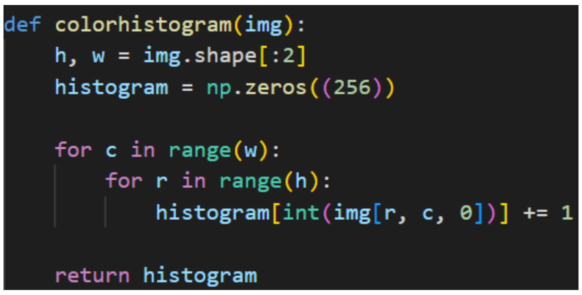
Homework 2　　　　　　　　　　　　網媒所碩一 何明倩 R11944009

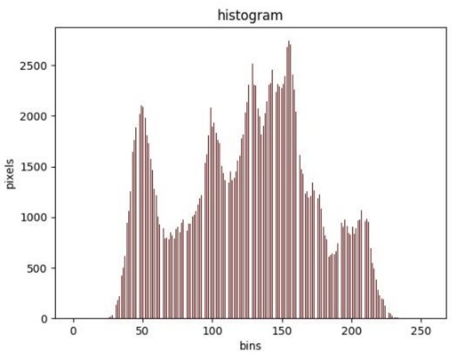
(a) original image and its histogram

- description:
  統計出原圖 0-255 各有多少 pixel
- algorithm:
  拜訪每個 pixel，然後將該 pixel 的亮度類別加 1
- principal code fragment:



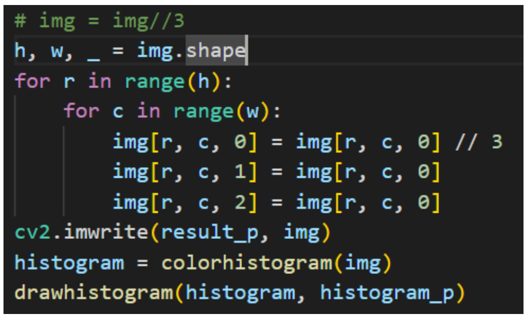
```python
def colorhistogram(img):
    h, w = img.shape[:2]
    histogram = np.zeros((256))

    for c in range(w):
        for r in range(h):
            histogram[int(img[r, c, 0])] += 1

    return histogram
```

- result:



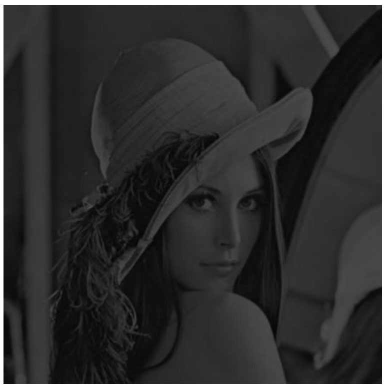
(b) image with intensity divided by 3 and its histogram

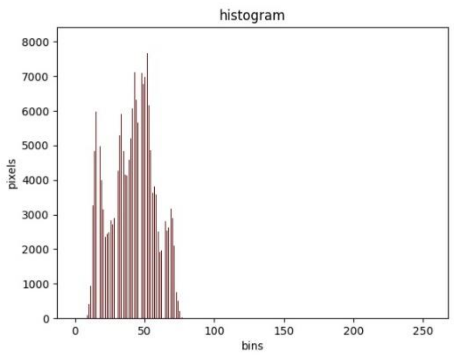
- description:
  將原圖數值除以 3 並無條件捨棄，並畫出對應的 histogram
- algorithm:
  拜訪每個 pixel 除以 3 並且無條件捨去。將新生成的影像，套用 colorhistogram（a 的部分有針對此程式說明）來畫出對應的 histogram。
- principal code fragment:



```python
# img = img//3
h, w, _ = img.shape
for r in range(h):
    for c in range(w):
        img[r, c, 0] = img[r, c, 0] // 3
        img[r, c, 1] = img[r, c, 0]
        img[r, c, 2] = img[r, c, 0]
cv2.imwrite(result_p, img)
histogram = colorhistogram(img)
drawhistogram(histogram, histogram_p)
```

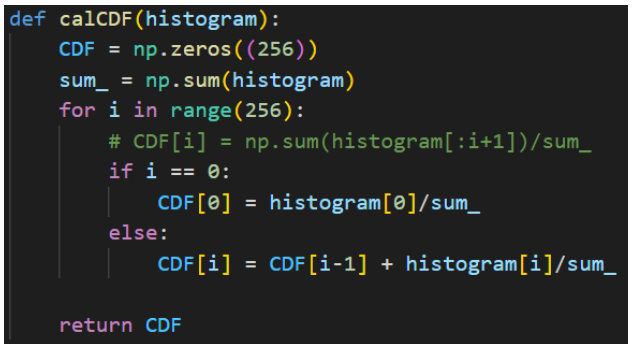
- result:



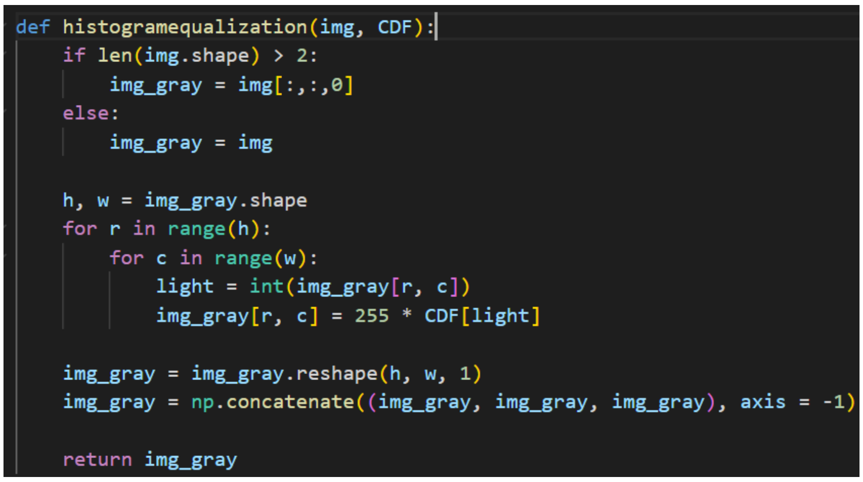


(c) image after applying histogram equalization to (b) and its histogram

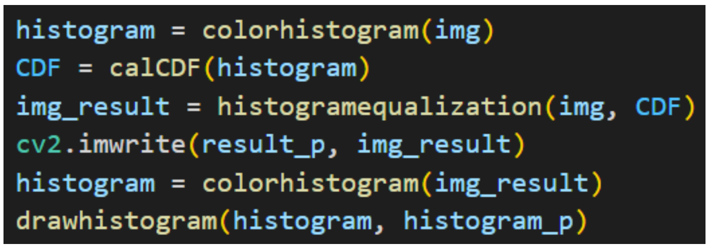
- description:
  將影像做 histogram equalization
- algorithm:
  1. 先算出(b)的 CDF
  2. 拜訪所有的 pixel，找出該 pixel 亮度對應的 CDF，新的亮度 = 255*CDF，然後將對應的 pixel 改成新的亮度
  3. 利用 colorhistogram 畫出新產生的影像 histogram
- principal code fragment:



```python
def calCDF(histogram):
    CDF = np.zeros((256))
    sum_ = np.sum(histogram)
    for i in range(256):
        # CDF[i] = np.sum(histogram[:i+1])/sum_
        if i == 0:
            CDF[0] = histogram[0]/sum_
        else:
            CDF[i] = CDF[i-1] + histogram[i]/sum_

    return CDF
```

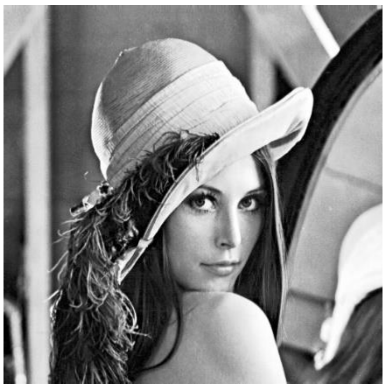


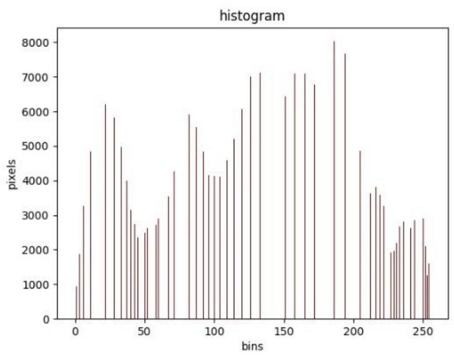
```python
def histogramequalization(img, CDF):
    if len(img.shape) > 2:
        img_gray = img[:,:,0]
    else:
        img_gray = img

    h, w = img_gray.shape
    for r in range(h):
        for c in range(w):
            light = int(img_gray[r, c])
            img_gray[r, c] = 255 * CDF[light]

    img_gray = img_gray.reshape(h, w, 1)
    img_gray = np.concatenate((img_gray, img_gray, img_gray), axis = -1)

    return img_gray
```



```
histogram = colorhistogram(img)
CDF = calCDF(histogram)
img_result = histogramequalization(img, CDF)
cv2.imwrite(result_p, img_result)
histogram = colorhistogram(img_result)
drawhistogram(histogram, histogram_p)
```

- result:




histogram
pixels
bins