2021 CV HW6 Report

Results

Yokoi Connectivity Number

Step 1. 對 512 x 512 的原圖做 down sampling 成 64 x 64，用 8 x 8 的區塊為單位取最左上角的 pixel value 做為採樣點。

```
# down sample
downsample = np.zeros((h//8, w//8), np.uint8)
for i in range(0, h, 8):
    for j in range(0, w, 8):
        downsample[i//8][j//8] = img[i][j]
```

Step 2. 依照 Yokoi Connectivity Number 的公式去實作 function。

$$h(b,c,d,e) = \begin{cases} q & if\ b = c\ and\ (d \neq b\ \lor e \neq b) \\ r & if\ b = c\ and\ (d = b \land e = b) \\ s & if\ b \neq c \end{cases}$$

$$\begin{aligned} & f(a_1, a_2, a_3, a_4) \\ & = \begin{cases} 5 & if\ a_1 = a_2 = a_3 = a_4 = r \\ n & where\ n = numberof\{a_k | a_k = q\}, otherwise \end{cases} \end{aligned}$$

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


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

Step 3. 若 pixel value 為 0，label 則為 0；若不為 0，則去計算 a1、a2、a3、a4（如下圖），再將 a1 ~ a4 帶入 f 函式中，得到 Yokoi connectivity number 的 output。

$$a_1 = h(x_0, x_1, x_6, x_2) \quad a_3 = h(x_0, x_3, x_8, x_4)$$
$$a_2 = h(x_0, x_2, x_7, x_3) \quad a_4 = h(x_0, x_4, x_5, x_1)$$

$$output = f(a_1, a_2, a_3, a_4)$$

```python
output = np.zeros((hh, ww), np.uint8)
for i in range(hh):
    for j in range(ww):
        if downsample[i][j] == 0:
            output[i][j] = 0
            continue
        x = pixelValues(i, j) # find x0 ~ x8's pixel value
        a1 = h(x[0], x[1], x[6], x[2])
        a2 = h(x[0], x[2], x[7], x[3])
        a3 = h(x[0], x[3], x[8], x[4])
        a4 = h(x[0], x[4], x[5], x[1])
        output[i][j] = f(a1, a2, a3, a4)
```

Step 4. 最後將剛剛標註完成的結果印出來，若 label 為 0 則印空白，其餘印出 label 值。

```python
for i in range(hh):
    for j in range(ww):
```

```python
            if output[i][j] == 0:
                print("  ", end='')
            else:
                print("{:2d}".format(output[i][j]), end='')
    print("")
```