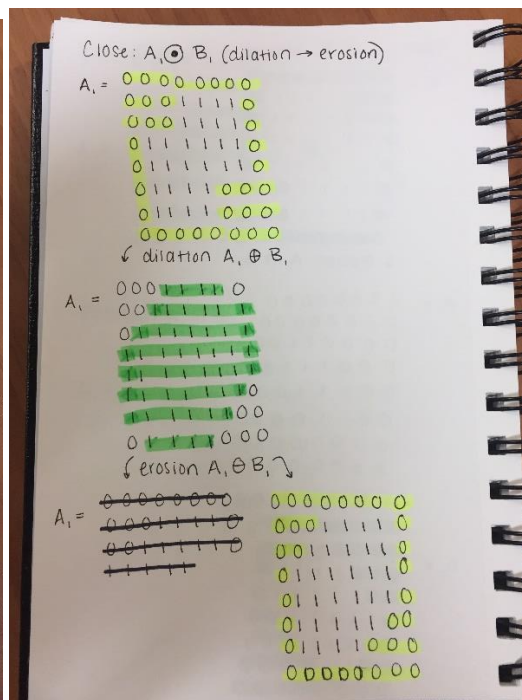
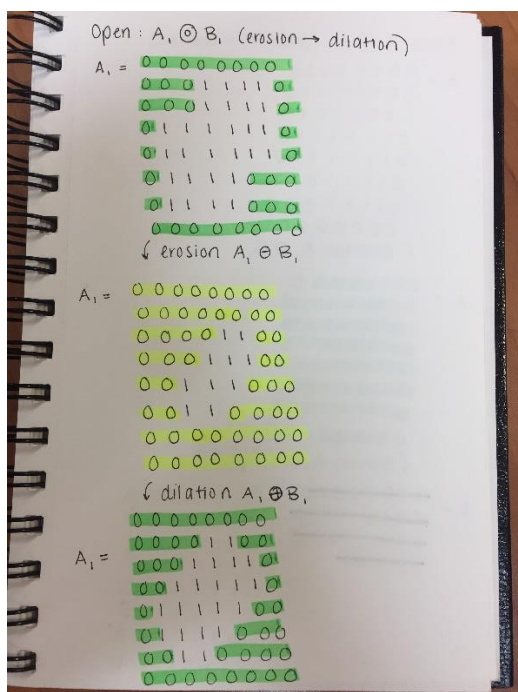
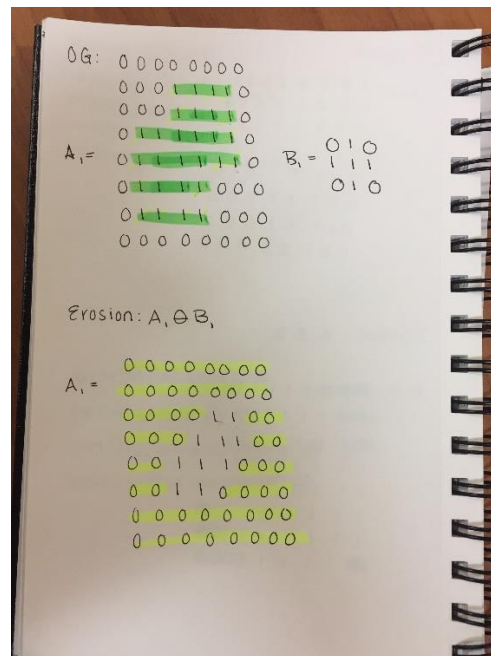
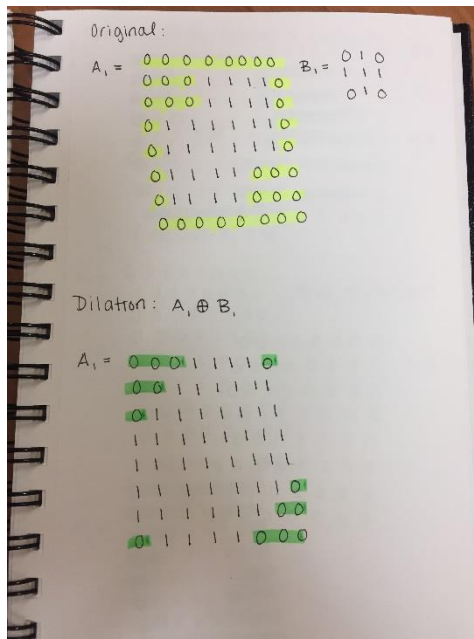


Caitlin Harris

### CSC 317: Homework 3

9 December 2019

1. Morphology – Exercise Problem #1 in our textbook Find  $A_1 \ominus B_1$ ;  $A_1 \oplus B_1$ ;  $A_1 \odot B_1$ ; and  $A_1 \bullet B_1$  manually. Check the answers with OpenCV programming.

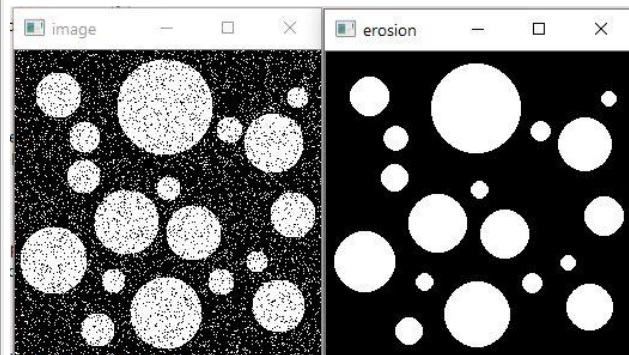


- One application of morphology is Noise Removal. In our textbook, there is an image circles.png. You can add some noise to the image and then use morphology to remove the noise. Show the original image and the resulting image.

```

1 # -*- coding: utf-8 -*-
2 """
3 Created on Wed Oct 30 20:19:53 2019
4
5 @author: Caity
6 """
7 import cv2
8 import numpy as np
9
10 import skimage.io as io
11 import skimage.util.noise as noise
12 import scipy.ndimage as ndi
13
14 #add noise to image
15 img = io.imread('../0-OriginalImages/circles.png')
16 img_noise = noise.random_noise(img,mode='s&p')
17 img_noise = noise.random_noise(img,mode='s&p',amount=0.2)
18
19 #display image with noise
20 cv2.imshow('image',img_noise)
21
22 #create kernel size of 5
23 kernel = np.ones((5,5), np.uint8)
24
25 #erode image
26 img_erosion = cv2.erode(img, kernel, iterations = 1)
27
28 #display image after erosion
29 cv2.imshow('erosion', img_erosion)
30
31 cv2.waitKey(0)
32

```



- Edge Detection – Apply Sobel X-Filter and Y-Filter to an image of your choice and demonstrate the effectiveness.

```

1 # -*- coding: utf-8 -*-
2 """
3 Created on Tue Dec 10 20:53:39 2019
4
5 @author: Caity
6 """
7
8 import cv2
9 import numpy as np
10 from matplotlib import pyplot as plt
11
12 img = cv2.imread('../0-OriginalImages/blocks.jpg')
13
14 laplacian = cv2.Laplacian(img, cv2.CV_64F)
15 sobelx = cv2.Sobel(img, cv2.CV_64F, 1, 0, ksize = 5)
16 sobely = cv2.Sobel(img, cv2.CV_64F, 0, 1, ksize = 5)
17
18 plt.subplot(2, 2, 1), plt.imshow(img, cmap='gray')
19 plt.title('original'), plt.xticks([], plt.yticks([]))
20 plt.subplot(2, 2, 2), plt.imshow(laplacian, cmap='gray')
21 plt.title('laplacian'), plt.xticks([], plt.yticks([]))
22 plt.subplot(2, 2, 3), plt.imshow(sobelx, cmap='gray')
23 plt.title('sobel x'), plt.xticks([], plt.yticks([]))
24 plt.subplot(2, 2, 4), plt.imshow(sobely, cmap='gray')
25 plt.title('sobel y'), plt.xticks([], plt.yticks([]))
26
27 plt.show()
28
29

```

