.12921607 -0.10190871 -0.92112935]
 [ 1.4273032 1.0996149 -0.12921607]

```

...

```

[-0.42959696 1.1405759 1.2907664 ]
[-0.38863593 1.1815369 1.3317274 ]
[-0.3476749 1.1815369 1.3453811 ]]]

```

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