```
average of y:  23.0
```

```
#random-oor too ogohod hereglegdene
import random
#arr--iin niilberiin olood urt huwaaj urtiig ni olno
def average(arr):
    return sum(arr) / len(arr)
#arr-iig osohoor erembeleed urt ni tegsh bol goliin 2 elementiin niilberiin dundaji
#songoi bol goliin elementiig butsaana
def median(arr1):
    arr1 = sorted(arr)
    n = len(arr1)
    if n % 2:
        return int(arr1[n // 2] + arr1[n // 2]) // 2
    else:
        return int(arr1[n // 2])
#endees program ehelne
#garaas x, y 2 buhel too awna
x = int(input())
#y = int(input())
#arr-iig list eer uusgene
arr = list()
#garaas oruulsan x-iin urtaar arr-d randomoor 0-ees 10-iin hoorond buhel too olgono

for i in range(x):
    arr.insert(i, random.randint(0, 10))

print(arr)
#garaas neg too awna
temp = int(input())
#tooluuraa noillono
cnt = 0
#arr listed garaas oruulsan too taaraldah ym bol tooluuriig negeer nemne
for i in arr:
    if i == temp:
        cnt += 1

print(cnt)
```

```
5
6
[5, 6, 3, 10, 4]
2
0
```

Lab2

```
import PIL
import matplotlib.pyplot as plt
```

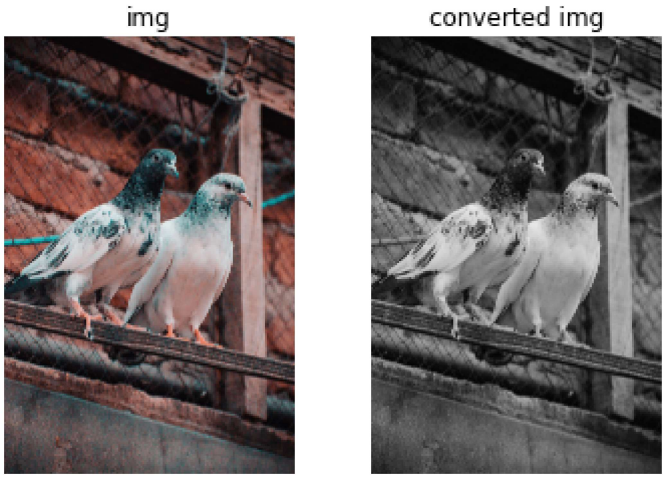
```
import matplotlib.pyplot as plt
```

```
img = Image.open("image1.jpg")
img_converted = img.convert("1")
```

```
plt.subplot(1, 2, 1)
plt.imshow(img)
plt.title("img")
plt.axis("off")
```

```
plt.subplot(1, 2, 2)
plt.imshow(img_converted)
plt.title("converted img")
plt.axis("off")
```

```
(-0.5, 3999.5, 5999.5, -0.5)
```

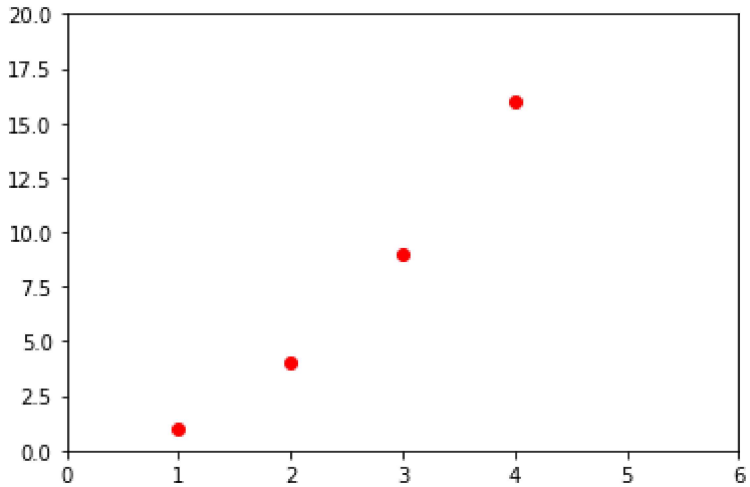



```
with Image.open('image1.jpg') as img:
    try:
        img.save('copy_image.jpg')
    except IOError:
        print('cannot convert')
```

```
plt.plot([1, 2, 3, 4], [1, 4, 9, 16])
```

```
[<matplotlib.lines.Line2D at 0x7fd931a8d510>]
```

```
import matplotlib.pyplot as plt
plt.plot([1,2,3,4], [1,4,9,16], 'ro')
plt.axis([0, 6, 0, 20])
plt.show()
```




```
from PIL import Image
```

```
# Thumbnail үүсгэж буй код
im = Image.open('image1.jpg')
im.thumbnail((128, 128))
im.save('thumbnail.jpg')
```

```
im = Image.open('image1.jpg').convert('L')
im.save('ByPython.jpg')
```

```
im = Image.open('image1.jpg')
box = (1800, 1500, 2500, 2000)
region = im.crop(box)
region = region.transpose(Image.ROTATE_180)
im.paste(region, box)
im.save('crop_rotate.jpg')
```

Үргэлжлэл

```
import numpy as np
import matplotlib.pyplot as plt
from PIL import Image, ImageOps
```

```
img = np.array(Image.open('image1.jpg'))
plt.figure(figsize=(8, 8))
plt.imshow(img)
```

```
<matplotlib.image.AxesImage at 0x7ff79798d6d0>
```

```
print('# of dims:', img.ndim)
print('Img shape:', img.shape)
print('DType:', img.dtype)
print(img[20, 20])
print(img[:, :, 2].min())
```

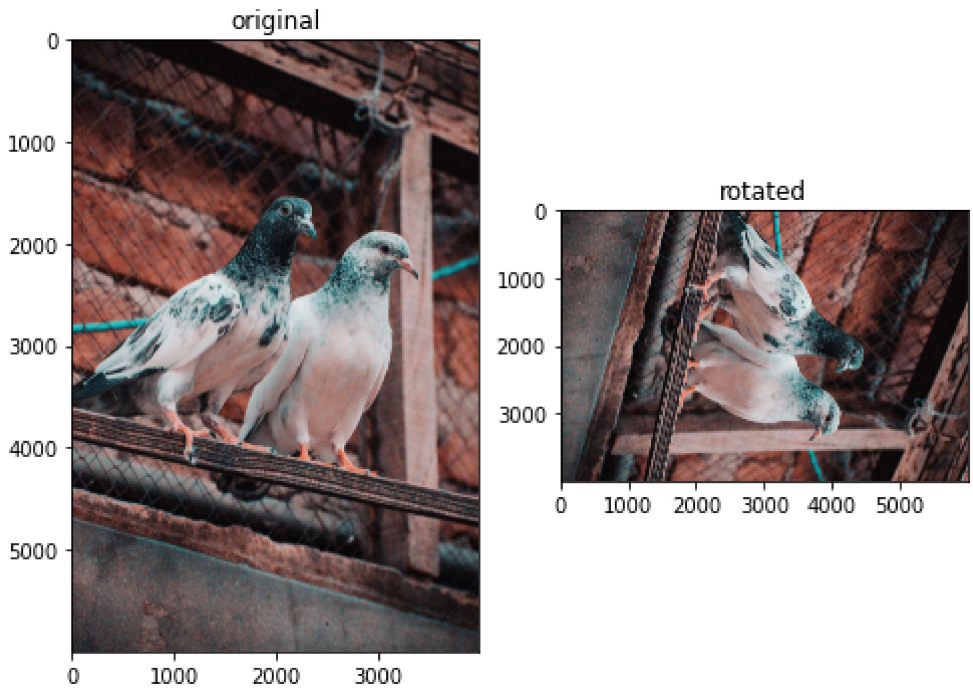
```
# of dims: 3
Img shape: (6000, 4000, 3)
DType: uint8
[14 12 15]
0
```

```
path = 'image2.jpg'
pil_img = Image.fromarray(img)
pil_img.save(path)
```

```
degrees = 90
img = np.array(Image.open('image1.jpg'))
fig = plt.figure(figsize = (8, 8))
```

```
fig = plt.figure(figsize=(8, 8))
fig.add_subplot(1, 2, 1)
plt.imshow(img)
plt.title('original')
img0 = img.copy()
for _ in range(degrees // 90):
    img0 = img0.transpose(1, 0, 2)
    for j in range(0, img0.shape[1] // 2):
        c = img0[:, j, :].copy()
        img0[:, j, :] = img0[:, img0.shape[1] - j - 1, :]
        img0[:, img0.shape[1] - j - 1, :] = c
fig.add_subplot(1, 2, 2)
plt.imshow(img0)
plt.title('rotated')
```

```
Text(0.5, 1.0, 'rotated')
```

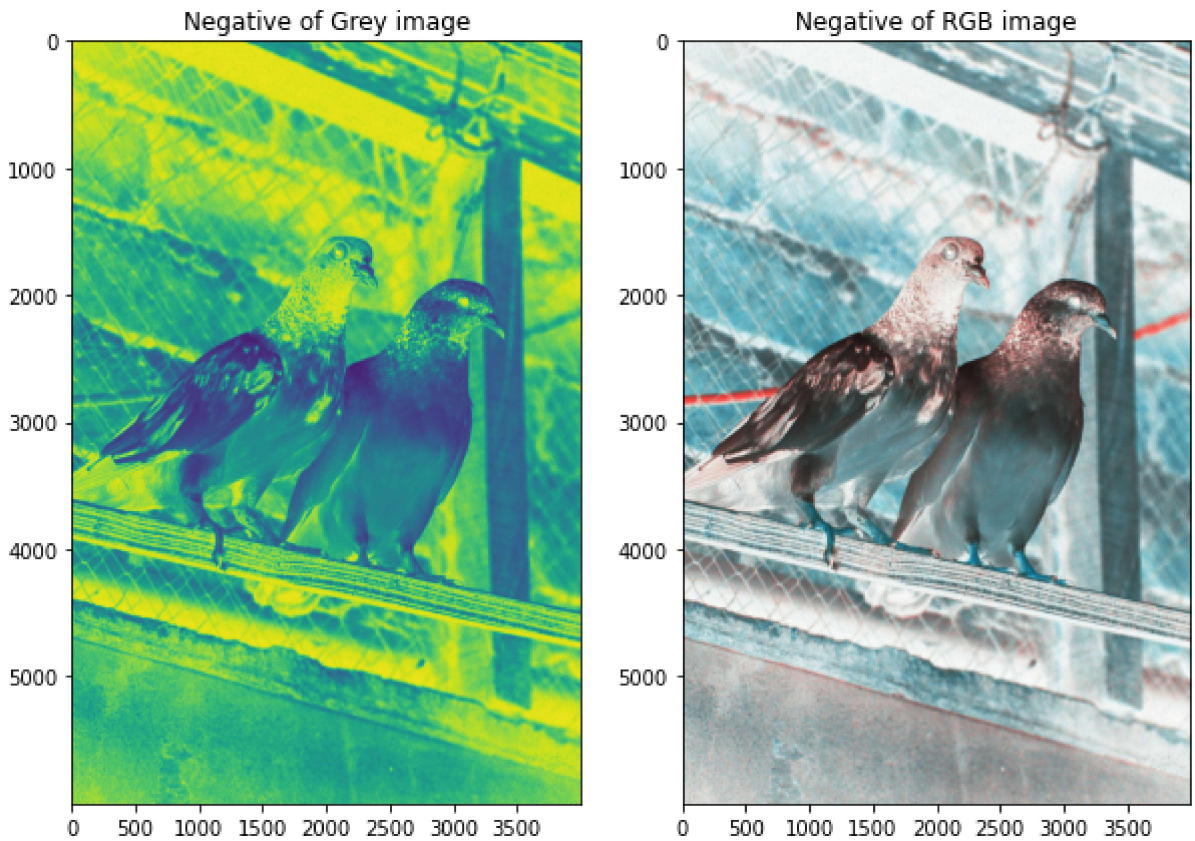



```
plt.imshow(np.rot90(img))
```

```
<matplotlib.image.AxesImage at 0x7ff7922f7ad0>
```

```
fig = plt.figure(figsize = (10, 10))
img_grey = img.sum(2) / (255 * 3)
img_grey = 255 * 3 - img_grey
fig.add_subplot(1, 2, 1)
plt.title('Negative of Grey image')
plt.imshow(img_grey)
img = 255 - img
fig.add_subplot(1, 2, 2)
plt.imshow(img)
plt.title('Negative of RGB image')
```

```
Text(0.5, 1.0, 'Negative of RGB image')
```



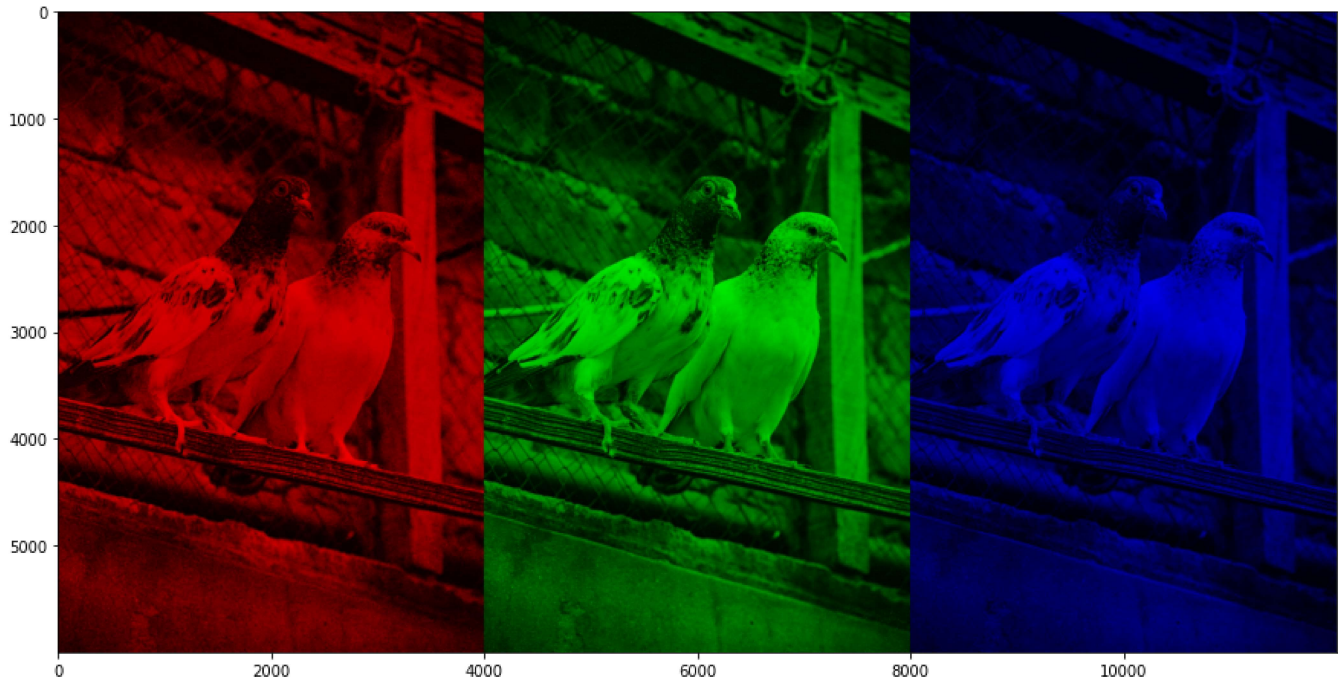

```
img = np.array(Image.open('image1.jpg'))
img_grey = img.sum(2) / (255 * 3)
img0 = img_grey.copy()
img0 = np.pad(img0, ((100, 100), (100, 100)))
plt.imshow(img0)
```

```
<matplotlib.image.AxesImage at 0x7ff7920140d0>
```

```
img = np.array(Image.open('image1.jpg'))
img_R, img_G, img_B = img.copy(), img.copy(), img.copy()
img_R[:, :, (1, 2)] =  0
img_G[:, :, (0, 2)] =  0
img_B[:, :, (0, 1)] =  0
img_rgb = np.concatenate((img_R, img_G, img_B), axis = 1)
plt.figure(figsize = (15, 15))

plt.imshow(img_rgb)
```

```
<matplotlib.image.AxesImage at 0x7ff791fedd10>
```

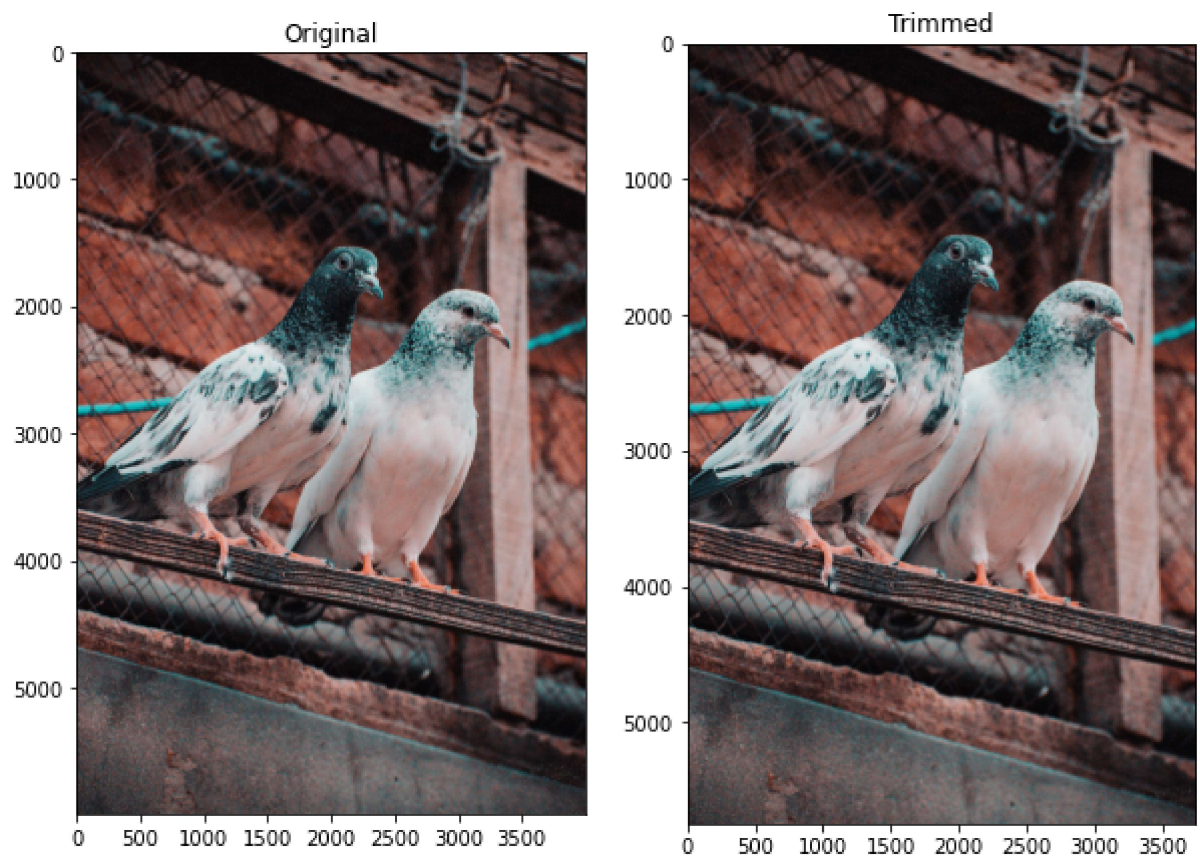



```
img = np.array(Image.open('image1.jpg'))
img0 = (img // 64) * 64
img1 = (img // 128) * 128
img_all = np.concatenate((img, img0, img1), axis = 1)
plt.figure(figsize = (15, 15))
plt.imshow(img_all)
```

```
<matplotlib.image.AxesImage at 0x7ff7922f7610>
```

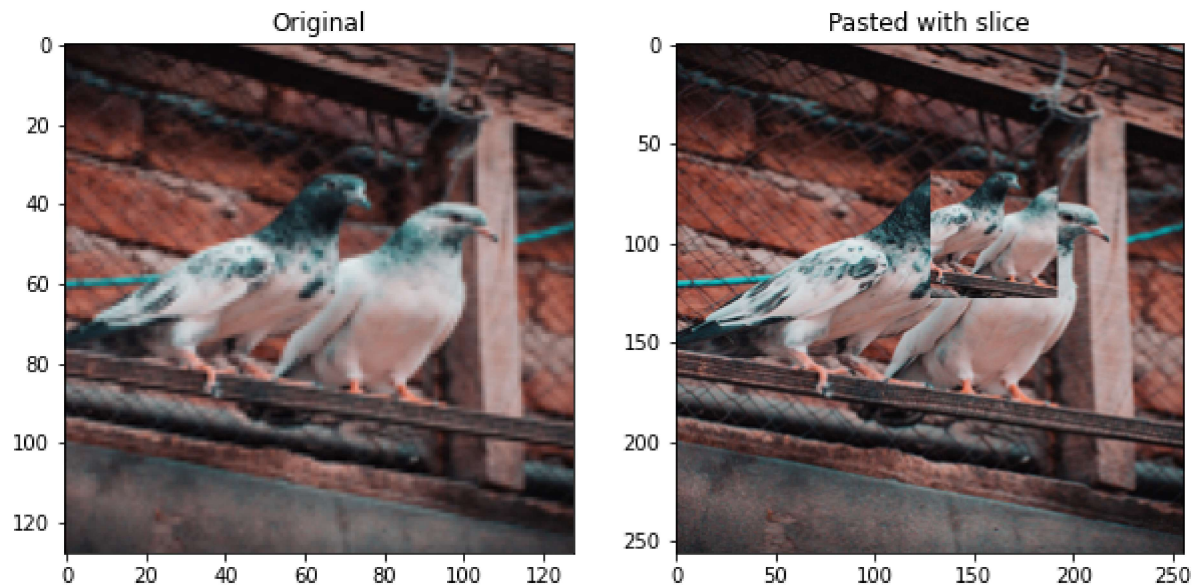
```
img = np.array(Image.open('image1.jpg'))
fig = plt.figure(figsize = (10, 10))
fig.add_subplot(1, 2, 1)
plt.imshow(img)
plt.title('Original')
img0 = img[128:-128, 128:-128, :]
fig.add_subplot(1, 2, 2)
plt.imshow(img0)
plt.title('Trimmed')
```

```
Text(0.5, 1.0, 'Trimmed')
```



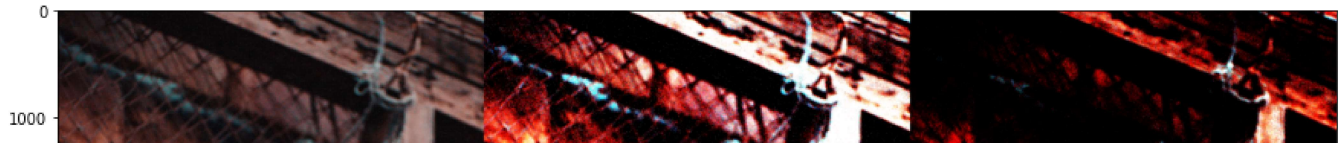
```
src = np.array(Image.open('image1.jpg').resize((128, 128)))
dst = np.array(Image.open('image1.jpg').resize((256, 256)))
dst_copy = dst.copy()
dst_copy[64:128, 128:192] = src[32:96, 32:96]
fig = plt.figure(figsize = (10, 10))
fig.add_subplot(1, 2, 1)
plt.imshow(src)
plt.title('Original')
fig.add_subplot(1, 2, 2)
plt.imshow(dst_copy)
plt.title('Pasted with slice')
```

```
Text(0.5, 1.0, 'Pasted with slice')
```




```
img = np.array(Image.open('image1.jpg'))
img64 = (img > 64) * 255
img128 = (img > 128) * 255
fig = plt.figure(figsize = (15, 15))
img_all = np.concatenate((img, img64, img128), axis = 1)
plt.imshow(img_all)
```

```
<matplotlib.image.AxesImage at 0x7ff791e8a050>
```




```
img0 = img.copy()
for i in range(img0.shape[0] // 2):
    c = img0[i, :, :].copy()
    img0[i, :, :] = img0[img0.shape[0] - i - 1, :, :]
    img0[img0.shape[0] - i - 1, :, :] = c
plt.imshow(img0)
```

```
<matplotlib.image.AxesImage at 0x7ff791e0af90>
```

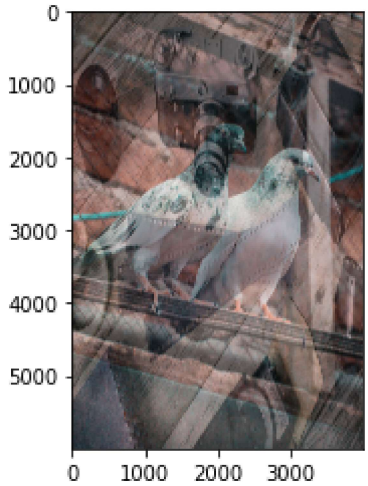
```
img·=·np.array(Image.open('image1.jpg'))
fig·=·plt.figure(figsize·=·(15,·15))
fig.add_subplot(1,·2,·1)
plt.imshow(np.fliplr(img))
fig.add_subplot(1,·2,·2)
plt.imshow(np.fliplr(img))
```

```
<matplotlib.image.AxesImage at 0x7ff791d7ead0>
```

```
img = np.array(Image.open('image1.jpg'))
img0 = np.array(Image.open('sample.jpg').resize(img.shape[1::-1]))
print(img.dtype)

dst = (img * 0.6 + img0 * 0.4).astype(np.uint8)
plt.imshow(dst)
```

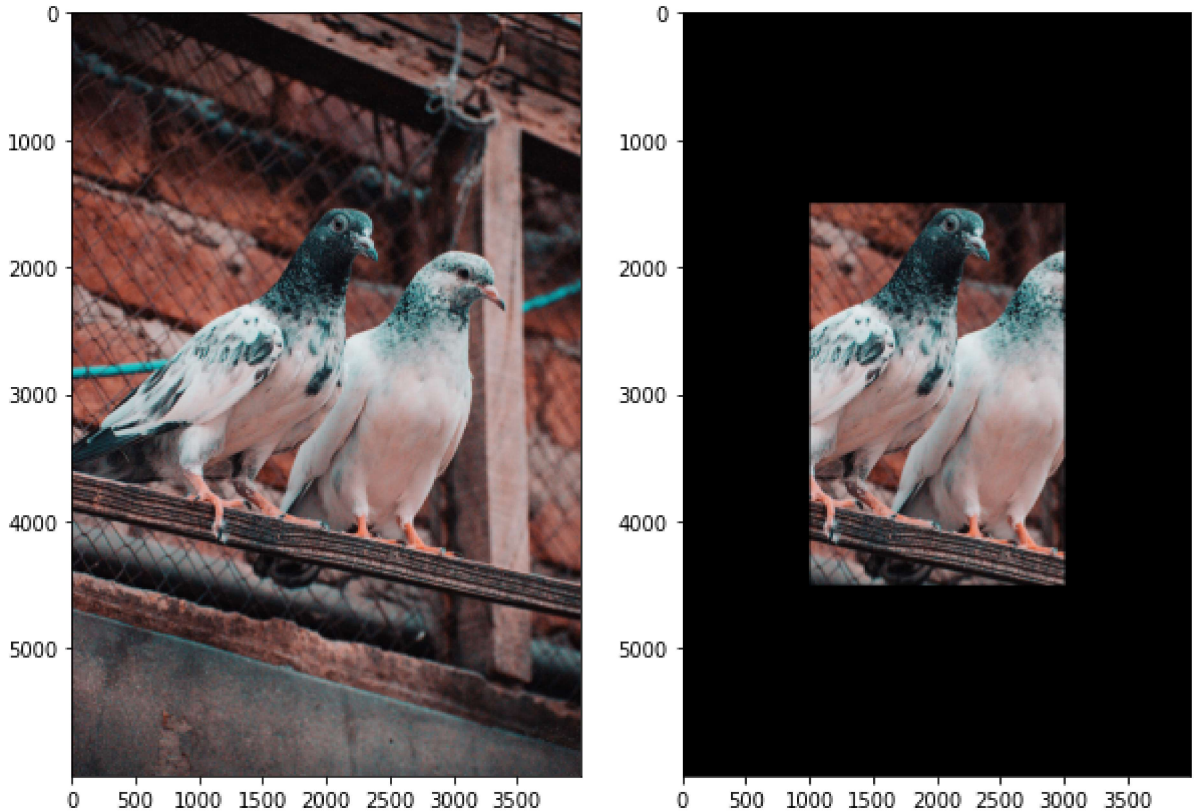
```
uint8
<matplotlib.image.AxesImage at 0x7ff791e04710>
```



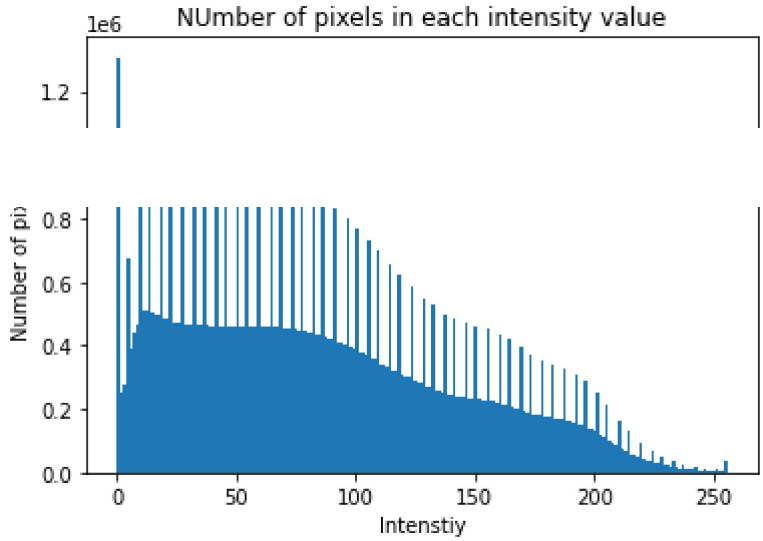

```
img = np.array(Image.open('image1.jpg'))
ones = np.ones((img.shape[0] // 2, img.shape[1] // 2, 3))
zeros = np.zeros((img.shape[0] // 4, img.shape[1] // 4, 3))
zeros_mid = np.zeros((img.shape[0] // 2, img.shape[1] // 4, 3))
up = np.concatenate((zeros, zeros, zeros, zeros), axis = 1)
middle = np.concatenate((zeros_mid, ones, zeros_mid), axis = 1)
down = np.concatenate((zeros, zeros, zeros, zeros), axis = 1)
mask = np.concatenate((up, middle, down), axis = 0)
mask = mask / 255
```

```
mask = mask / 255
img0 = mask * img
fig = plt.figure(figsize = (10, 10))
fig.add_subplot(1, 2, 1)
plt.imshow(img)
fig.add_subplot(1, 2, 2)
plt.imshow(img0)
```

```
<matplotlib.image.AxesImage at 0x7ff791bf2850>
```




```
img = np.array(Image.open('image1.jpg'))
img_flat = img.flatten()
plt.hist(img_flat, bins = 200, range = [0, 256])
plt.title('NUmber of pixels in each intensity value')
plt.xlabel('Intenstiy')
plt.ylabel('Number of pixels')
plt.show()
```



✓ 2s completed at 12:51 AM