TDT4195 Image processing assignment 3 report

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Task 1.a

Opening is an operation defined as an erosion followed by a dilation.
Closing is the opposite, a dilation followed by an erosion.

If opening is applied multiple times to an image, the result is equivalent to if opening had been performed only once. The same goes for closing.

Task 1.b

The purpose of smoothing before an edge detection is removing high-frequency noise which without smoothing would be amplified a lot. This makes the actual edges much easier to find when differentiating the image.

Task 1.c

The basic idea of hysteresis thresholding is to set a threshold for the pixel values, but if pixels below the threshold are connected (through 4- or 8-connectivity, implementer's choice) to pixels above it, they are thresholded with a lower threshold. This means that in practice, if one has encountered a pixel above the threshold, the threshold is lowered for the surrounding pixels.
If one encounters pixels below the original threshold that are not connected to any that are above, they will not be accepted into the thresholded image.

Task 1.d

We use hysteresis thresholding because we want to "catch" weak connections between strong edges, and show them in out thresholded image.

A weak connection is a line between two things that is below the threshold.

A strong edge is a line or an aggregation of connected pixels that are above the threshold.

Task 1.e)

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

(a) A 6×6 binary image.

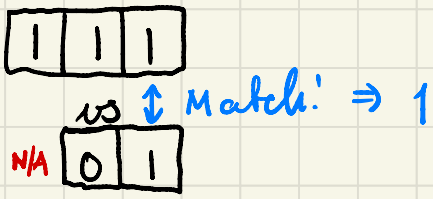
1	•	1

(b) A 1×3 structuring element

& structuring element is symmetric, thus its reflection is the same as itself.

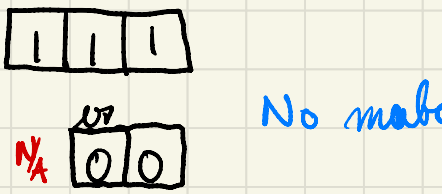
Dilation

(0,0): (upper left, $y \downarrow$ $x \rightarrow$)



This is the same for (0,1) & (0,2)

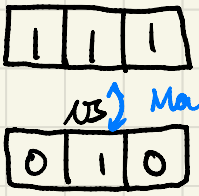
(0, 3):



No match ⇒ 0

This is the same for (0,4) & (0,5)

(1, 6):



.... And so on, you get the point, and so do I...

The dilation of (1a) with (1b) is then:

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

Note that here, the reference pixel is assumed to be 1.

Task 2.a

Figure 1: Thumbrint, segmented with Otsu's method

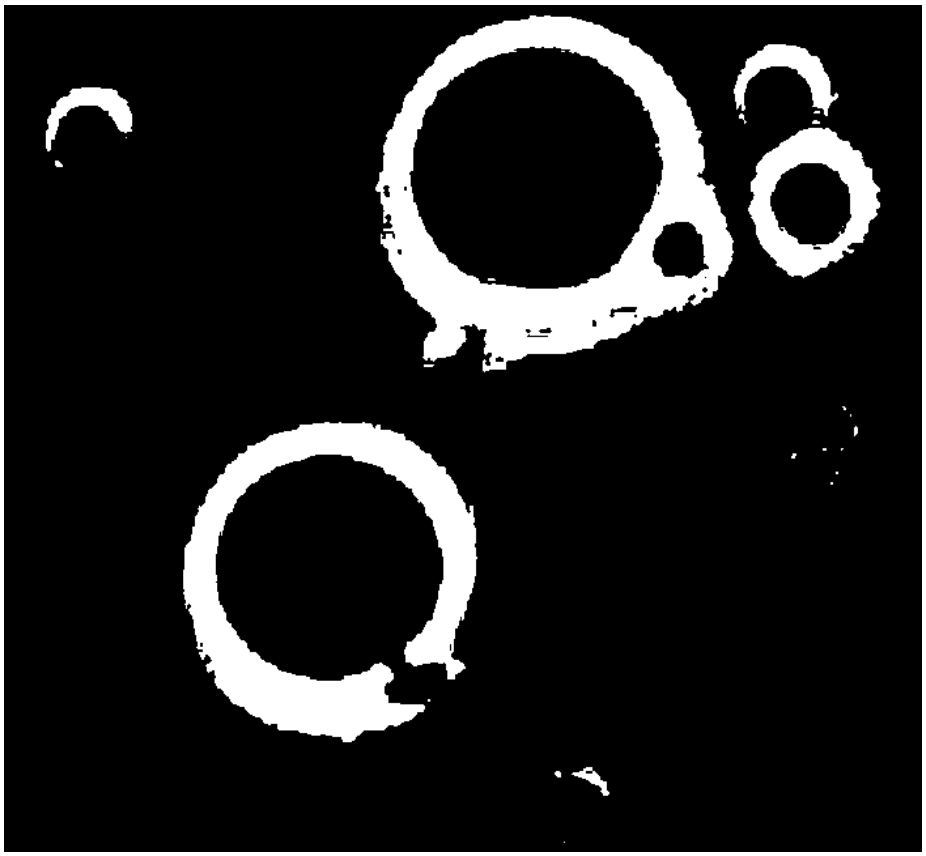


Figure 2: Polymercell, segmented with Otsu's method

The optimal threshold found for the thumbrpint was 153. The optimal threshold found for the polymercell was 181.

Task 2.b

Figure 3: Defective weld segmented with reqion growing using a threshold of 50

Task 3.a

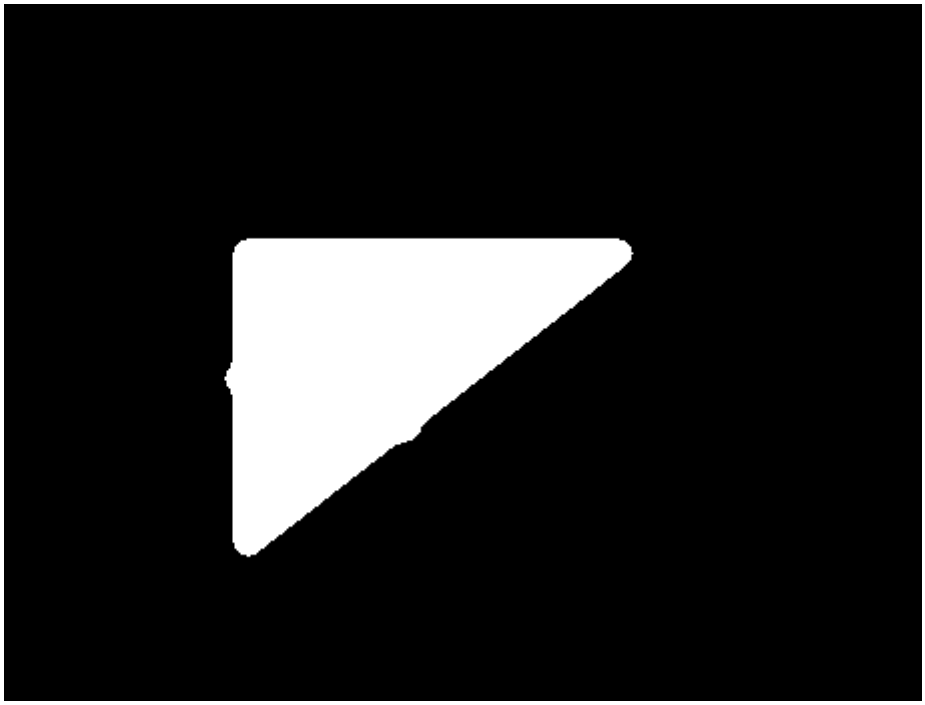


Figure 4: Filtered image from 3a

First, an opening is performed, this is to remove the so-called “salt noise” outside of the triangle without degenerating the triangle too much.

Then, a closing is performed, to remove the noise inside the triangle, and still keep the shape of the triangle relatively intact.

Task 3.b

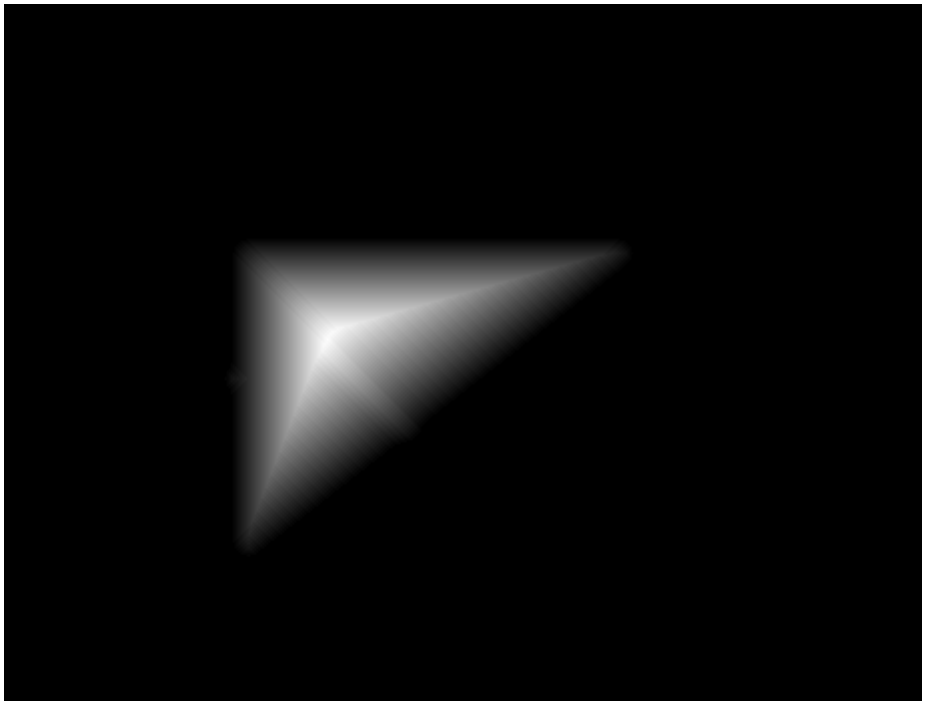


Figure 5: noisy.png after being subjected to noise removal and distance transform

Task 3.c

Figure 6: border of Lincoln

Task 3.d

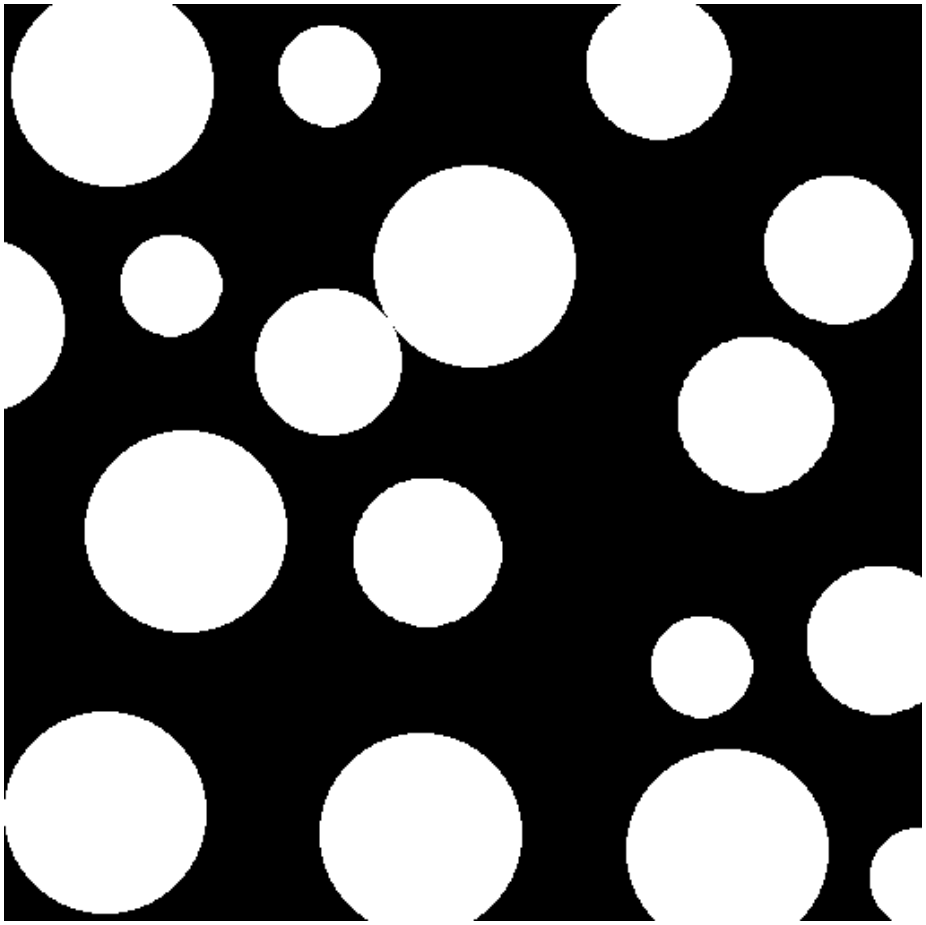


Figure 7: Balls after hole filling