

Homework 5

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a. Dilation

Description: For each pixel, it checks a local neighborhood defined by the kernel and assigns the maximum pixel value found in that neighborhood to the current pixel position.



```
1. def dilation(img, kernel):
2.     kernel_size = len(kernel)
3.     dilation_img = np.zeros_like(img)
4.
5.     for i in range(img_size0):
6.         for j in range(img_size1):
7.             max_value = 0
8.             for ki in range(kernel_size):
9.                 for kj in range(kernel_size):
10.                    ni, nj = i + ki - kernel_size // 2, j + kj - kernel_size // 2
11.                    if 0 <= ni < img_size0 and 0 <= nj < img_size1:
12.                        if kernel[ki][kj] == 1:
13.                            pixel_value = img[ni][nj]
14.                            if pixel_value > max_value:
15.                                max_value = pixel_value
16.                    dilation_img[i, j] = max_value
17.
18.     return dilation_img.astype(np.uint8)
```

b. Erosion

Description: For each pixel, it searches for the minimum pixel value within the neighborhood specified by the kernel, assigning that minimum value to the current position.



```
1. def erosion(img, kernel):
2.     kernel_size = len(kernel)
3.     erosion_img = np.zeros_like(img)
4.
5.     for i in range(img_size0):
6.         for j in range(img_size1):
7.             min_value = 255
8.             for ki in range(kernel_size):
9.                 for kj in range(kernel_size):
10.                    ni, nj = i + ki - kernel_size // 2, j + kj - kernel_size // 2
11.                    if 0 <= ni < img_size0 and 0 <= nj < img_size1:
12.                        if kernel[ki][kj] == 1:
13.                            pixel_value = img[ni][nj]
14.                            if pixel_value < min_value:
15.                                min_value = pixel_value
16.                    erosion_img[i, j] = min_value
17.
18.     return erosion_img.astype(np.uint8)
```

c. Opening

Description: First use erosion, then use dilation.



```
1. def opening(img, kernel):  
2.     return (dilation(erosion(img, kernel), kernel))
```

d. Closing

Description: First use dilation, then use erosion.



```
1. def closing(img, kernel):  
2.     return (erosion(dilation(img, kernel), kernel))
```