Computer Vision HW5 楊閔喻 R09921012

Write a program to generate images and histograms:

(a) Dilation
(b) Erosion
(c) Opening
(d) Closing

(a)

```
def Dilation(image_output,image,ker,ker_num:int,ker_val:int):
    for i in range(image.shape[0]):
        for j in range(image.shape[1]):
            max_val = 0
            for k in range(kernal_num):
                if i+ker[k,0]>=0 and i+ker[k,0]<image.shape[0] and j+ke
r[k,1]>=0 and j+ker[k,1]<image.shape[1]:
                    temp = image[i+ker[k,0],j+ker[k,1]]+ker_val
                    if temp > max_val : max_val = temp
            if max_val > 255 : max_val = 255
            image_output[i,j] = max_val
```

```
kernal[0,0],kernal[0,1] = -2,-1
kernal[1,0],kernal[1,1] = -2,0
kernal[2,0],kernal[2,1] = -2,1
kernal[3,0],kernal[3,1] = -1,-2
kernal[4,0],kernal[4,1] = -1,-1
kernal[5,0],kernal[5,1] = -1,0
kernal[6,0],kernal[6,1] = -1,1
kernal[7,0],kernal[7,1] = -1,2
kernal[8,0],kernal[8,1] = 0,-2
kernal[9,0],kernal[9,1] = 0,-1
kernal[10,0],kernal[10,1] = 0,0
kernal[11,0],kernal[11,1] = 0,1
kernal[12,0],kernal[12,1] = 0,2
kernal[13,0],kernal[13,1] = 1,-2
```

```
kernal[14,0],kernal[14,1] = 1,-1
kernal[15,0],kernal[15,1] = 1,0
kernal[16,0],kernal[16,1] = 1,1
kernal[17,0],kernal[17,1] = 1,2
kernal[18,0],kernal[18,1] = 2,-1
kernal[19,0],kernal[19,1] = 2,0
kernal[20,0],kernal[20,1] = 2,1
```

- 在主程式中使用二維陣列紀錄 kernal
- 在 Dilation 函式中，對每個 pixel 的 kernal 範圍進行處裡，使用 max_val 做為紀錄該 pixel kernal 範圍內的 intensity 最大值，並將 max_val 賦值給該 pixel

(b)

```
def Erosion(image_output,image,ker,ker_num:int,ker_val:int):
    for i in range(image.shape[0]):
        for j in range(image.shape[1]):
            min_val = 256
            for k in range(kernal_num):
                if i+ker[k,0]>=0 and i+ker[k,0]<image.shape[0] and j+ke
r[k,1]>=0 and j+ker[k,1]<image.shape[1]:
                    temp = image[i+ker[k,0],j+ker[k,1]]+ker_val
                    if temp < min_val : min_val = temp
            if min_val < 0 : min_val = 0
            image_output[i,j] = min_val
```

- 在 Erosion 函式中，對每個 pixel 的 kernal 範圍進行處裡，使用 min_val 做為紀錄該 pixel kernal 範圍內的 intensity 最小值，並將 min_val 賦值給該 pixel

(c)、(d)

```
print("Start Opening")
Dilation(img_c,img_b,kernal,kernal_num,kernal_value)
print("Start Closing")
Erosion(img_d,img_a,kernal,kernal_num,kernal_value)
```

- Opening 為在主程式中，對已經過 Erosion 的原圖再進行 Dilation

- Closing 為在主程式中，對已經過 Dilation 的原圖再進行 Erosion