

Morphological Image Processing

Basics

- ▶ Once image segmentation is complete, morphological operations can be used to remove imperfections in the segmented image, and
- ▶ Provide information on the form and structure of the image



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- ▶ Provide information on the form and structure of the image
- ▶ Chapter Contents:
 - ▶ Structuring element
 - ▶ Erosion, Dilation
 - ▶ Opening, Closing
- ▶ Chapter Exercise:
 - ▶ Get outline of an object in an image

Structuring Element

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 - ▶ It can be of any size and shape
- ↓

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1	1	1
1	1	1
1	1	1

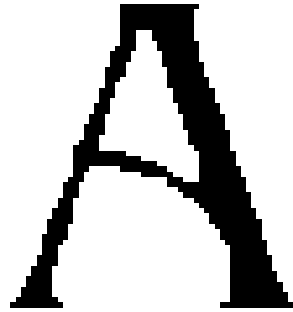
0	1	0
1	1	1
0	1	0

0	0	1	0	0
0	1	1	1	0
1	1	1	1	1
0	1	1	1	0
0	0	1	0	0

Erosion - Example



Original image



Erosion by 3*3
square structuring
element



Erosion by 5*5
square structuring
element

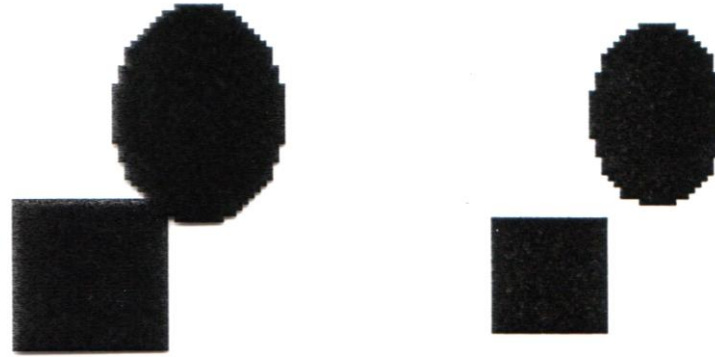
What Is Erosion For?

- ▶ Erosion can split apart joined objects



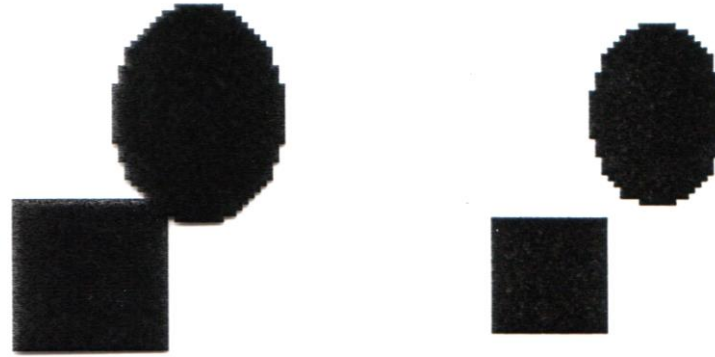
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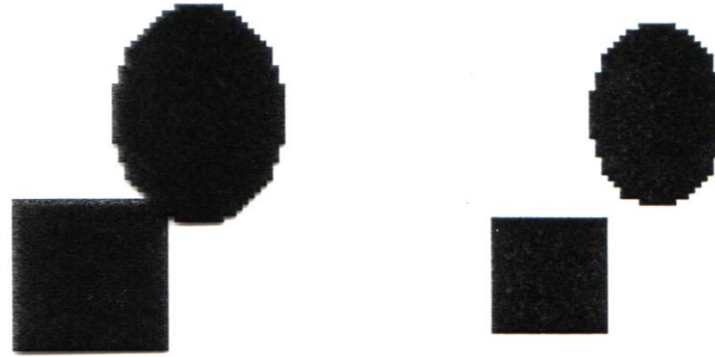


- ▶ Erosion can strip away extrusions

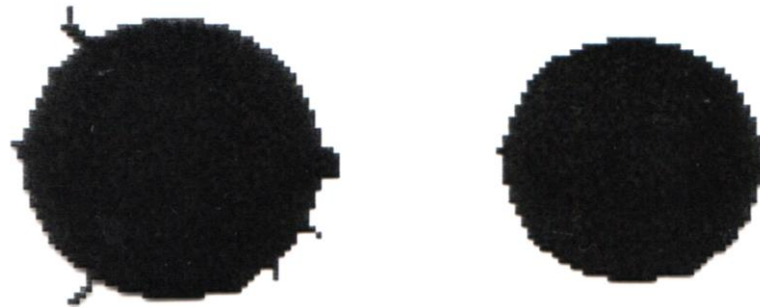


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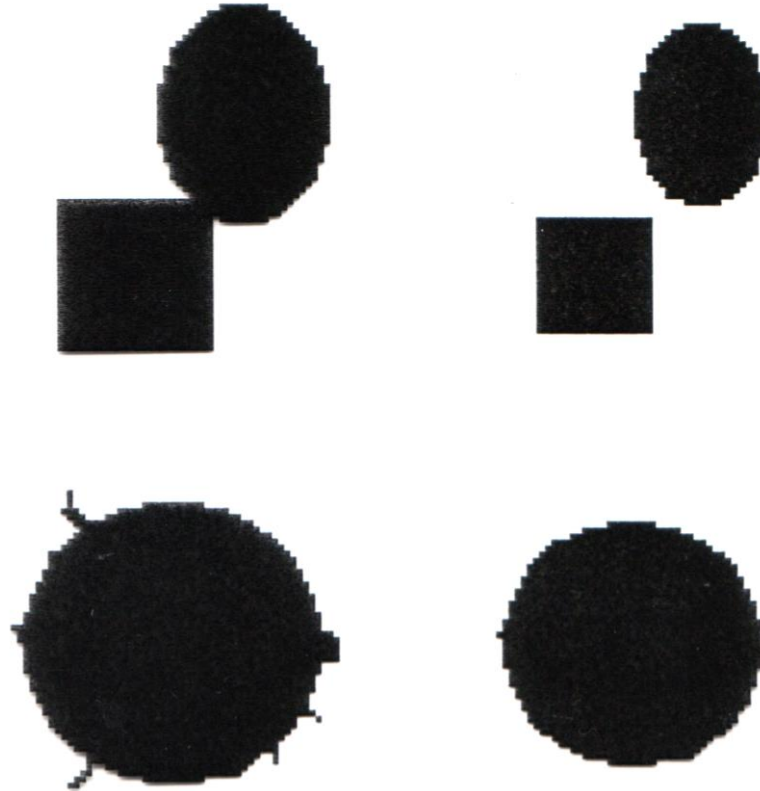


- ▶ Erosion can strip away extrusions



What Is Erosion For?

- ▶ Erosion can split apart joined objects
- ▶ Erosion can strip away extrusions
- ▶ **Watch out:** Erosion shrinks objects



Dilation - Example



Original image



Dilation by 3*3
square structuring
element



Dilation by 5*5
square structuring
element

What Is Dilation For?

- ▶ Dilation can repair breaks



What Is Dilation For?

- Dilation can repair breaks



What Is Dilation For?

- ▶ Dilation can repair breaks
- ▶ Dilation can repair intrusions



What Is Dilation For?

- ▶ Dilation can repair breaks



- ▶ Dilation can repair intrusions



What Is Dilation For?

- Dilation can repair breaks



- Dilation can repair intrusions



- Watch out: Dilation enlarges objects

Compound Operations



Compound Operations

- ▶ Image Opening
 - ▶ Erosion followed by a dilation

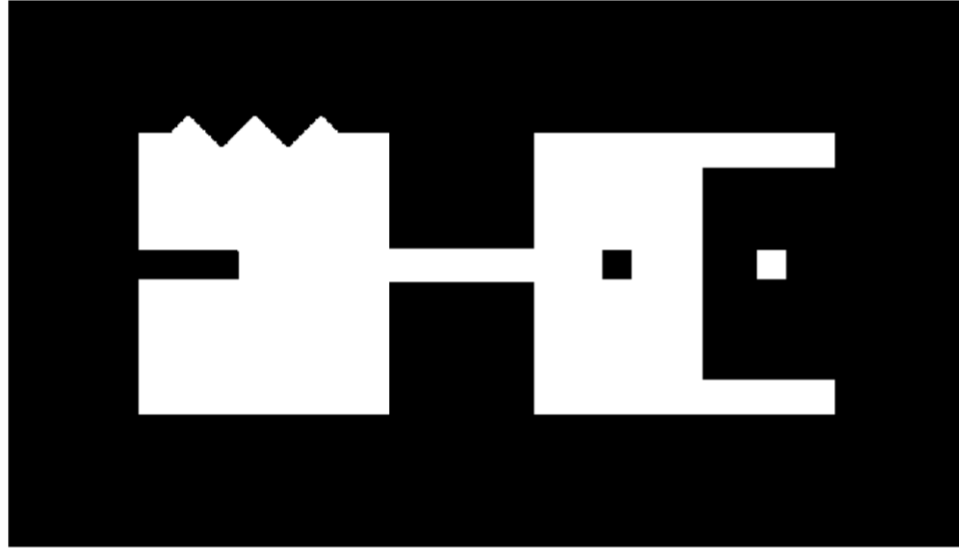


Compound Operations

- ▶ Image Opening
 - ▶ Erosion followed by a dilation
- ▶ Image Closing
 - ▶ Dilation followed by an erosion

Opening Example

Original
Image



Opening Example

Original
Image

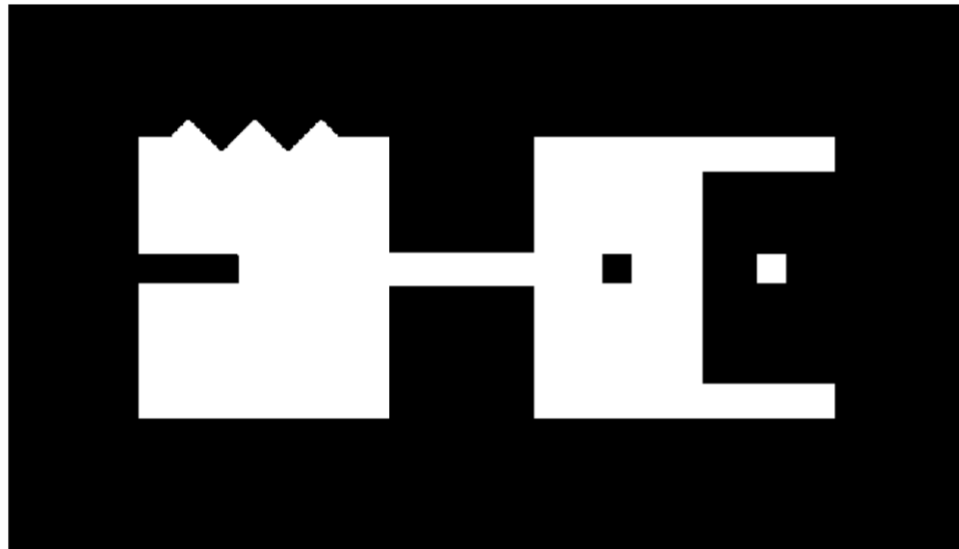
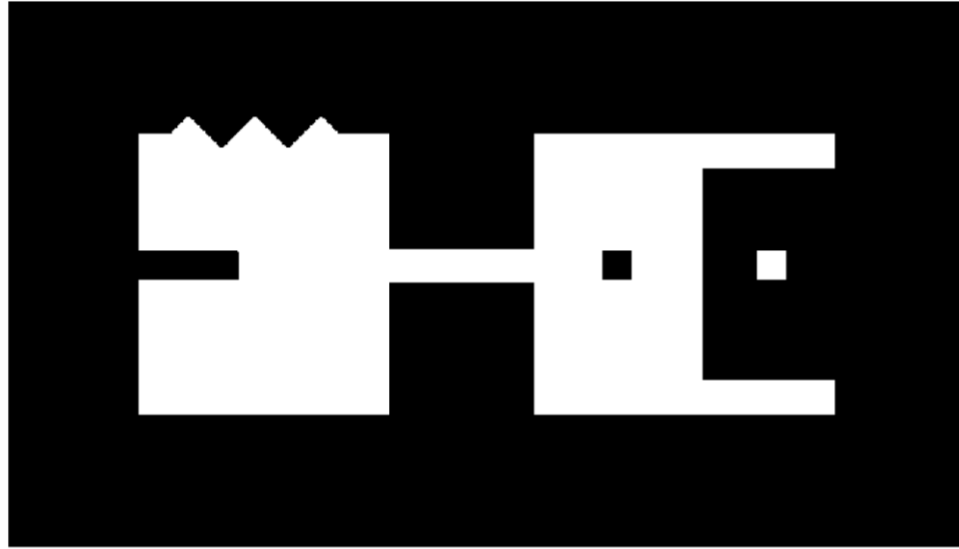


Image
After
Opening



Closing Example

Original
Image



Closing Example

Original
Image

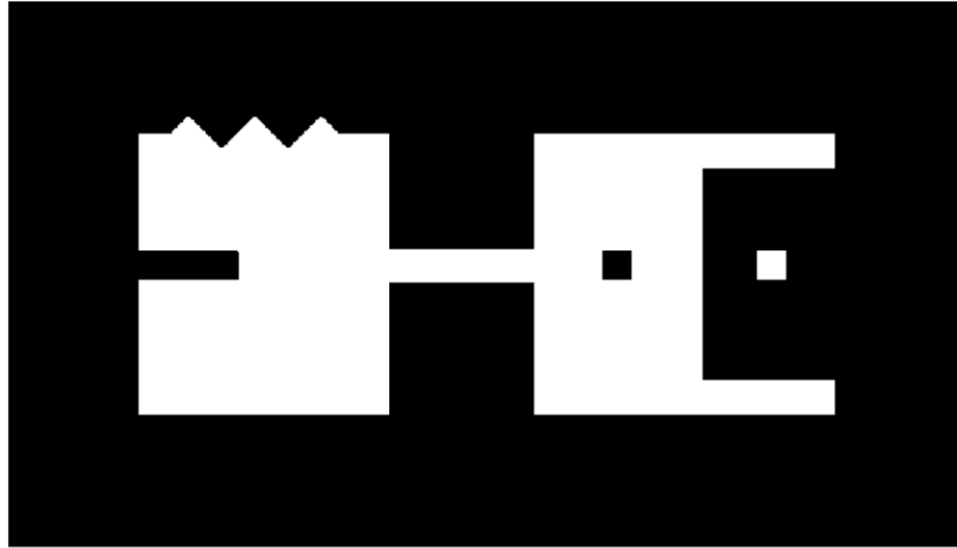


Image
After
Closing



Boundary Extraction Example

- ▶ A simple image and the result of performing boundary extraction using a square 3*3 structuring element



Boundary Extraction Example

- ▶ A simple image and the result of performing boundary extraction using a square 3×3 structuring element
 - ▶ First erode the original image and then subtract the eroded image from original image to get object boundary



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 - ▶ Possible using dilation also: THINK ABOUT IT

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- ▶ A simple image and the result of performing boundary extraction using a square 3×3 structuring element
 - ▶ First erode the original image and then subtract the eroded image from original image to get object boundary
 - ▶ Possible using dilation also: THINK ABOUT IT



Original Image

Extracted Boundary