TDT4195 - Assignment 6

Nora Evensen Jansrud, Olaf Rosendahl

November 2022

Task 1: Theory

a) Define opening and closing in terms of erosion and dilation. What happens when open and closing are applied multiple times on the same image?

Opening is Erosion followed by dilation with the same structuring element. *Closing* is the opposite, dilation followed by erosion.
If opening or closing is performed multiple times on the same image, the output will be as if it was done only once.

b) Smoothing of an image is often done before performing edge detection. What is the purpose of smoothing the image before edge detection?

Smoothing removes high-frequency noise. During edge detection, this will make it easier to actually identify edges, as edge-detection often is very sensitive to noise.

c) The Canny edge detector uses a method called hysteresis thresholding. Shortly explain how hysteresis thresholding work.

Hysteresis thersholding sets a threshold for the pixel values. It does not only use the value of the single pixel, but also the value of connected pixels to determine which pixels should be included. The pixels connected to a pixel above the threshold are thersholded with a lower threshold. This favors big clusters of valid pixels and disfavors pixels not connected to anything.

d) Why do we use hysteresis thresholding instead of a single threshold?

Hysteresis thresholding is used when a picture contains a lot of noice. By using hysteris thresholding it is possible to catch weak edges, without including a lot of noise.

e) Determine the dilation $A \oplus B$ of the binary image in Figure 1a. Use the structuring element in Figure 1b.

The structuring element B is symmertrical around the referenc pixel, marked with a dot. This gives $\hat{B} = B$

1	•	1

By placing the structuring element over every pixel in the original image, we can see if there is a hit. If so, the pixel is set to 1. Otherwise it is set to 0.
The original image:

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

The image after dilation:

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

Task 2: Programming

a)

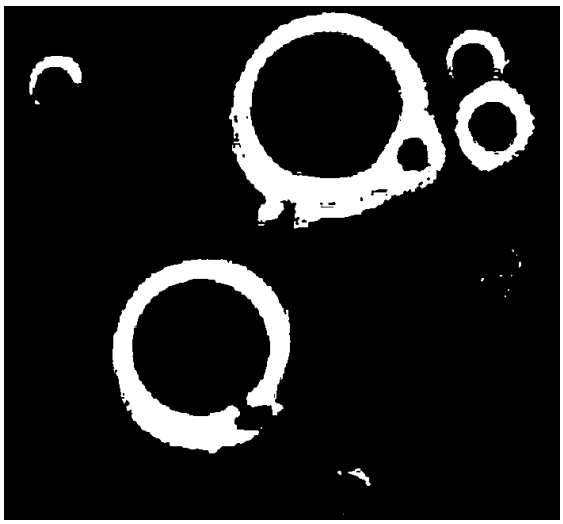

Figure 1: Segmented polymercell.png

Figure 2: Segmented thumbprint.png

b)

Figure 3: Segmented defective-weld.png

Task 3: Morphology

a)

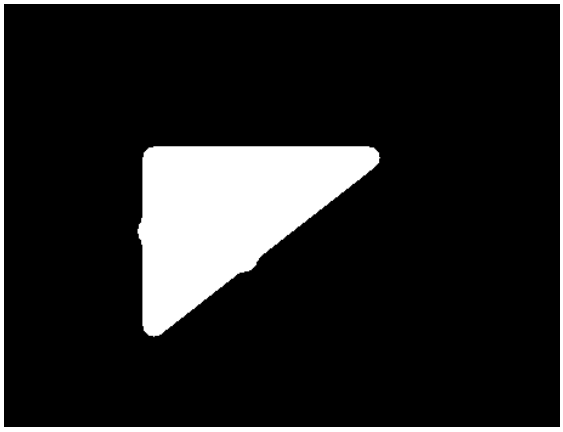

Figure 4: We used Skimage's binary_closing and binary_closing to remove the noise with a structuring element shaped as a disk with a radius of 9

b)

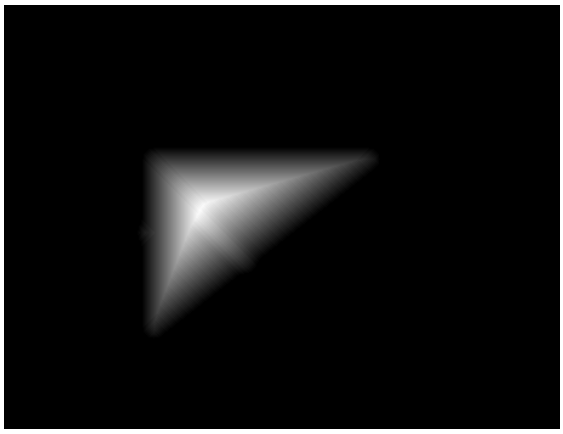

Figure 5: The distance transform using the erosion method

c)

Figure 6: The boundary on the image lincoln.png

d)

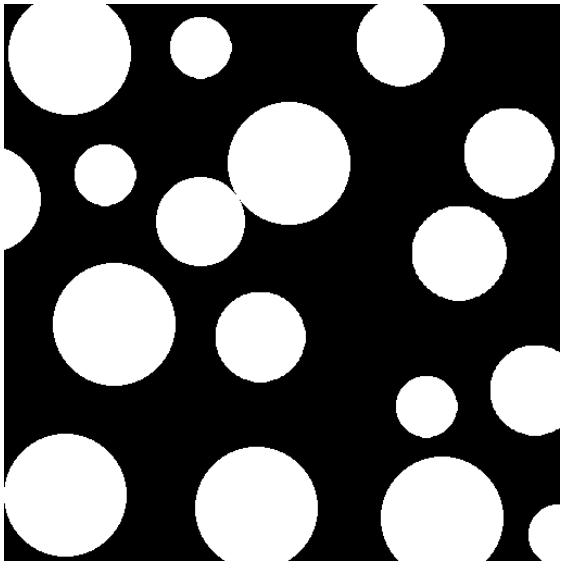

Figure 7: Filled holes