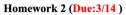
41047011S 資工 114 趙安庭

(1) Assignment statement



(A) Given a grayscale image I,

Step 1: Use the dithering matrix D_2 to generate an array ${\cal D}$ of image size by repeating ${\cal D}_2$

$$D_2 = \begin{bmatrix} 0 & 128 & 32 & 160 \\ 192 & 64 & 224 & 96 \\ 48 & 176 & 16 & 144 \\ 240 & 112 & 208 & 80 \end{bmatrix} \xrightarrow{\begin{array}{c} D \\ \hline D_2 & D_2 & D_2 & D_2 \\ \hline D_2 & D_2 & D_2$$

Step 2: Threshold image I by

$$I'(i,j) = \begin{cases} 255 & \text{if } I(i,j) > D(i,j) \\ 0 & \text{if } I(i,j) \le D(i,j) \end{cases}$$
Step 3: Show images I and I'

(B) Extend to n = 4 gray values

$$1.255 / 3 = 85$$

2.
$$Q(i, j) = [I(i, j)/85]$$

3.
$$D_1 = \begin{bmatrix} 0 & 56 \\ 84 & 28 \end{bmatrix} \Longrightarrow_{\text{extend}} D_1$$

4.
$$I'(i, j) = Q(i, j) + \begin{cases} 1 & \text{if } I(i, j) - 85Q(i, j) > D(i, j) \\ 0 & \text{if } I(i, j) - 85Q(i, j) \le D(i, j) \end{cases}$$

5. Scale values of I' so that its values are in [0, 255] for displaying

(2)

(A) the first question

(A-a) Input/output images

Input:



Output:





(A-b) Source code

(B) the second question

(B-a) Input/output images

Input:



Output:





(B-b) Source code

```
♦ hw2-2.py × ♦ hw2.py
     import matplotlib.image as mpimg
     x=mpimg.imread(sys.argv[1])
 10 D2 = np.array([[0, 56], [84, 28]])
     r2 = x.copy()
r2[:x.shape[0]//D2.shape[0] *2, :x.shape[1]//D2.shape[1] *2] = np.tile(D2, (x.shape[0]//D2.shape[0], x.shape[1]//D2.shape[1]))
     x4 = x.copy()
     x = x.astype(np.float64)
     for i in range( x.shape[0] ):
         for j in range( x.shape[1] ):
q = math.floor(x[i][j]/85)
              x4[i][j] = q+(x[i][j]-85*q>r2[i][j])
     plt.imsave("input_"+sys.argv[1],x,cmap='gray')
      plt.imsave("out_b"+sys.argv[1],x4,cmap='gray')
     figure,ax=plt.subplots(1,2)
     ax[0].imshow(x,cmap='gray')
      ax[1].imshow(x4,cmap='gray')
      plt.show()
```

(c) Comments

產生輸出圖以後,我發現 output 圖片在預覽程式裡看起來比用 imshow()顯示的還要更淺。後來發現顏色不同應該是我用的預覽程式的問題,因為我將 output 圖片放到 word 中就發現它看起來與用 imshow()顯示的圖片顏色相同,代表 output 圖片本身應該是跟 imshow()顯示的相同,只是我用的預覽程式顯示圖片時會將圖片的顏色變淡。