CV HW6

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(a) **Yokoi connectivity number**

Brief description, algorithm:

Step 1: 用 HW1 的 shrink 跟 HW2 的 binarize function 做 down-sampling。

Step 2: 依照講義 6.2.5.1 的公式實作 h_function 與 f_function。

Step 3: 輸出成 txt 文檔。

Parameters: None

Principal code fragment:

Step 1:

```
4   def binarize(img):
5       height, width = img.shape
6       binarize_img = np.zeros_like(img)
7
8       for h in range(height):
9           for w in range(width):
10              if((img[h, w] >= 128)):
11                  binarize_img[h, w] = 255
12              else:
13                  binarize_img[h, w] = 0
14      return binarize_img
15
16  def shrink(img, ratio):
17      height, width = img.shape
18      new_height = height // ratio
19      new_width = width // ratio
20      shrink_img = np.zeros((new_height, new_width))
21
22      for h in range(new_height):
23          for w in range(new_width):
24              shrink_img[h, w] = img[h * ratio, w * ratio]
25
26      return shrink_img
```

Step 2:

```python
def yokoi_connectivity(img):
    height, width = img.shape

    pad_img = np.zeros((height+2, width+2)) - 1
    pad_img[1:height+1, 1:width+1] = img

    output_img = np.zeros_like(img) - 1

    for h in range(1, height+1):
        for w in range(1, width+1):
            if pad_img[h, w] == 255:
                a1 = h_function(pad_img[h, w], pad_img[h, w+1], pad_img[h-1, w+1], pad_img[h-1, w])
                a2 = h_function(pad_img[h, w], pad_img[h-1, w], pad_img[h-1, w-1], pad_img[h, w-1])
                a3 = h_function(pad_img[h, w], pad_img[h, w-1], pad_img[h+1, w-1], pad_img[h+1, w])
                a4 = h_function(pad_img[h, w], pad_img[h+1, w], pad_img[h+1, w+1], pad_img[h, w+1])

                output_img[h-1, w-1] = f_function(a1, a2, a3, a4)

    return output_img

def h_function(b, c, d, e):
    if b == c and (b != d or b != e):
        return 'q'
    elif b == c == d == e:
        return 'r'
    else:
        return 's'

def f_function(a1, a2, a3, a4):
    if a1 == a2 == a3 == a4 == 'r':
        return 5
    else:
        return [a1, a2, a3, a4].count('q')
```

Step 3:

```python
    height, width = yokoi_map.shape
    with open('yokoi.txt', 'w') as file:
        for h in range(height):
            for w in range(width):
                if yokoi_map[h, w] != -1:
                    file.write(f'{int(yokoi_map[h, w])}')
                else:
                    file.write(f' ')
            file.write('\n')
```

Resulting image: