Computer Vision — Homework 5

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1 Dilation

The definition of *Gray Scale Dilation* is as follows.

$$A \oplus B = \max\{a[i - x, j - y] \mid a \in A, \ b[x, y] \in B\}$$

以 i, j 為中心，找 structuring element 範圍裡的 maximum Value，將此值給 Result[i][j]。

```python
def dilation(img, kernel):
    dil = np.zeros(img.shape, int)
    for i in range(img.shape[0]):
        for j in range(img.shape[1]):
            maxValue = img[i][j]
            for dot in kernel:
                x = dot[0]
                y = dot[1]
                if i + x >= 0 and i + x < img.shape[0] \
                and j + y >= 0 and j + y < img.shape[1]:
                    if img[i + x][j + y] > maxValue:
                        maxValue = img[i + x][j + y]
            dil[i][j] = maxValue
    return dil
```

結果圖

Figure 1: Dilation

1

2 Erosion

The definition of *Gray Scale Erosion* is as follows.

$$A \ominus B = \min\{a[i-x, j-y] \mid a \in A,\ b[x,y] \in B\}$$

以 i, j 為中心，找 structuring element 範圍裡的 minimum Value，將此值給 Result[i][j]。

```python
def erosion(img, kernel):
    ero = np.zeros(img.shape, int)
    for i in range(img.shape[0]):
        for j in range(img.shape[1]):
            minValue = img[i][j]
            for dot in kernel:
                x = dot[0]
                y = dot[1]
                if i + x >= 0 and i + x < img.shape[0] \
                and j + y >= 0 and j + y < img.shape[1]:
                    if img[i + x][j + y] < minValue:
                        minValue = img[i + x][j + y]
            ero[i][j] = minValue
    return ero
```

結果圖

Figure 2: Erosion

3 Opening

The definition of *Gray Scale Opening* is as follows.

$$A \circ B = (A \ominus B) \oplus B$$

. 先做 Erosion，再做 Dilation。

Figure 3: Erosion

4 Closing

The definition of *Gray Scale Closing* is as follows.

$$A \bullet B = (A \oplus B) \ominus B$$

與 Gray Scale Opening 相反，先 Dilation 再 Erosion。

Figure 4: Erosion