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Code

Dilation:

抓出當前 kernel 範圍內最大 pixel value assign 給現在這個 pixel。

```python
def dilation(a, b):
    row_a, col_a = a.shape
    img = np.zeros(a.shape, dtype='int32')

    for a_i in range(row_a):
        for a_j in range(col_a):
            max_value = 0
            for lis in kernel:
                b_i, b_j = lis
                if (a_i + b_i) < row_a and (a_i + b_i) >= 0 and \
                   (a_j + b_j) < col_a and (a_j + b_j) >= 0:
                    max_value = max(max_value, a[a_i+b_i, a_j+b_j])
            img[a_i, a_j] = max_value
    return img
```

Erosion:

抓出當前 kernel 範圍內最小 pixel value assign 給現在這個 pixel。

```python
def erosion(a, b):
    row_a, col_a = a.shape
    img = np.zeros(a.shape, dtype='int32')

    for a_i in range(row_a):
        for a_j in range(col_a):
            min_value = 255

            for lis in b:
                b_i, b_j = lis
                if (a_i + b_i) < row_a and (a_i + b_i) >= 0 and \
                   (a_j + b_j) < col_a and (a_j + b_j) >= 0:
                    min_value = min(min_value, a[a_i+b_i, a_j+b_j])
            img[a_i, a_j] = min_value
    return img
```

Opening:

與 hw4 相同

```python
def opening(a, b):
    cv2.imwrite("opening_gray_lena.bmp", dilation(erosion(a, b), b))
```

Closing:

與 hw4 相同

```
def closing(a, b):
    cv2.imwrite("closing_gray_lena.bmp", erosion(dilation(a, b), b))
```

Result

Dilation   Erosion

Opening   Closing