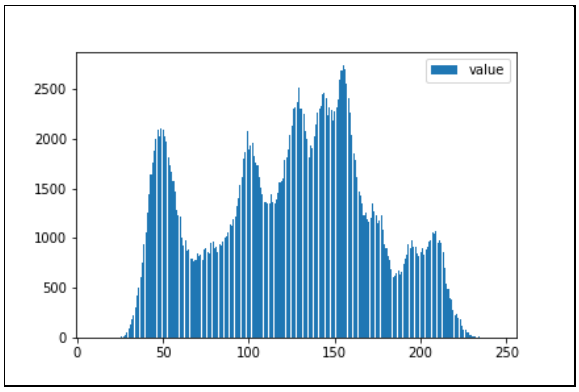
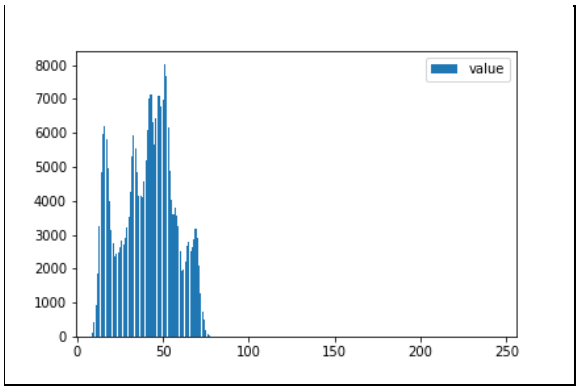
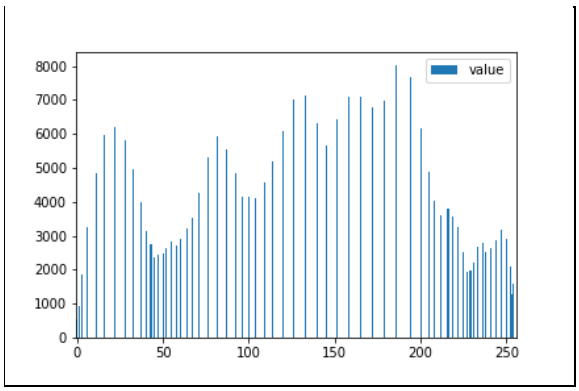
Homework 3 R08921005 黃國郡

Ans

part	image	histogram
(a) original		
(b) image with intensity divided by 3		
(c) image after applying histogram equalization to (b)		

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Description

1. 圖片及 csv 檔位於資料夾中
2. 本次作業使用 python，編譯器採用 spyder
3. Source Code [R08921005_HW3_ver1.py]說明如下

```python
from PIL import Image
import numpy as np
import pandas as pd

lena_pic = Image.open("Lena.bmp")
original_lena_array = np.array(lena_pic)
height, width = original_lena_array.shape


def getHistogram(picArray, name):
    histogram = np.zeros(256)
    for r in picArray:
        for pixel in r:
            histogram[pixel] += 1
    df = pd.DataFrame(histogram, columns=['value'])
    df.to_csv(name+'.csv')
    ax1 = df.plot.bar(y='value', rot=0, width=0.8)
    ticks = ax1.xaxis.get_ticklocs()
    ticklabels = [l.get_text() for l in ax1.xaxis.get_ticklabels()]
    ax1.xaxis.set_ticks(ticks[::50])
    ax1.xaxis.set_ticklabels(ticklabels[::50])
    fig = ax1.get_figure()
    fig.savefig(name+'_histogram.png')
    return(histogram)
```

把原圖讀成 array

定義一個可以畫 histogram 的副程式

建立一個 256histogram 矩陣存放每個 pixel 數量

將 histogram 資料存入 panda dataframe 在寫入 csv

設定每一個座標 label 間距，然後將 histogram 存起來

```python
# (a)    original image and its histogram
name = 'original_lena'
getHistogram(original_lena_array, name)

# (b)    image with intensity divided by 3 and its histogram
name = 'dark_lena'
dark_lena_array = original_lena_array.copy()
for row in range(height):
    for col in range(width):
        dark_lena_array[row, col] = original_lena_array[row, col]//3
Image.fromarray(dark_lena_array.astype(np.uint8)).save(name+'.bmp')
dark_lena_histogram = getHistogram(dark_lena_array, name)

# (c)    image after applying histogram equalization to (b) and its histogram
name = 'histeq_lena'
histeq_lena_array = dark_lena_array.copy()
transformTable = np.zeros(256)
for ii in range(len(transformTable)):
    transformTable[ii] = int(
        255 * np.sum(dark_lena_histogram[0:ii + 1]) / (width * height))

for row in range(height):
    for col in range(width):
        histeq_lena_array[row, col] = transformTable[dark_lena_array[row, col]]
Image.fromarray(histeq_lena_array.astype(np.uint8)).save(name+'.bmp')
histeq_lena_histogram = getHistogram(histeq_lena_array, name)
```

畫原圖 histogram

先複製原圖 array 到 dark_lena_array 然後取出將每一個 pixel 將值除 3，並將之存入 dark_lena.bmp，然後畫 histogram

將公式 $s_k = 255\sum_{j=0}^{k}\frac{n_j}{n}$ 打成程式碼，每一個強度的 pixel 有對應表放在 transformTable array 裡

將每一個 pixel 所對應的值透過 tramsformTable 改變，獲得 Histogram equation 圖，再將之存入 bmp 檔，畫 histogram