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
Erosion

```python
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.

CAP4453
Dilation

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

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

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

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

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

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

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

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