

19110413_VongVinhPhu_ DIP Lab01

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1 Images Processing and Analysis LAB 1

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```
[ ]: import numpy as np
import pandas as pd
import cv2
from matplotlib import pyplot as plt
from pylab import imread
from skimage.color import rgb2gray
```

```
[ ]: from matplotlib import pyplot as plt

def imshow(ImageData, LabelData, rows, cols, gridType=False):

    # Convert ImageData and LabelData to List
    ImageArray = list(ImageData)
    LabelArray = list(LabelData)
    if(rows == 1 & cols == 1):
        fig = plt.figure(figsize=(20, 20))
    else:
        fig = plt.figure(figsize=(cols*8, rows*5))
    for i in range(1, cols * rows + 1):
        fig.add_subplot(rows, cols, i)
        image = ImageArray[i - 1]
    # If the channel number is less than 3, we display as grayscale image
    # otherwise, we display as color image
        if (len(image.shape) < 3):
            plt.imshow(image, plt.cm.gray)
            plt.grid(gridType)
        else:
            plt.imshow(image)
            plt.grid(gridType)
        plt.title(LabelArray[i - 1])
plt.show()
```

```

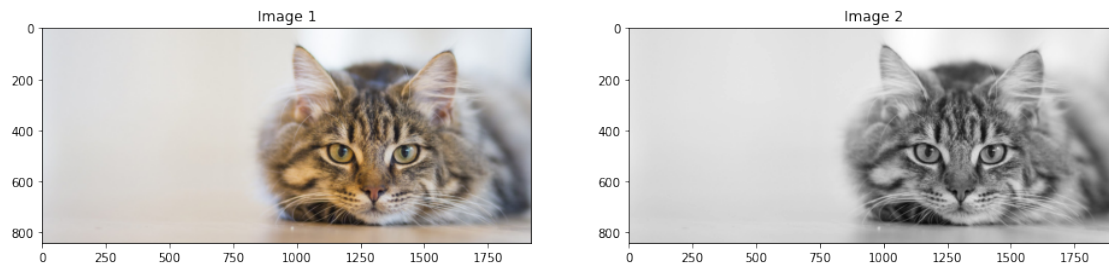
def ShowThreeImages(IM1, IM2, IM3):
    imshow([IM1, IM2, IM3], ["Image 1", "Image 2", "Image 3"], 1, 3)
def ShowTwoImages(IM1, IM2):
    imshow([IM1, IM2], ["Image 1", "Image 2"], 1, 2)
def ShowOneImage(IM):
    imshow([IM], ["Image"], 1, 1)
def ShowListImages(listImage, row, col):
    listCaption = []
    for i in range(len(listImage)):
        listCaption.append(str(i))
    imshow(listImage, listCaption, row, col)

```

```

[ ]: # Read Image
image_color = imread("My Pictures/images2.jpg")
# Convert Image into Gray
image_gray = cv2.cvtColor(image_color, cv2.COLOR_RGB2GRAY)
# Display Image
ShowTwoImages(image_color, image_gray)

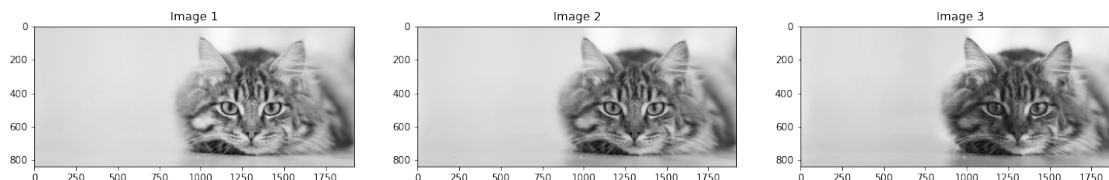
```

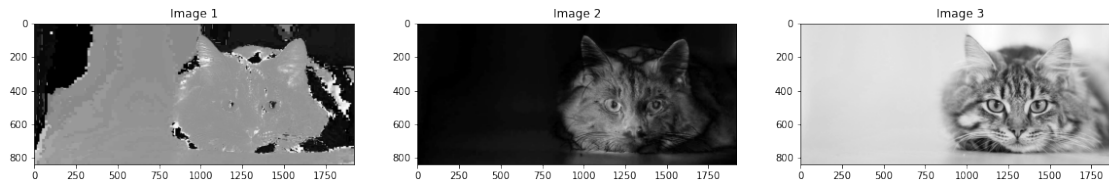


```

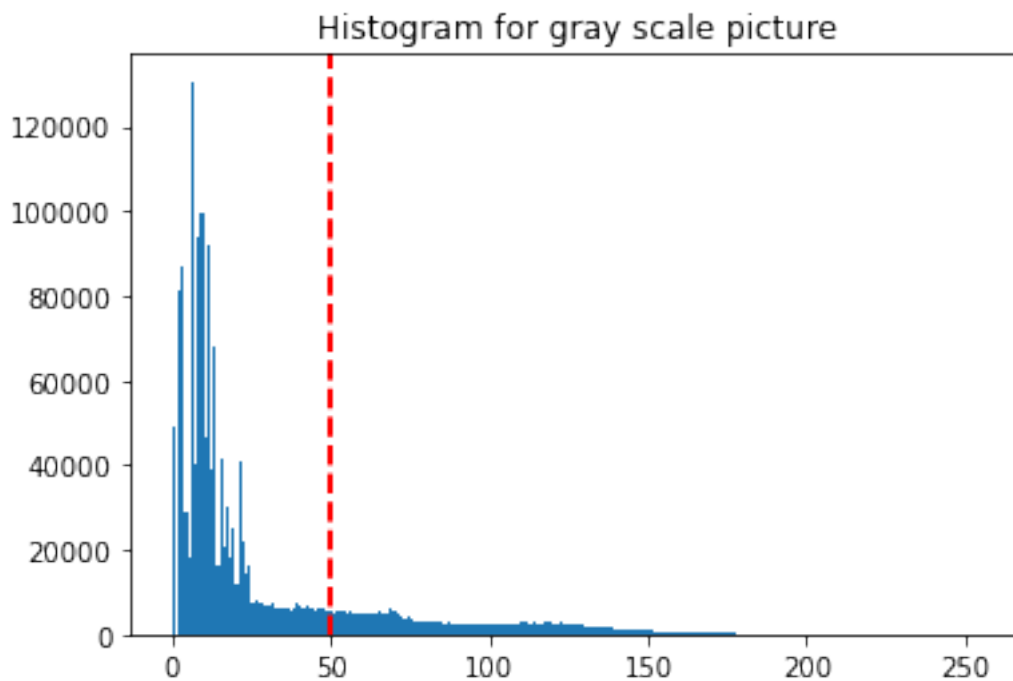
[ ]: # Convert Image into HSV color spaces
image_hsv = cv2.cvtColor(image_color, cv2.COLOR_BGR2HSV)
# Show each channel R , G and B
ShowThreeImages(image_color[:, :, 0],
                 image_color[:, :, 1], image_color[:, :, 2])
# Show each channel H , S and V
ShowThreeImages(image_hsv[:, :, 0], image_hsv[:, :, 1], image_hsv[:, :, 2])

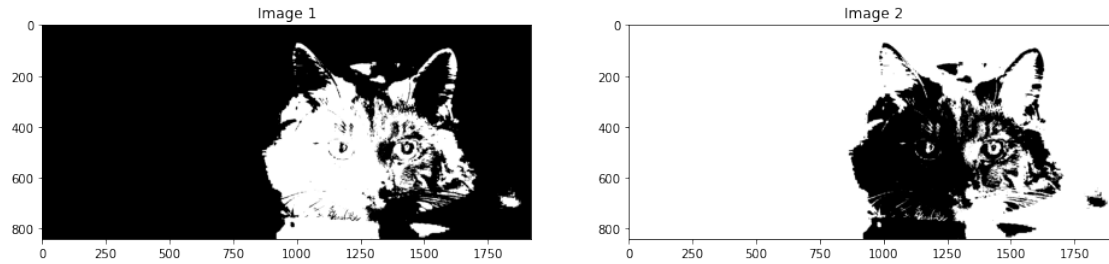
```



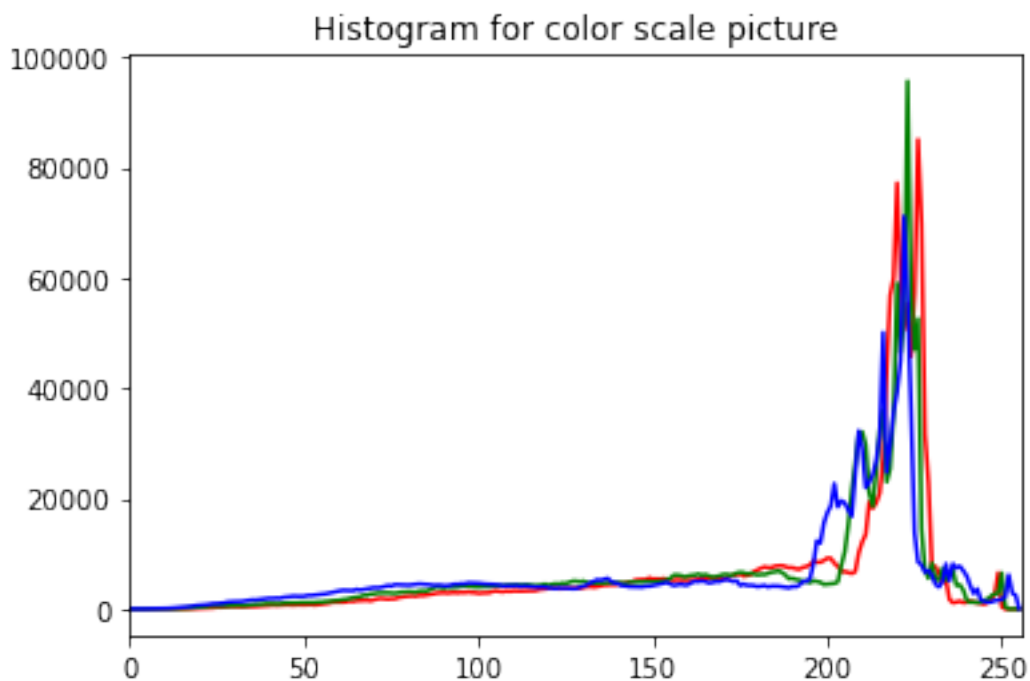


```
[ ]: hue_img = image_hsv[:, :, 1]
hue_threshold = 50
# Show Histogram of Hue Channel
hist = cv2.calcHist([hue_img], [0], None, [256], [0, 256])
plt.hist(hue_img.ravel(), 256, [0, 256])
plt.axvline(x=hue_threshold, color='r', linestyle='dashed', linewidth=2)
plt.title('Histogram for gray scale picture')
plt.show()
# Use threshold to segment object by histogram
hue_binary01 = hue_img > hue_threshold
hue_binary02 = 1 - hue_binary01
ShowTwoImages(hue_binary01, hue_binary02)
```



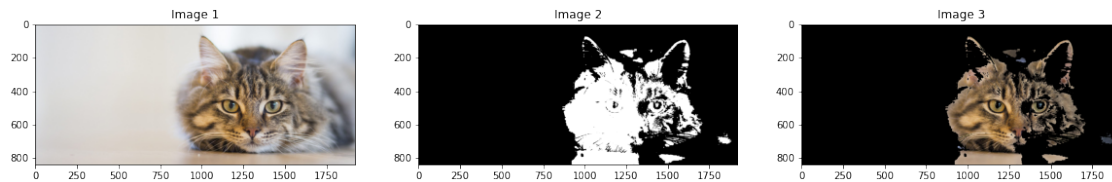


```
[ ]: color = ('r', 'g', 'b')
for channel, col in enumerate(color):
    histr = cv2.calcHist([image_color], [channel], None, [256], [0, 256])
    plt.plot(histr, color=col)
    plt.xlim([0, 256])
plt.title('Histogram for color scale picture')
plt.show()
```

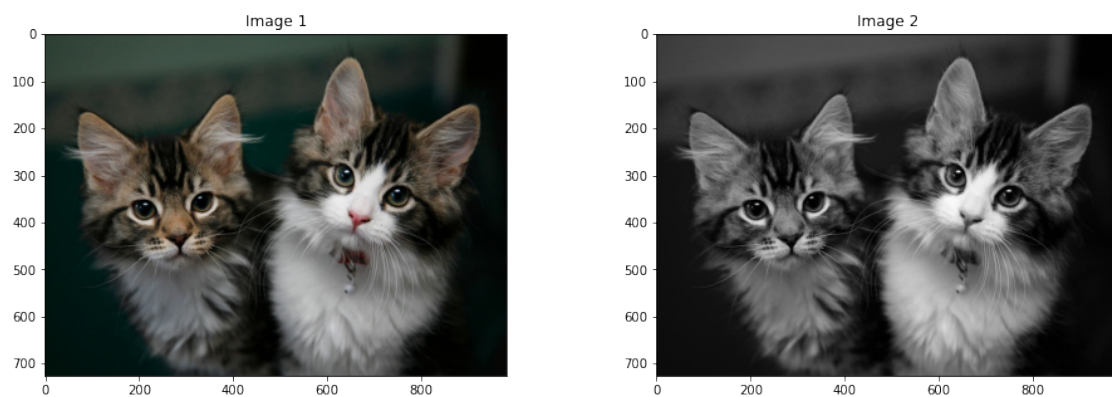


```
[ ]: def SegmentColorImageByMask(IM, Mask):
    Mask = Mask.astype(np.uint8)
    result = cv2.bitwise_and(IM, IM, mask=Mask)
    return result
```

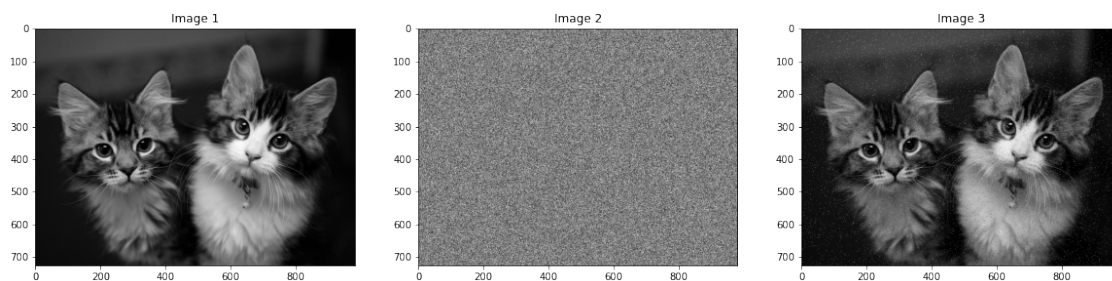
```
[ ]: hue_binary01_rgb = SegmentColorImageByMask(image_color, hue_binary01)
ShowThreeImages(image_color, hue_binary01, hue_binary01_rgb)
```



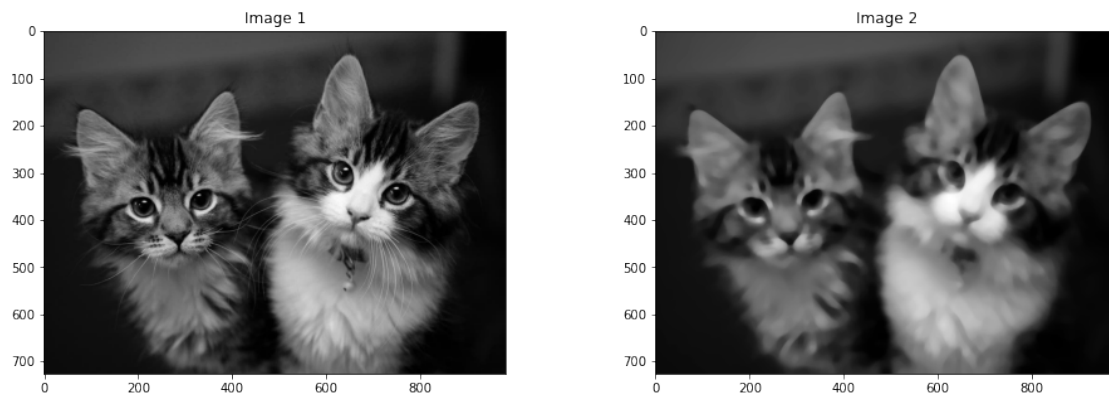
```
[ ]: # Read Image
image_color = imread("My Pictures/images.jpg")
# Convert Image into Gray
image_gray = cv2.cvtColor(image_color, cv2.COLOR_RGB2GRAY)
# Display Image
ShowTwoImages(image_color, image_gray)
```



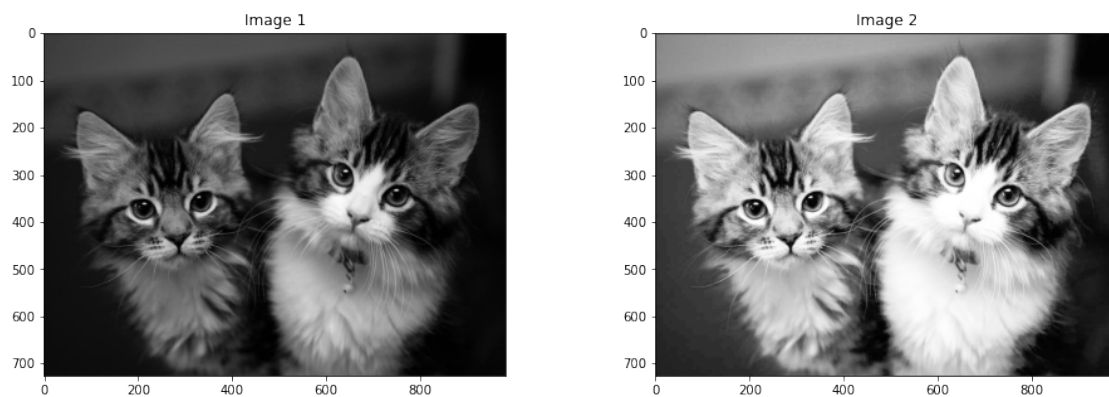
```
[ ]: noise = np.random.random(image_gray.shape)
image_noise = image_gray.copy()
image_noise[noise > 0.99] = 255
image_noise[noise < 0.01] = 0
ShowThreeImages(image_gray, noise, image_noise)
```



```
[ ]: # Create Blurred Image
from skimage.filters.rank import median
from skimage.morphology import disk
image_blurred = median(image_gray, disk(10))
ShowTwoImages(image_gray, image_blurred)
```

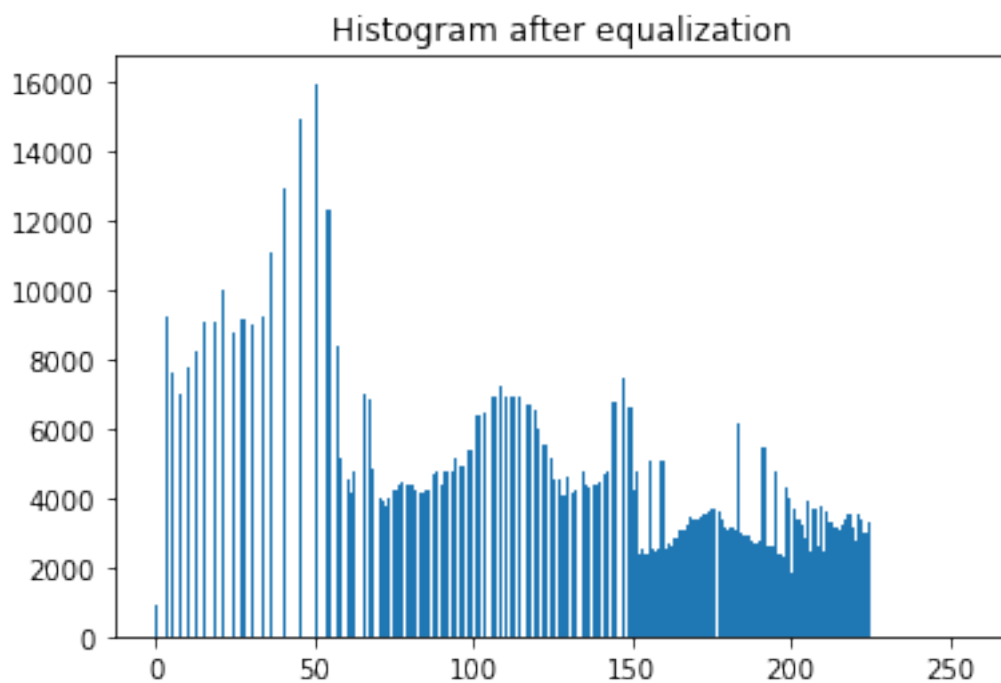
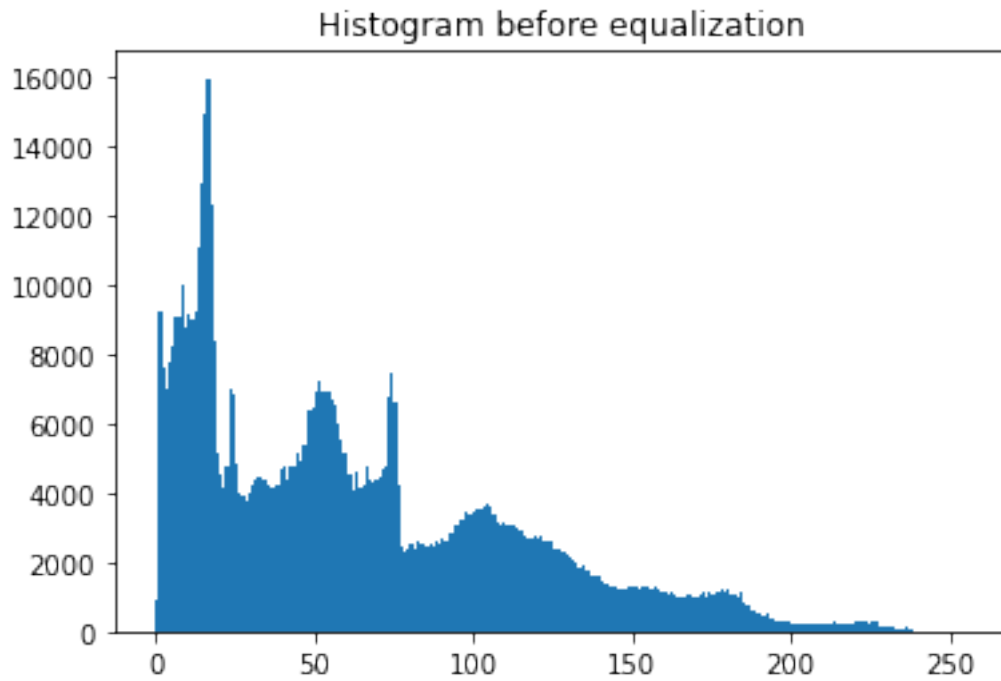


```
[ ]: from skimage import data, exposure
image_equalization = exposure.equalize_hist(image_gray)
image_equalization = np.float32(image_equalization * 225)
ShowTwoImages(image_gray, image_equalization)
```



```
[ ]: hist = cv2.calcHist([image_gray], [0], None, [256], [0, 256])
plt.hist(image_gray.ravel(), 256, [0, 256])
plt.title('Histogram before equalization')
plt.show()
```

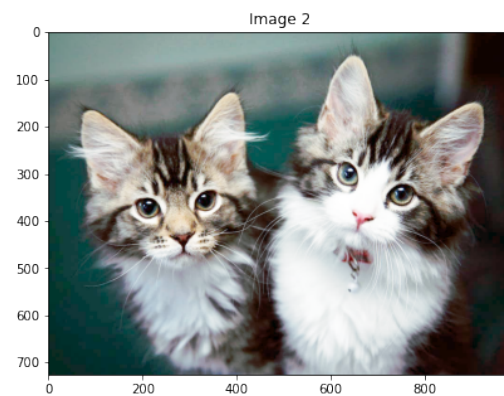
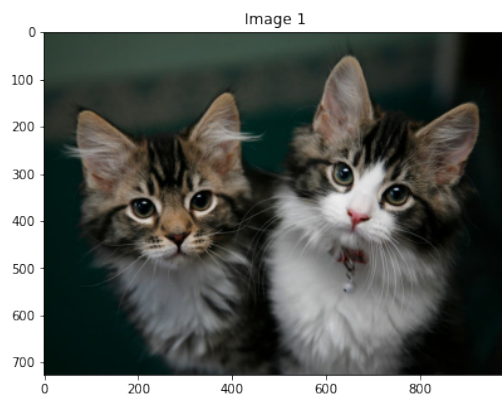
```
hist = cv2.calcHist([image_equalization], [0], None, [256], [0, 256])  
plt.hist(image_equalization.ravel(), 256, [0, 256])  
plt.title('Histogram after equalization')  
plt.show()
```



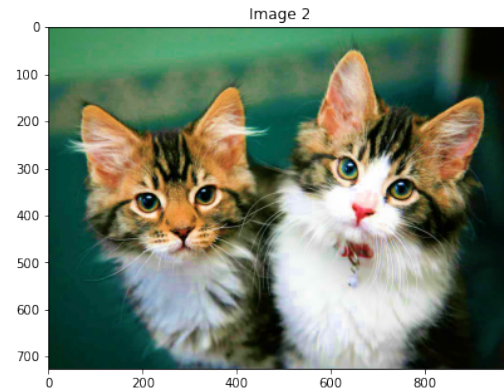
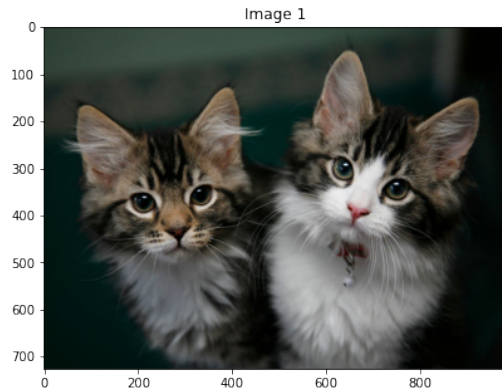
```
[ ]: def histogram_equalize(img):

    r, g, b = cv2.split(img)
    red = cv2.equalizeHist(r)
    green = cv2.equalizeHist(g)
    blue = cv2.equalizeHist(b)
    return cv2.merge((red, green, blue))
```

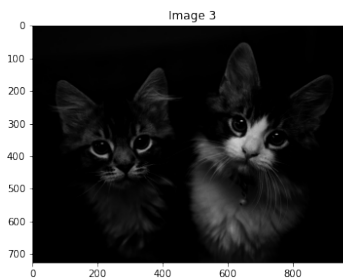
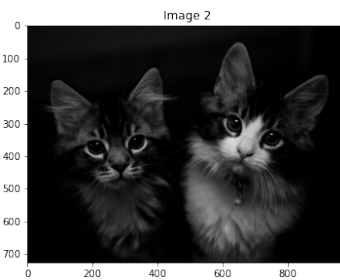
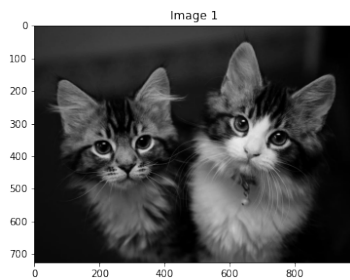
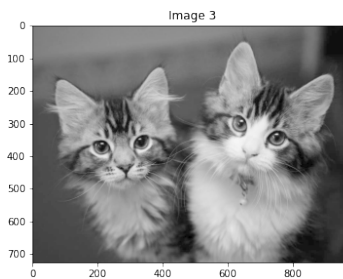
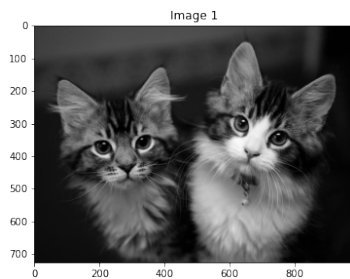
```
[ ]: image_equalization_color = histogram_equalize(image_color)
ShowTwoImages(image_color, image_equalization_color)
```



```
[ ]: # Convert Image into HSV color spaces
image_hsv = cv2.cvtColor(image_color, cv2.COLOR_RGB2HSV)
# Apply histogram equalization
channel = 1
image_hsv[:, :, channel] = cv2.equalizeHist(image_hsv[:, :, channel])
channel = 2
image_hsv[:, :, channel] = cv2.equalizeHist(image_hsv[:, :, channel])
# Convert to RGB
image_enhanced = cv2.cvtColor(image_hsv, cv2.COLOR_HSV2RGB)
ShowTwoImages(image_color, image_enhanced)
```

```
[ ]: image_hsv = cv2.cvtColor(image_color, cv2.COLOR_RGB2HSV)
img = image_hsv[:, :, 2]
gamma = [0.1, 0.5, 1.2, 2.2, 3.2]
gamma_corrected_01 = np.array(255*(img / 255) ** gamma[0], dtype='uint8')
gamma_corrected_02 = np.array(255*(img / 255) ** gamma[1], dtype='uint8')
gamma_corrected_03 = np.array(255*(img / 255) ** gamma[2], dtype='uint8')
gamma_corrected_04 = np.array(255*(img / 255) ** gamma[3], dtype='uint8')
gamma_corrected_05 = np.array(255*(img / 255) ** gamma[4], dtype='uint8')
ShowThreeImages(image_gray, gamma_corrected_01, gamma_corrected_02)
ShowThreeImages(gamma_corrected_03, gamma_corrected_04, gamma_corrected_05)
```



```
[ ]: channel = 2
image_hsv_01 = image_hsv.copy()
image_hsv_01[:, :, 2] = gamma_corrected_01
image_enhanced_01 = cv2.cvtColor(image_hsv_01, cv2.COLOR_HSV2RGB)
image_hsv_02 = image_hsv.copy()
image_hsv_02[:, :, 2] = gamma_corrected_02
image_enhanced_02 = cv2.cvtColor(image_hsv_02, cv2.COLOR_HSV2RGB)
image_hsv_03 = image_hsv.copy()
image_hsv_03[:, :, 2] = gamma_corrected_03
image_enhanced_03 = cv2.cvtColor(image_hsv_03, cv2.COLOR_HSV2RGB)
image_hsv_04 = image_hsv.copy()
image_hsv_04[:, :, 2] = gamma_corrected_04
image_enhanced_04 = cv2.cvtColor(image_hsv_04, cv2.COLOR_HSV2RGB)
image_hsv_05 = image_hsv.copy()
image_hsv_05[:, :, 2] = gamma_corrected_05
image_enhanced_05 = cv2.cvtColor(image_hsv_05, cv2.COLOR_HSV2RGB)
ShowThreeImages(image_color, image_enhanced_01, image_enhanced_02)
ShowThreeImages(image_enhanced_03, image_enhanced_04, image_enhanced_05)
```



```
[ ]: def pixelValTransformation(pix, r1, s1, r2, s2):

    if (0 <= pix and pix <= r1):
        return (s1 / r1)*pix
    elif (r1 < pix and pix <= r2):
```

```

        return ((s2 - s1)/(r2 - r1)) * (pix - r1) + s1
    else:
        return ((255 - s2)/(255 - r2)) * (pix - r2) + s2

```

```

[ ]: image_hsv = cv2.cvtColor(image_color, cv2.COLOR_RGB2HSV)
     image_hsv_value = image_hsv[:, :, 2]

     hist = cv2.calcHist([image_hsv_value], [0], None, [256], [0, 256])
     plt.hist(image_hsv_value.ravel(), 256, [0, 256])
     plt.title('Histogram of Image')
     plt.show()

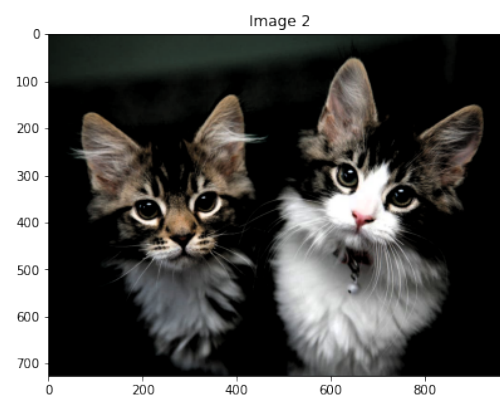
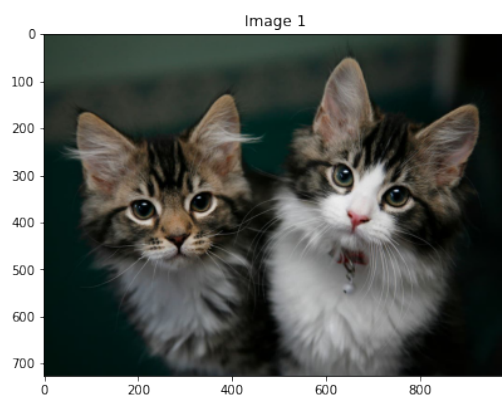
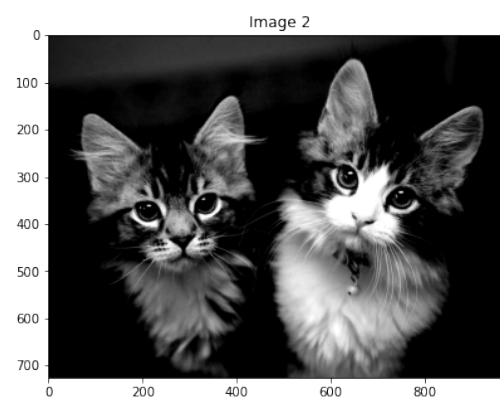
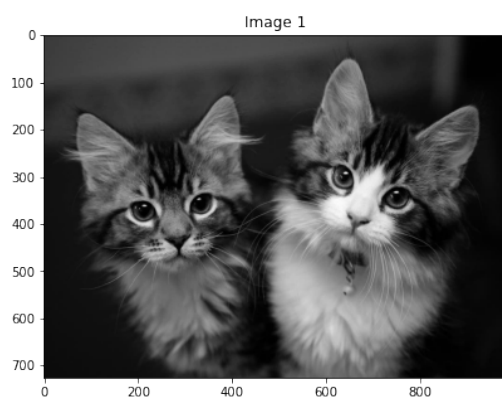
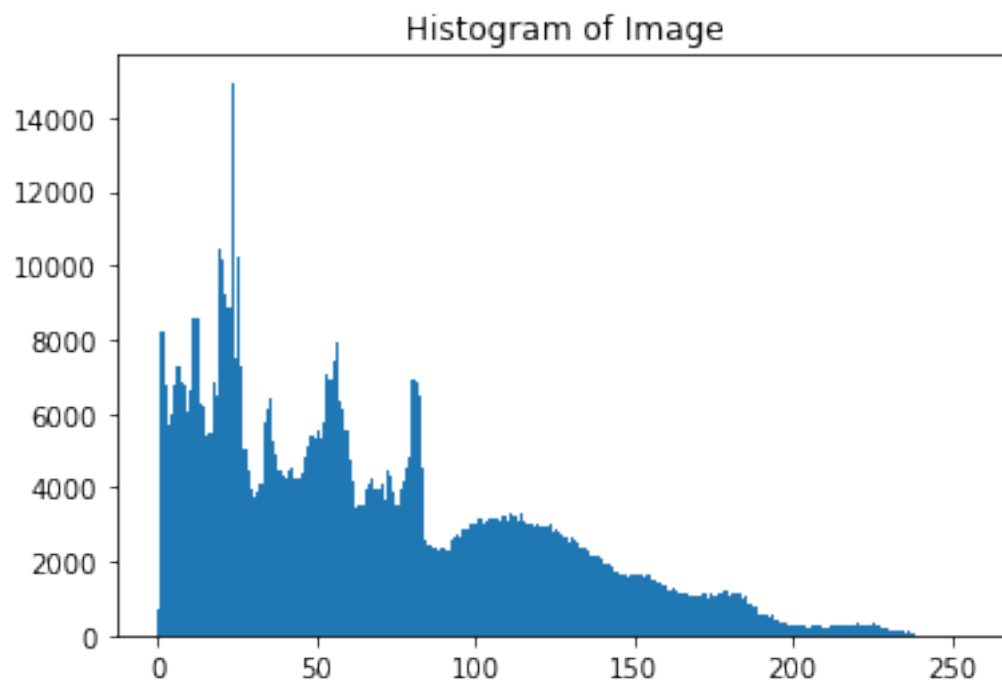
     # Define parameters.
     r1 = 50
     s1 = 0
     r2 = 200
     s2 = 255

     # Vectorize the function to apply it to each value in the Numpy array.
     pixelVal_vec = np.vectorize(pixelValTransformation)
     # Apply contrast stretching.
     contrast_stretched = pixelVal_vec(image_hsv_value, r1, s1, r2, s2)

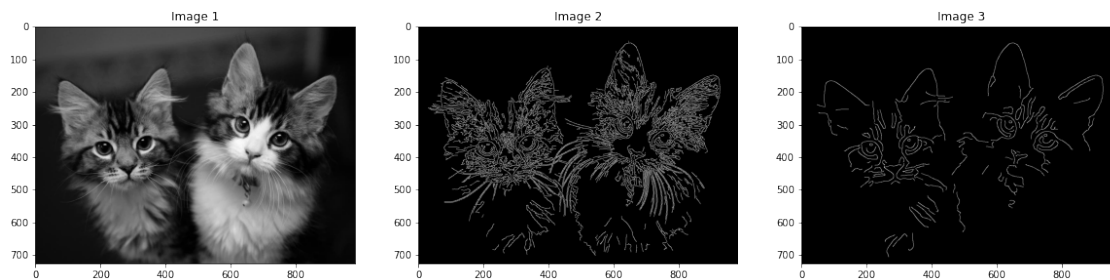
     image_hsv[:, :, 2] = contrast_stretched
     image_enhanced = cv2.cvtColor(image_hsv, cv2.COLOR_HSV2RGB)

     ShowTwoImages(image_gray, contrast_stretched)
     ShowTwoImages(image_color, image_enhanced)

```

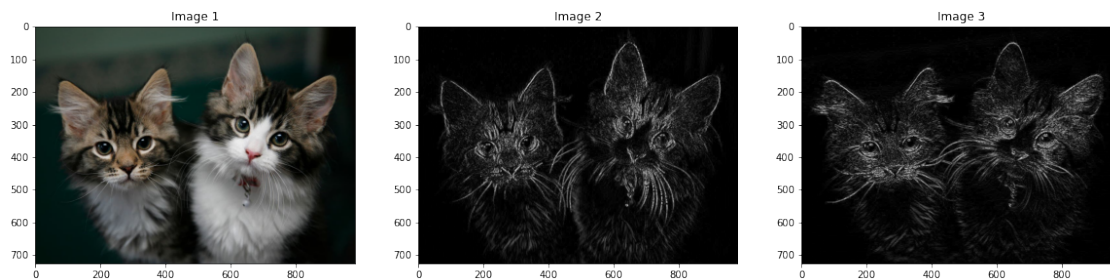


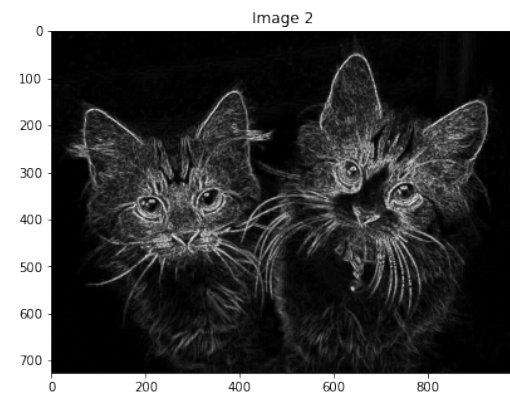
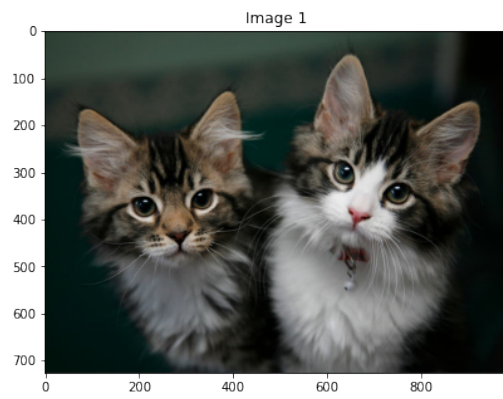
```
[ ]: from skimage import feature
# sigma help to remove the noisy image in edge detection
image_edges_01 = feature.canny(image_gray)
image_edges_02 = feature.canny(image_gray, sigma=3)
ShowThreeImages(image_gray, image_edges_01, image_edges_02)
```



```
[ ]: #Image processing Gradients and Edge Detection (Additional)
sobelx= cv2.Sobel(image_gray,cv2.CV_64F,1,0) #find edge in Horizontal axis
sobely= cv2.Sobel(image_gray,cv2.CV_64F,0,1) #find edge in vertical axis

sobelx = np.uint8(np.absolute(sobelx))
sobely = np.uint8(np.absolute(sobely))
ShowThreeImages(image_color,sobelx,sobely)
sobel = cv2.bitwise_or(sobelx,sobely) #Edge Detection
ShowTwoImages(image_color,sobel)
```





[]: