Computer Vision — Homework 7

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1 Thinning Operator

Step 1. Turn the image into binary image. Use 128 as the threshold.

Figure 1: binary image

Step 2. Downsample image to 64x64 pixels.

Figure 2: downsampled image

Step 3. Do thinning operator. Keep doing this step until the input image and the output image are the same.

step 1 Do Yokoi Operator.

```
def yokoi_func(listOfx, i, j, rowEdge, colEdge, down_image):
    listOfx[0] = down_image[i][j]
    if i - 1 >= 0:
        listOfx[2] = down_image[i - 1][j]
        if j - 1 >= 0:
            listOfx[7] = down_image[i - 1][j - 1]
        if j + 1 < colEdge:
            listOfx[6] = down_image[i - 1][j + 1]
    if i + 1 < rowEdge:
        listOfx[4] = down_image[i + 1][j]
        if j - 1 >= 0:
            listOfx[8] = down_image[i + 1][j - 1]
        if j + 1 < colEdge:
            listOfx[5] = down_image[i + 1][j + 1]
    if j - 1 >= 0:
        listOfx[3] = down_image[i][j - 1]
    if j + 1 < colEdge:
        listOfx[1] = down_image[i][j + 1]
    count = [h(listOfx[0], listOfx[1], listOfx[6], listOfx[2]), \
             h(listOfx[0], listOfx[2], listOfx[7], listOfx[3]), \
             h(listOfx[0], listOfx[3], listOfx[8], listOfx[4]), \
             h(listOfx[0], listOfx[4], listOfx[5], listOfx[1])]
    ans = count.count('q')
    if count.count('r') == 4:
        ans = 5
    return ans
def h(b, c, d, e):
    if b != c:
        return 's'
    if d == b and e == b:
        return 'r'
    return 'q'
```

step 2 Do Pair Relationship Operator

```
    for i in range(down_rows):
        for j in range(down_cols):
            if yokoi[i][j] == 1:
                add = 0
                if i != 0:
                    add += (yokoi[i-1][j] == 1)
                if i != down_rows - 1:
                    add += (yokoi[i+1][j] == 1)
                if j != 0:
                    add += (yokoi[i][j-1] == 1)
                if j != down_cols - 1:
                    add += (yokoi[i][j+1] == 1)
                if add > 0:
                    pair[i][j] = 'p'
                else:
                    pair[i][j] = 'q'
            elif yokoi[i][j] > 1:
                pair[i][j] = 'q'
```

step 3 Connected Shrink Operator.

```
    for i in range(down_rows):
        for j in range(down_cols):
            if pair[i][j] == 'p':
                if yokoi_func([0]*9, i, j, down_rows, down_cols, newDown) == 1:
                    newDown[i][j] = 0
```

結果圖

Figure 3: Thinning Operator