

Morphology

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Image Morphology

- Nonlinear operations related to shape of features in an image
- Selection or suppression of features of a certain shape
- Generally, a binary image as an input for morphology
- For example, erosion, dilation, opening, and closing operations



Erosion

- Minimum value of all pixels in a given window, for example, 0 in a binary image
- Decrease of object brightness (for grey-level images) and object size (for binary images)
- Removal of impulse noise and small objects

0	0	0	0	0
0	255	255	255	0
0	255	255	255	0
0	255	255	255	0
0	0	0	0	0

A

255	255	255
255	255	255
255	255	255

B

0	0	0	0	0
0	0	0	0	0
0	0	255	0	0
0	0	0	0	0
0	0	0	0	0

Based on $A \wedge B$



Dilation

- Maximum value of all pixels in a given window, for example, 255 in a binary image
- Increase of object brightness (for grey-level images) and object size (for binary images)
- Connection of separate regions and removal of background holes

0	0	0	0	0
0	0	0	0	0
0	0	255	0	0
0	0	0	0	0
0	0	0	0	0

A

0	0	0
0	0	0
0	0	0

B

0	0	0	0	0
0	255	255	255	0
0	255	255	255	0
0	255	255	255	0
0	0	0	0	0

Based on A \cup B



Example

0	0	0	0	0	0	0	0	0	0
0	255	255	255	255	0	0	0	0	0
0	255	255	255	255	0	255	255	0	0
0	255	255	255	255	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

255	255	255
255	255	255
255	255	255



Erosion

0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	255	255	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	255	255	0	0	255	255	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

0	0	0
0	0	0
0	0	0



Dilation

0	0	0	0	0	0	0	0	0	0
0	255	255	255	255	255	255	255	255	0
0	255	255	255	255	255	255	255	255	0
0	255	255	255	255	255	255	255	255	0
0	0	0	0	0	0	0	0	0	0



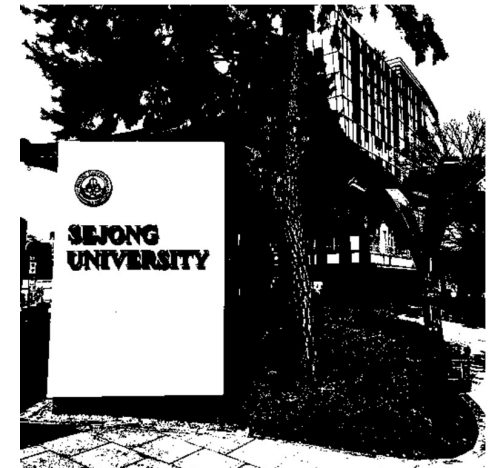
Opening and Closing

- Erosion followed by dilation in opening, and dilation followed by erosion in closing
- In opening, removal of impulse noise, while preserving foreground regions
- In closing, removal of background holes, while preserving background regions
- Generally, less destructive than erosion and dilation
- Sometimes, erosion or dilation multiple times

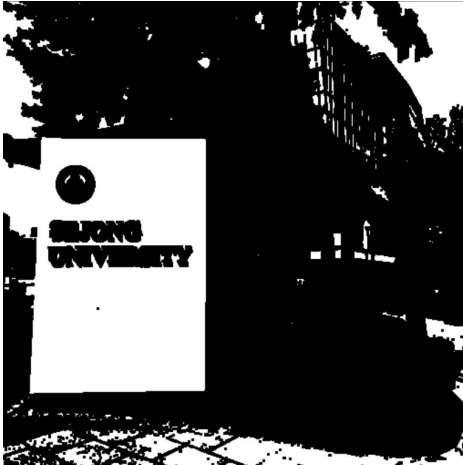


Experiment

- Thresholding with 255 for $Y \geq 200$ and 0 for $Y < 200$ in GateY.bmp
- Erosion, dilation, opening, and closing on the binary image
- More binary images through thresholding, such as edge detection



Thresholding(200)



Erosion



Dilation



Opening



Closing

