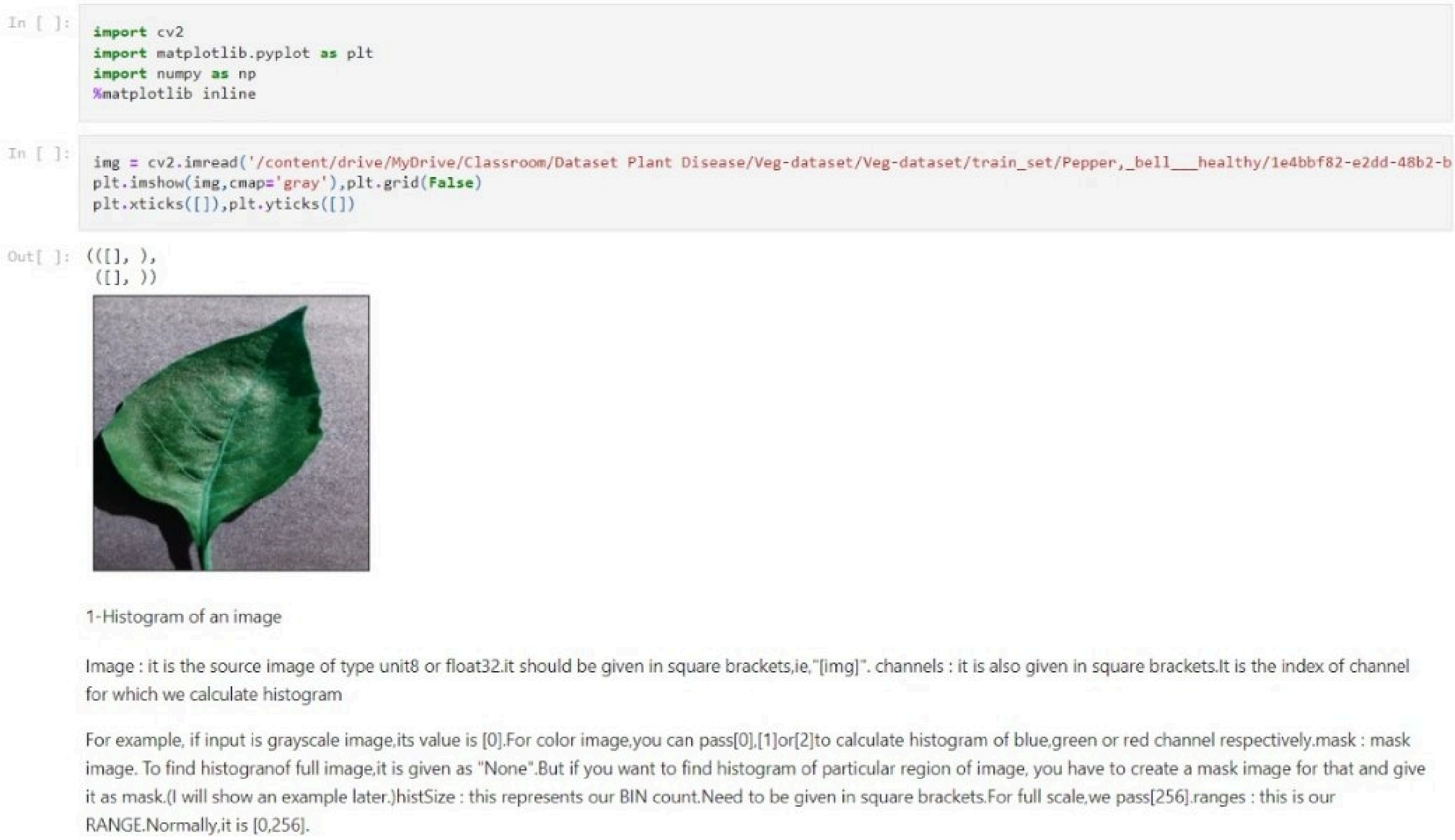


```
In [ ]:
import cv2
import matplotlib.pyplot as plt
import numpy as np
%matplotlib inline
```

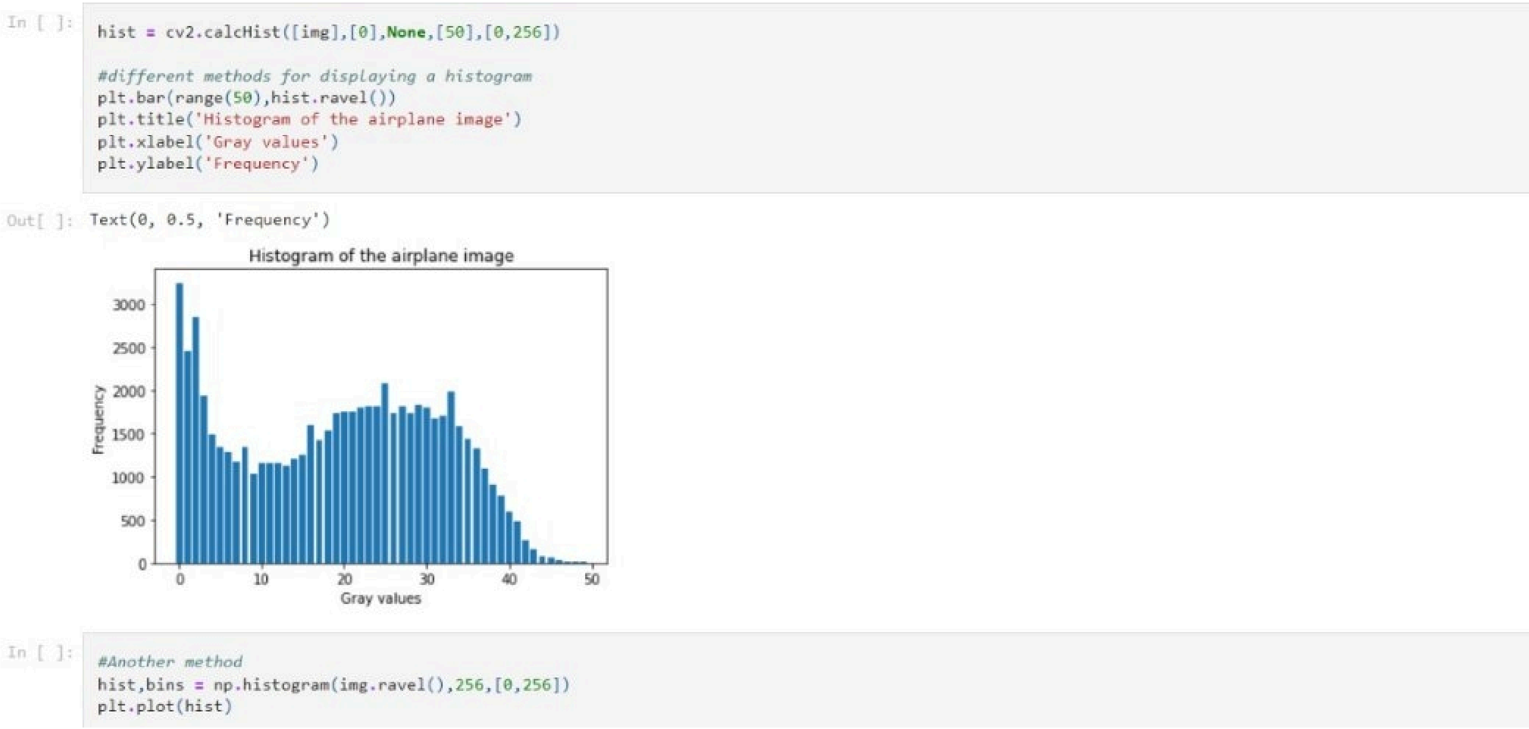
```
In [ ]:
img = cv2.imread('/content/drive/MyDrive/Classroom/Dataset Plant Disease/Veg-dataset/Veg-dataset/train_set/Pepper,_bell___healthy/1e4bbf82-e2dd-48b2-b
plt.imshow(img,cmap='gray'),plt.grid(False)
plt.xticks([]),plt.yticks([])
```

```
Out[ ]: (([], ),
         ([], ))
```

1-Histogram of an image

Image : it is the source image of type unit8 or float32.it should be given in square brackets,ie,"[img]". channels : it is also given in square brackets.It is the index of channel for which we calculate histogram

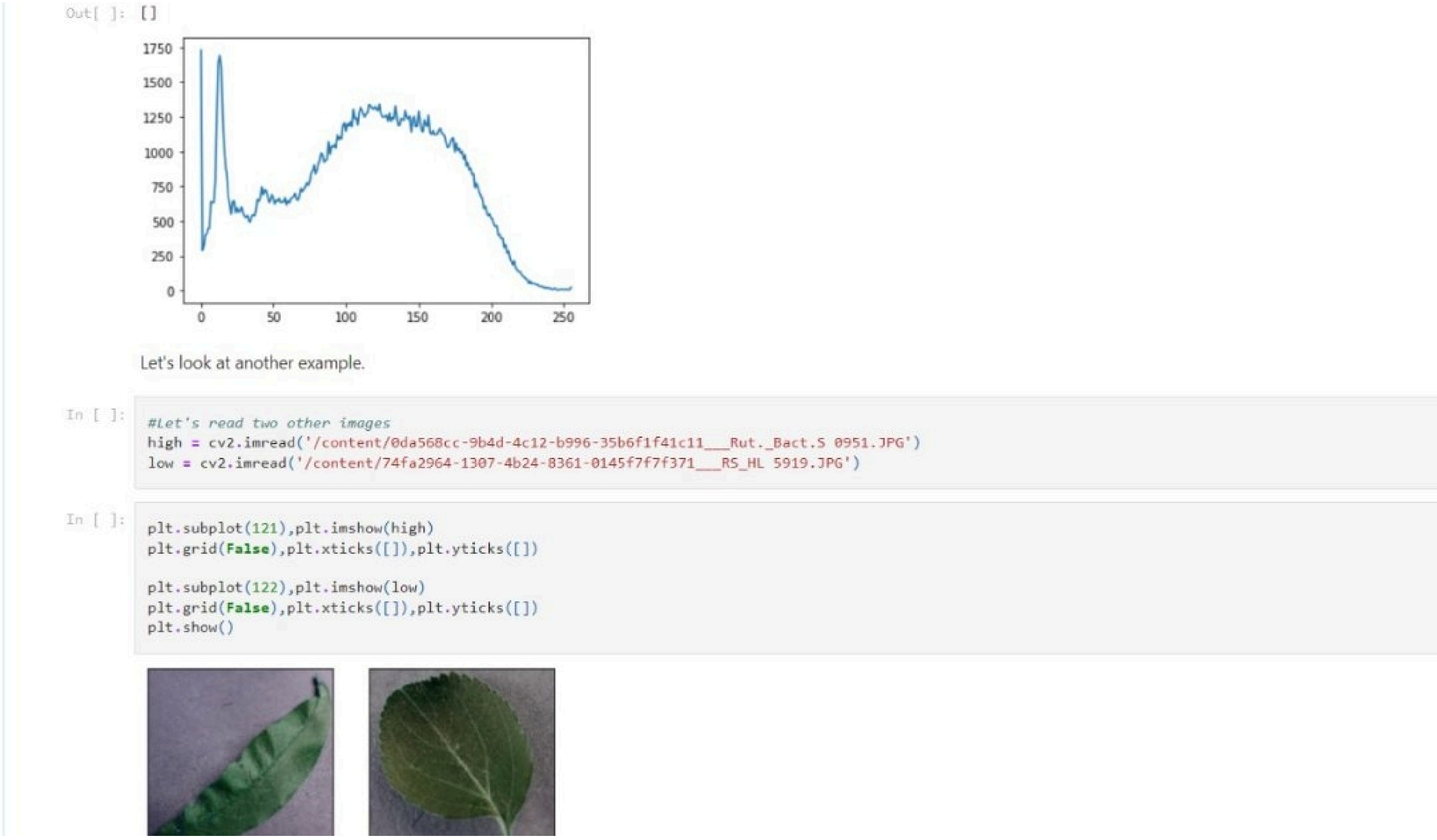
For example, if input is grayscale image,its value is [0].For color image,you can pass[0],[1]or[2]to calculate histogram of blue,green or red channel respectively.mask : mask image. To find histogranof full image,it is given as "None".But if you want to find histogram of particular region of image, you have to create a mask image for that and give it as mask.(I will show an example later.)histSize : this represents our BIN count.Need to be given in square brackets.For full scale,we pass[256].ranges : this is our RANGE.Normally,it is [0,256].



```
In [ ]: hist = cv2.calcHist([img],[0],None,[50],[0,256])

        #different methods for displaying a histogram
        plt.bar(range(50),hist.ravel())
        plt.title('Histogram of the airplane image')
        plt.xlabel('Gray values')
        plt.ylabel('Frequency')
```

```
Out[ ]: Text(0, 0.5, 'Frequency')
```

```
In [ ]: #Another method
        hist,bins = np.histogram(img.ravel(),256,[0,256])
        plt.plot(hist)
```

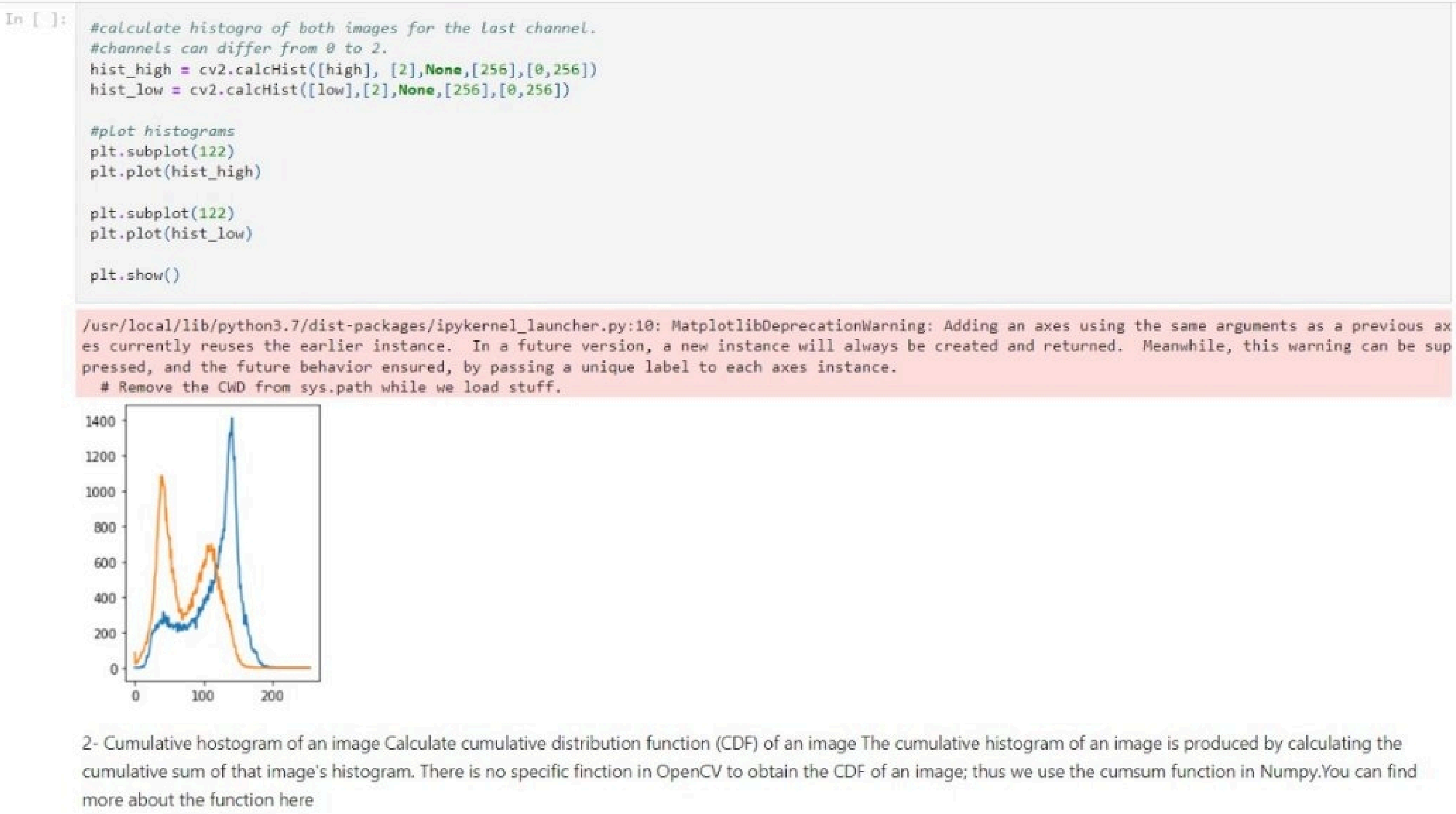


```
Out[ ]: []
```

Let's look at another example.

```
In [ ]:
#Let's read two other images
high = cv2.imread('/content/0da568cc-9b4d-4c12-b996-35b6f1f41c11___Rut._Bact.S 0951.JPG')
low = cv2.imread('/content/74fa2964-1307-4b24-8361-0145f7f7f371___RS_HL 5919.JPG')
```

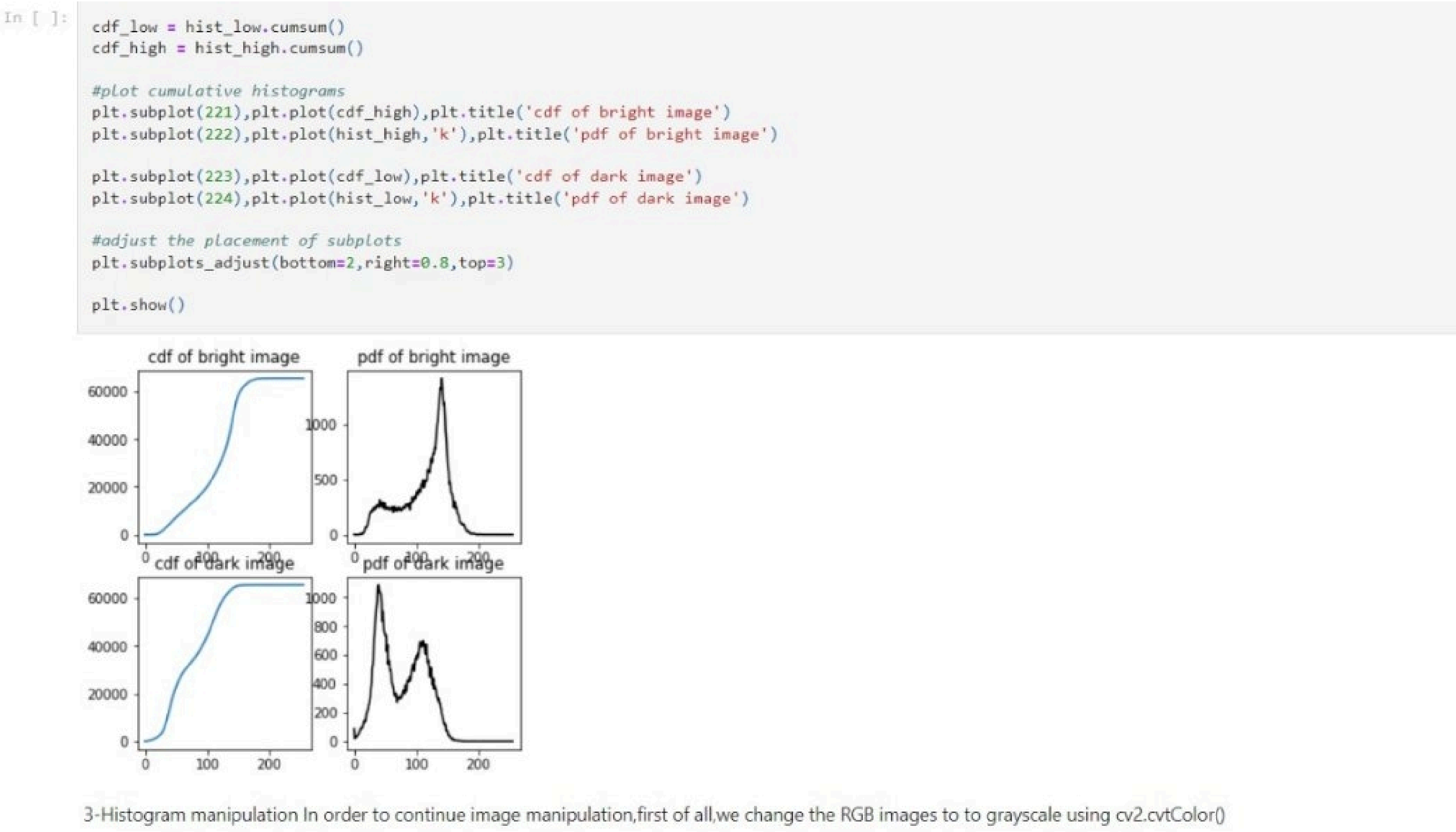
```
In [ ]:
plt.subplot(121),plt.imshow(high)
plt.grid(False),plt.xticks([]),plt.yticks([])

plt.subplot(122),plt.imshow(low)
plt.grid(False),plt.xticks([]),plt.yticks([])
plt.show()
```



```
In [ ]:  #calculate histogra of both images for the last channel.
         #channels can differ from 0 to 2.
         hist_high = cv2.calcHist([high], [2],None,[256],[0,256])
         hist_low = cv2.calcHist([low],[2],None,[256],[0,256])

         #plot histograms
         plt.subplot(122)
         plt.plot(hist_high)

         plt.subplot(122)
         plt.plot(hist_low)

         plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:10: MatplotlibDeprecationWarning: Adding an axes using the same arguments as a previous ax
es currently reuses the earlier instance.  In a future version, a new instance will always be created and returned.  Meanwhile, this warning can be sup
pressed, and the future behavior ensured, by passing a unique label to each axes instance.
  # Remove the CWD from sys.path while we load stuff.
```

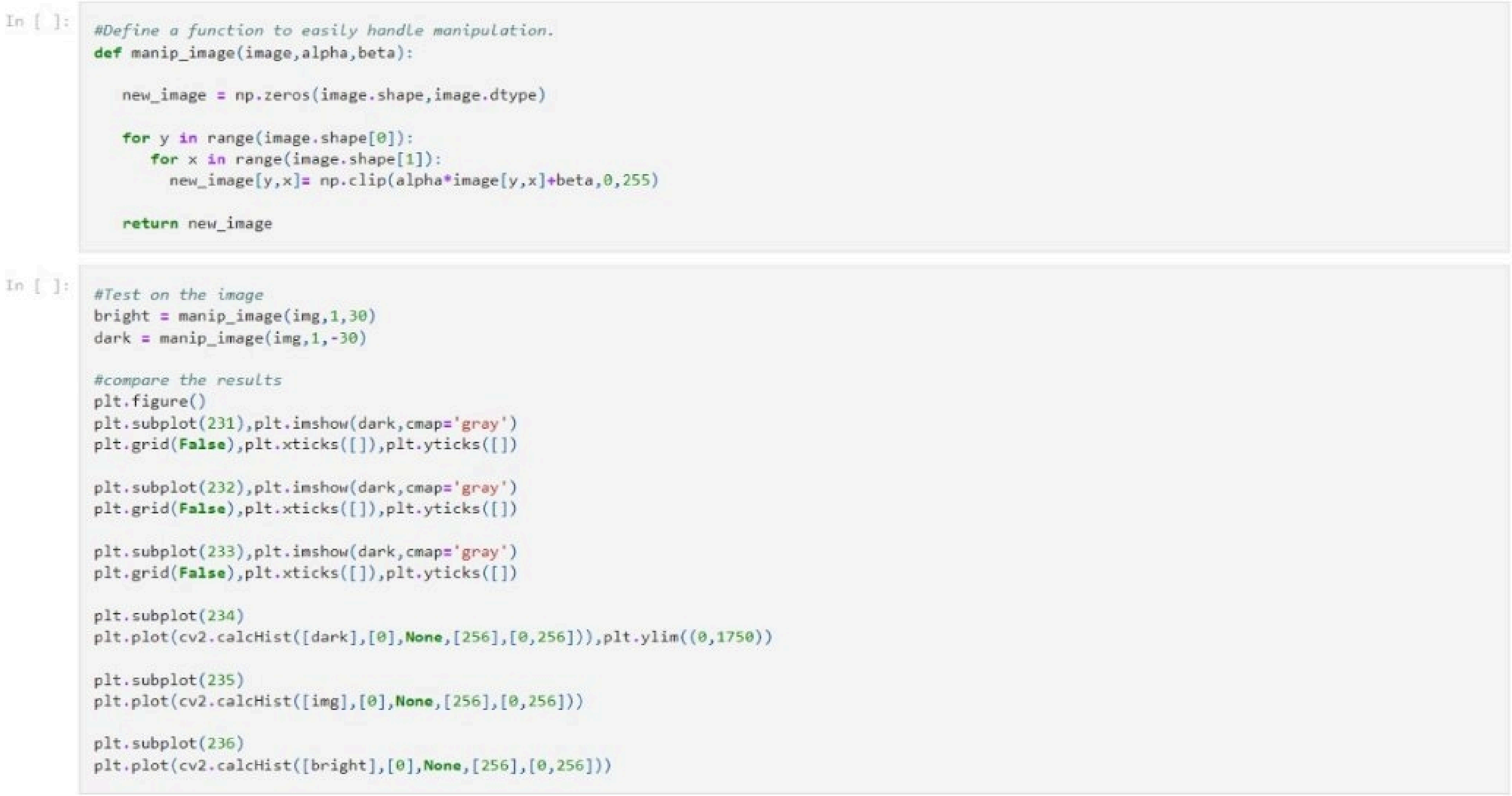
2- Cumulative hostogram of an image Calculate cumulative distribution function (CDF) of an image The cumulative histogram of an image is produced by calculating the cumulative sum of that image's histogram. There is no specific finction in OpenCV to obtain the CDF of an image; thus we use the cumsum function in Numpy.You can find more about the function here



In [ ]:

```
cdf_low = hist_low.cumsum()
cdf_high = hist_high.cumsum()

#plot cumulative histograms
plt.subplot(221),plt.plot(cdf_high),plt.title('cdf of bright image')
plt.subplot(222),plt.plot(hist_high,'k'),plt.title('pdf of bright image')

plt.subplot(223),plt.plot(cdf_low),plt.title('cdf of dark image')
plt.subplot(224),plt.plot(hist_low,'k'),plt.title('pdf of dark image')

#adjust the placement of subplots
plt.subplots_adjust(bottom=2,right=0.8,top=3)

plt.show()
```

3-Histogram manipulation In order to continue image manipulation,first of all,we change the RGB images to to grayscale using cv2.cvtColor()

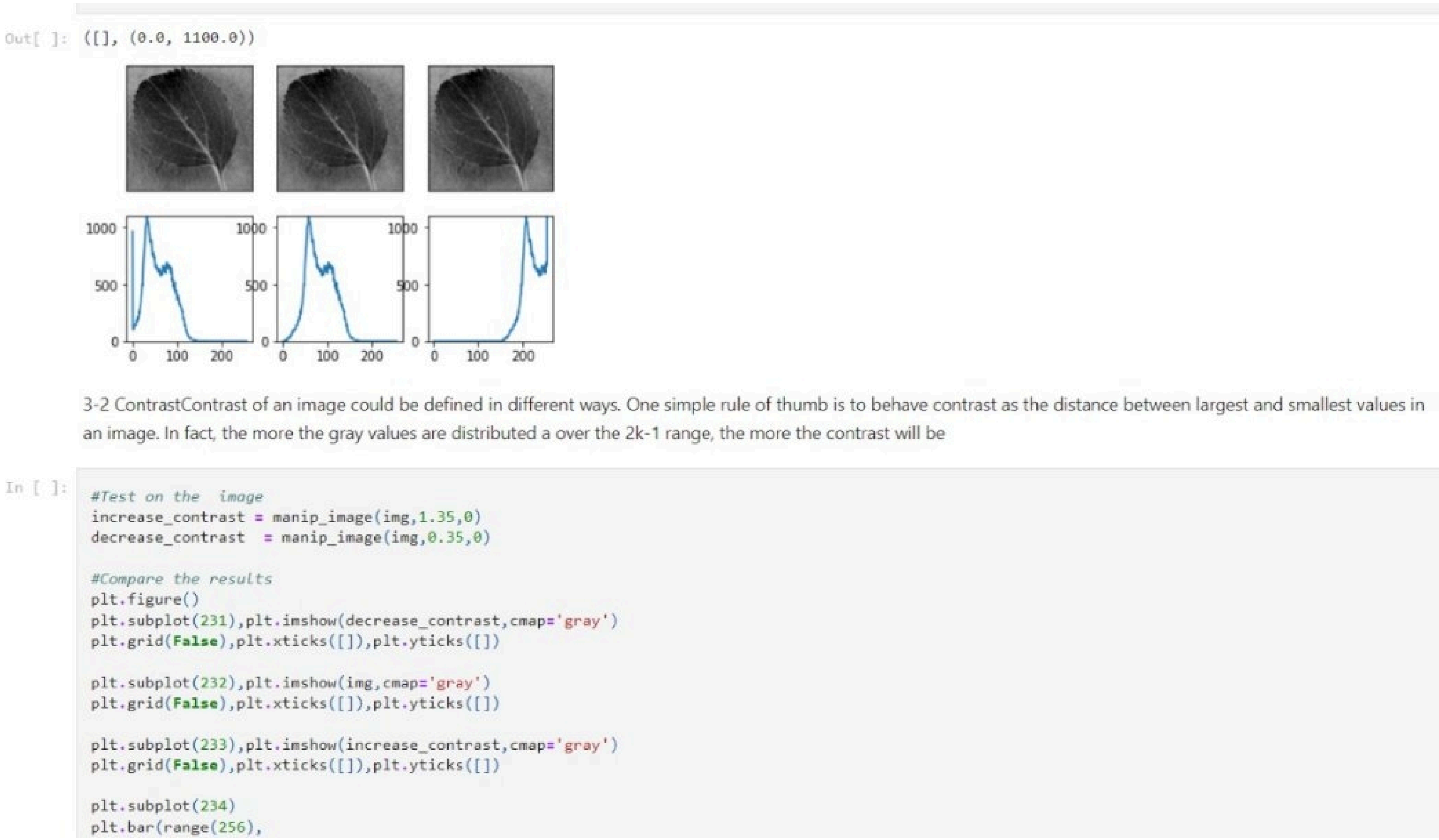


In [ ]:

```
#Define a function to easily handle manipulation.
def manip_image(image,alpha,beta):

   new_image = np.zeros(image.shape,image.dtype)

   for y in range(image.shape[0]):
      for x in range(image.shape[1]):
        new_image[y,x]= np.clip(alpha*image[y,x]+beta,0,255)

   return new_image
```

In [ ]:

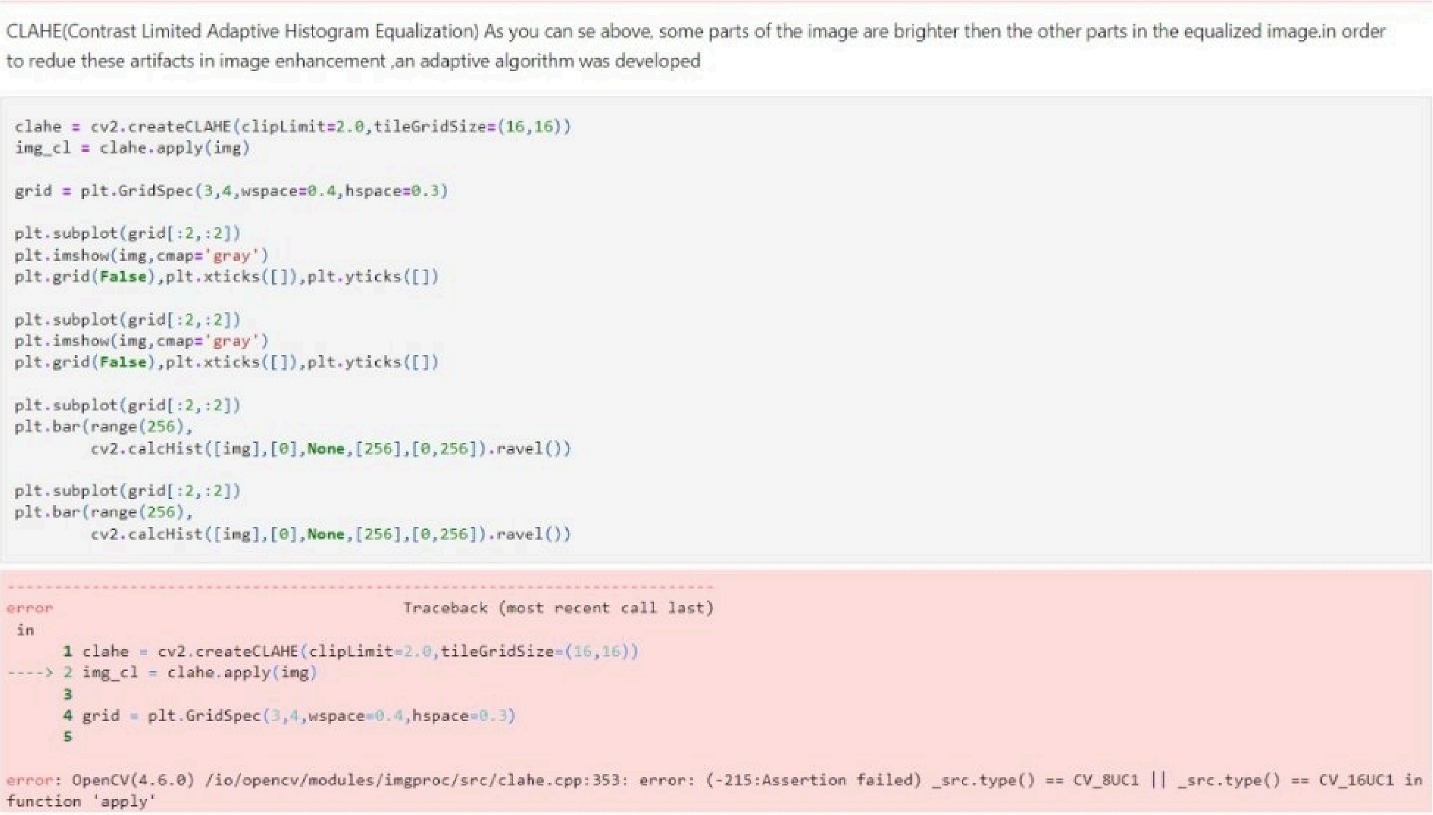
```
#Test on the image
bright = manip_image(img,1,30)
dark = manip_image(img,1,-30)

#compare the results
plt.figure()
plt.subplot(231),plt.imshow(dark,cmap='gray')
plt.grid(False),plt.xticks([]),plt.yticks([])

plt.subplot(232),plt.imshow(dark,cmap='gray')
plt.grid(False),plt.xticks([]),plt.yticks([])

plt.subplot(233),plt.imshow(dark,cmap='gray')
plt.grid(False),plt.xticks([]),plt.yticks([])

plt.subplot(234)
plt.plot(cv2.calcHist([dark],[0],None,[256],[0,256])),plt.ylim((0,1750))

plt.subplot(235)
plt.plot(cv2.calcHist([img],[0],None,[256],[0,256]))

plt.subplot(236)
plt.plot(cv2.calcHist([bright],[0],None,[256],[0,256]))
```



```
Out[ ]: ([], (0.0, 1100.0))
```

3-2 ContrastContrast of an image could be defined in different ways. One simple rule of thumb is to behave contrast as the distance between largest and smallest values in an image. In fact, the more the gray values are distributed a over the 2k-1 range, the more the contrast will be

```
In [ ]:
#Test on the  image
increase_contrast = manip_image(img,1.35,0)
decrease_contrast  = manip_image(img,0.35,0)

#Compare the results
plt.figure()
plt.subplot(231),plt.imshow(decrease_contrast,cmap='gray')
plt.grid(False),plt.xticks([]),plt.yticks([])

plt.subplot(232),plt.imshow(img,cmap='gray')
plt.grid(False),plt.xticks([]),plt.yticks([])

plt.subplot(233),plt.imshow(increase_contrast,cmap='gray')
plt.grid(False),plt.xticks([]),plt.yticks([])

plt.subplot(234)
plt.bar(range(256),
```



CLAHE(Contrast Limited Adaptive Histogram Equalization) As you can se above, some parts of the image are brighter then the other parts in the equalized image.in order to redue these artifacts in image enhancement ,an adaptive algorithm was developed

```
In [ ]:
clahe = cv2.createCLAHE(clipLimit=2.0,tileGridSize=(16,16))
img_cl = clahe.apply(img)

grid = plt.GridSpec(3,4,wspace=0.4,hspace=0.3)

plt.subplot(grid[:2,:2])
plt.imshow(img,cmap='gray')
plt.grid(False),plt.xticks([]),plt.yticks([])

plt.subplot(grid[:2,:2])
plt.imshow(img,cmap='gray')
plt.grid(False),plt.xticks([]),plt.yticks([])

plt.subplot(grid[:2,:2])
plt.bar(range(256),
        cv2.calcHist([img],[0],None,[256],[0,256]).ravel())

plt.subplot(grid[:2,:2])
plt.bar(range(256),
        cv2.calcHist([img],[0],None,[256],[0,256]).ravel())
```

```
---------------------------------------------------------------------------
error                                     Traceback (most recent call last)
 in
      1 clahe = cv2.createCLAHE(clipLimit=2.0,tileGridSize=(16,16))
----> 2 img_cl = clahe.apply(img)
      3 
      4 grid = plt.GridSpec(3,4,wspace=0.4,hspace=0.3)
      5 

error: OpenCV(4.6.0) /io/opencv/modules/imgproc/src/clahe.cpp:353: error: (-215:Assertion failed) _src.type() == CV_8UC1 || _src.type() == CV_16UC1 in function 'apply'
```