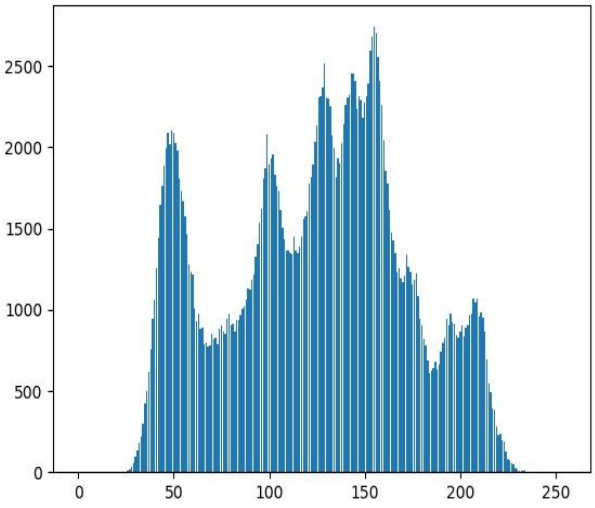
Computer Vision HW3

R08922156 黃劍韜

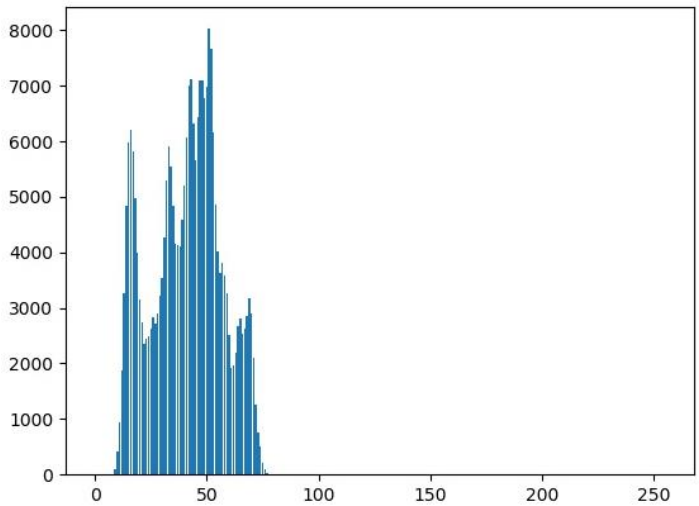
(a) Original image and its histogram




```python
# (a) Original image and its histogram
def img_histogram(image,width,height):
    Y = np.zeros(256)
    X = [i for i in range(256)]
    for i in range(width):
        for j in range(height):
            Y[image[i,j]] += 1
    plt.bar(X,Y)
    plt.savefig('Histogram_image.jpg')
```

第一題的部分，我創建了一個長度為 256 (0~255)的矩陣，去讀取並儲存圖像中每一個像素不同 intensity 的出現次數，然後用 matplotlib 中的 pyplot 套件繪製柱狀圖並儲存。

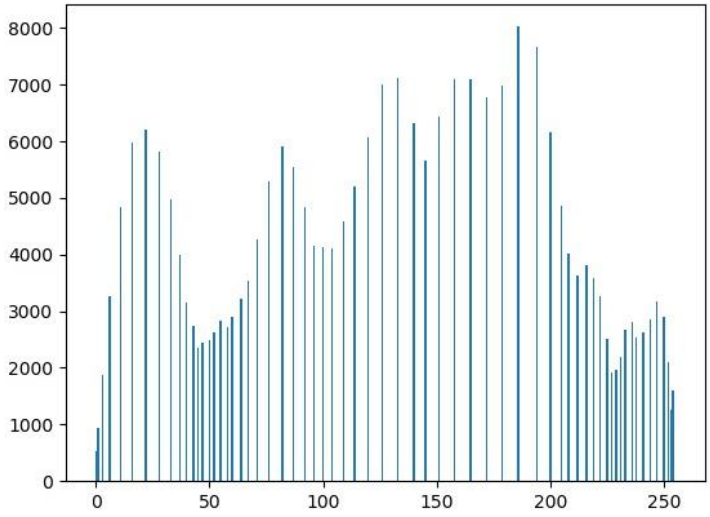
(b) Image with intensity divided by 3 and its histogram




```python
# (b) Image with intensity divided by 3 and its histogram
def img_divide3(image,width,height):
    img = image.copy()
    Y = np.zeros(256)
    X = [i for i in range(256)]
    for i in range(width):
        for j in range(height):
            img[i,j] = int(image[i,j]/3)
            Y[img[i,j]] += 1
    plt.bar(X,Y)
    plt.savefig('Histogram_image_Divide3.jpg')
    return img
```

第二題的部分，我創建了一個長度為 256 (0~255)的矩陣，然後每次讀取的時候，把每個像素的 intensity 都除以 3 然後取整數。然後把計算後每一個像素不同 intensity 的出現次數，然後用 matplotlib 中的 pyplot 套件繪製柱狀圖並儲存。

(c) Image after applying histogram equalization to (b) and its histogram




```python
# (c) Image after applying histogram equalization to (b) and its histogram
def histogram_equalization(image,width,height):
    img = image.copy()
    Y = np.zeros(256)
    Y_2 = np.zeros(256)
    Y_h = np.zeros(256)
    X = [i for i in range(256)]
    for i in range(width):
        for j in range(height):
            img[i,j] = int(image[i,j]/3)
            Y[img[i,j]] += 1

    Y_2[0] = Y[0]
    for i in range(1,256):
        Y_2[i] = Y_2[i-1] + Y[i]
    Y_2 = 255*(Y_2/(width*height))

    for i in range(width):
        for j in range(height):
            img[i,j] = Y_2[img[i,j]]
            Y_h[img[i,j]] += 1

    plt.clf()
    plt.cla()
    plt.bar(X,Y_h)
    plt.savefig('Histogram_histogram_equalization.jpg')
    return img
```

第三題的部分，是在第二題的基礎上利用 Histogram Equalization(公式為$s_k = 255\sum_{j=0}^{k}\frac{n_j}{n}$)將原本的矩陣轉換成新的一個分佈，然後重新去把更新後的圖像，去計算每一個像素不同 intensity 的出現次數，然後用 matplotlib 中的 pyplot 套件繪製柱狀圖並儲存。