CV HW5

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(a) **Dilation**

Brief description, algorithm: iterate through 每個 pixels，region 爲 kernel 的範圍，並將 output image 的對應 pixel 值設爲 region 中對應 kernel 值爲 1 的 pixel 的最大值。

Parameters: None

Principal code fragment:

```python
def dilation(img, kernel):
    height, width = img.shape
    half_ks = kernel.shape[0] // 2

    output_img = np.zeros_like(img)
    for h in range(half_ks, height-half_ks):
        for w in range(half_ks, width-half_ks):
            region = img[h-half_ks:h+half_ks+1, w-half_ks:w+half_ks+1]

            output_img[h, w] = np.max(region[kernel == 1])

    return output_img
```

Resulting image:

(b) Erosion

Brief description, algorithm: iterate through 每個 pixels，region 爲 kernel 的範圍，並將 output image 的對應 pixel 值設爲 region 中對應 kernel 值爲 1 的 pixel 的最小值。

Parameters: None

Principal code fragment:

```python
def erosion(img, kernel):
    height, width = img.shape
    half_ks = kernel.shape[0] // 2

    output_img = np.zeros_like(img)
    for h in range(half_ks, height-half_ks):
        for w in range(half_ks, width-half_ks):
            region = img[h-half_ks:h+half_ks+1, w-half_ks:w+half_ks+1]

            output_img[h, w] = np.min(region[kernel == 1])

    return output_img
```

Resulting image:

(c) Opening

Brief description, algorithm: 對 image 先以前面 function 先做 erosion 再做 dilation。

Parameters: None

Principal code fragment:

```
49      # (c) Opening
50      opening_img = dilation(erosion_img, kernel)
51      cv2.imwrite('c.png', opening_img)
```

Resulting image:

(d) Closing

Brief description, algorithm: 對 image 先以前面 function 先做 dilation 再做 erosion。

Parameters: None

Principal code fragment:

```
53      # (d) Closing
54      closing_img = erosion(dilation_img, kernel)
55      cv2.imwrite('d.png', closing_img)
```

Resulting image: