



CAP 4453

Robot Vision

Dr. Gonzalo Vaca-Castaño
gonzalo.vacacastano@ucf.edu



Morphological operations

- Morphological transformations are some simple operations based on the image shape.
- It is normally performed on binary images
- Two inputs:
 - original image
 - **structuring element** or **kernel** which decides the nature of operation.
- Two basic morphological operators:
 - Erosion
 - Dilation

Erosion

- A pixel in the original image (either 1 or 0) will be considered:
 - 1 only if all the pixels under the kernel is 1,
 - otherwise, it is eroded (made to zero).
- All the pixels near boundary will be discarded depending upon the size of kernel
- It is useful for:
 - removing small white noises
 - detach two connected objects



Original



Output

Erosion

```
import cv2 as cv
import numpy as np

img = cv.imread('j.png', cv.IMREAD_GRAYSCALE)
assert img is not None, "file could not be read, check with os.path.exists()"
kernel = np.ones((5,5),np.uint8)
erosion = cv.erode(img,kernel,iterations = 1)
```



Original



Output



Dilation

- A pixel in the original image will be considered:
 - 1 if at least one pixel under the kernel is '1'.
 - otherwise, it is zero.
- It increases the white region in the image or size of foreground object increases
-

Dilation

```
dilation = cv.dilate(img, kernel, iterations = 1)
```



Original



Output

Opening

- Opening is just another name of **erosion followed by dilation**
- In cases like noise removal, erosion is followed by dilation.
 - Erosion removes white noises (but it also shrinks our object)
 - Dilation. (our object area increases). It is also useful in joining broken parts of an object.

```
opening = cv.morphologyEx(img, cv.MORPH_OPEN, kernel)
```



Original

Output

Closing

- Closing is reverse of Opening, **Dilation followed by Erosion.**
- It is useful in closing small holes inside the foreground objects, or small black points on the object.

```
closing = cv.morphologyEx(img, cv.MORPH_CLOSE, kernel)
```



Original

Output

Morphological Gradient

- It is the difference between dilation and erosion of an image.
- The result will look like the outline of the object.

```
gradient = cv.morphologyEx(img, cv.MORPH_GRADIENT, kernel)
```



Original

Output

Top hat

- It is the difference between input image and Opening of the image.
- Below example is done for a 9x9 kernel.

```
tophat = cv.morphologyEx(img, cv.MORPH_TOPHAT, kernel)
```



Original

Output

Black Hat

- It is the difference between the closing of the input image and input image.

```
blackhat = cv.morphologyEx(img, cv.MORPH_BLACKHAT, kernel)
```



Original

Output



Questions?