Computer Vision HW1

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1　Principle Code and method

Part 1:

Change original to binary image and choose topmost-left pixel as the down-sampled data.

Code:

```
def binarize (img):
    blank_image = np.zeros((len(img),len(img[0]),3), np.uint8)
    for i in range (len(img)):
        for j in range (len(img[0])):
            if(img[i][j][0]>=128):
                blank_image[i][j][0]=255
                blank_image[i][j][1]=255
                blank_image[i][j][2]=255
            else:
                blank_image[i][j][0]=0
                blank_image[i][j][1]=0
                blank_image[i][j][2]=0
    return blank_image
def down_sample (img):
    blank_image = np.zeros((64,64,3), np.uint8)
    index_i = 0
    index_j = 0
    for i in range (0,512,8):
        for j in range (0,512,8):
            #print(i,j,index_i,index_j)
            blank_image[index_i][index_j][0]=img[i][j][0]
            blank_image[index_i][index_j][1]=img[i][j][0]
            blank_image[index_i][index_j][2]=img[i][j][0]
            index_j+=1
        index_j=0
        index_i+=1
    return blank_image
```

Part 2:

Use method from slide (CV1_CH6_2018 ,pp.60-63) to find Yokoi Connectivity Number.

Code:

```
def yokoi_4connected (img):
    exp_img = expand(img,1)
    yokoi_matrix = np.zeros((len(img),len(img[0])), np.uint8)
    f_array = ["s","s","s","s"]
    for i in range (1,len(img)+1):
        for j in range (1,len(img[0])+1):
            if(exp_img[i][j][0]==0):
                yokoi_matrix[i-1][j-1]=6
            else:
                yokoi_matrix[i-1][j-1]=f_func(exp_img,i,j)
    return yokoi_matrix
def f_func(img,i,j):
    f_array = ["a","a","a","a"]
    f_array[0]=h_func(img[i][j][0],img[i][j+1][0],img[i-1][j+1][0],img[i-1][j][0])
    f_array[1]=h_func(img[i][j][0],img[i-1][j][0],img[i-1][j-1][0],img[i][j-1][0])
    f_array[2]=h_func(img[i][j][0],img[i][j-1][0],img[i+1][j-1][0],img[i+1][j][0])
    f_array[3]=h_func(img[i][j][0],img[i+1][j][0],img[i+1][j+1][0],img[i][j+1][0])
    if (f_array[0]=="r" and f_array[1]=="r" and f_array[2]=="r" and f_array[3]=="r"):
        return 5
    else:
        num = 0
        for i in range (4):
            if(f_array[i]=="q"):
                num+=1
        return num
def h_func (b,c,d,e):
    if(b==c):
        if(d!=b or e!=b):
            return "q"
        elif(d==b and e==b):
            return "r"
    return "s"
```

Part3:

main and create txt

Code:

```
img = cv2.imread(sys.argv[1])

b_img = binarize(img)

ds_b_img = down_sample (b_img)

yokoi_matrix = yokoi_4connected(ds_b_img)

text_file = open("yokoi_matrix.txt", "w")

for i in range (len(yokoi_matrix)):

    for j in range (len(yokoi_matrix[0])):

        if(yokoi_matrix[i][j]==6):

            text_file.write(" ")

        else:

            text_file.write(str(yokoi_matrix[i][j]))

    text_file.write("\n" )

text_file.close()
```

2. Result :

part1:binary image and down sample image

Part 2 :yokoi matrix

yokoi_matrix.txt

```
11111111        12111111111122322221     111111111111       0  0
15555551         115555555511 2 11  11   1155555555511        0
15555551        1 2115555112  21112221    155555555551      21
15555551        1 2 155112 22221511        1555555555511     1
15555551         22 2112 22    121 0 0    15555555555511   0
15555551         1  2  21 2     1   1     15555555555551  0
15555551           12 1  121111    1321   155555555555511
15111551           1322 1155551111         155555555555551
111 1551            1  121555555511        155555555555511
11  1551                 21155555511       15511155555511
21  1551                 2 15555555111     1551 11555511
1   1551                 2 155555555511    1551  115551         1
    1551                1121155555555551   1551   15511        12
    1551                15555555555555511  1551   1111        111
    1551        1     2221155555555555511 1151    11         1151
    1551        2    22 1 1555555555555511 151  11111       1551
    1551        2    1   11555555555555551 151 115551      11551
    1551        2       1155555555555555551111511155511     115551
    1551       12      115555555555555555555555555551      155551
    1551       11   0 22155555555555555555555555555112     1155551
    1551       111   22 155555555555555555555555551 1     1555551
    1551       1511  1 125112111112111555555555111      11555551
    1551       15521  1 121 1 11  1  15555555111  0     15555551
    1551       1151  132 2          1155555111   0     115555551
    1551        151 0  322         115555111  121      155555551
    1551        1221   2           1555551   131      1155555551
    1551         2  0  1          115555511   1       1155555551
    1551         2   0      0    1155555551  0       1 155555551
    1551         2              11555555551          21155555551
    1551         1  0           115555555551          15555555551
    1551           1           11511115555521  1     115555555551
    1551        1 1           11111  1155511   2     155555555551
    1551       131            111     15111    2     155555555551
    1551      121 0         1121   1  111  1   2    1155555555551
    1551      11            111 1  221 11  1   2    1555555555551
    1551    12  0    1      21 121  11 1111    2    1555555555551
    1551     1      12    22  151111111551    2   11555555555551
    1551   1              2   1555551115511   1   15555555555551
    1551   2    0     0  22  12555551 15551    1  15555555555551
    1551   1             1    1555511 11511    2 115555555555551
    1551      0 0      21     155551 1 151     2 155555555555551
    1551               2      15555112 151     2 155555555555551
    1551         1   1 1     1155555511111     2 155555555555551
    1551         2  22       111511111212      21155555555555551
    1551  0      1 12          151    2 1      15555555111555551
    1551       0  0  0         1111  121       155555551 1555551
    1551          0           11111111        155555551 1555551
    1551        0               115551        155555551 1555511
    1551                          15551        211111111 155511
    11521      1   12          122155511       2     11 115511
1    151 0     1    1            155555111     2111     15511
22   1511          1            15555555111   155111   1511
 22  1511          1            15555555551   155551  1151
  2  151            0 1        11155555555511  155511  1511
  2  1521    0        1        155555555555511 15551 12151
  2  151           121         155555555555551 155511 1551
  2  1511                   0  155555555555551 115551 1511
  21 1511            11        155555555555551  111111151
  11 151           0           11555555555555511    111511
  11 151                       1555555555555551      151
  11 151             0        115555555555555551      211
  11 151                      1155555555555555511     1
  11 151                     0 155555555555555551
  11 111        0             1211111111111111111
```