Image Processing
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Course: CAS-320321
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Homework 1

Experiment 1: Symmetric vs. Asymmetric SE (on f3.png)

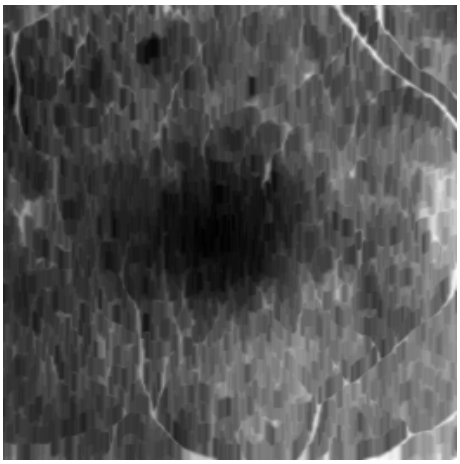

Figure 1: Erosion with Symmetric SE that is a backward diagonal of size 9 (SE5.txt)

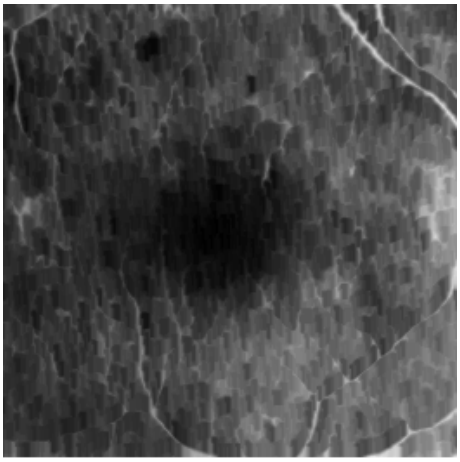

Figure 2: Erosion with Asymmetric SE that is a 9x10 resembling a backward diagonal (SE7.txt)

Border effects tend to occur when using an asymmetric SE that does not fit the definition domain of the image set. As expected the chosen border handling method does introduce artifacts to the image.

A possible explanation for this could be the fact that the definition domain of the image set decreases when doing the operation due to image borders not being handled correctly.

If you were to observe and compare Figure 1 and 2 closely you can see that the bottom border of Figure 2 contains a row of white space. This is evident when viewing the image with a black background.

Experiment 2: Improving the clarity of handwritten digits

Problem: Handwritten digit classification

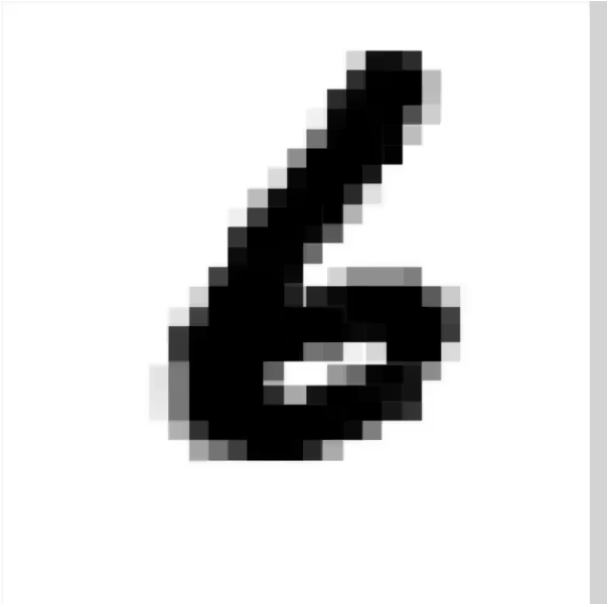

Figure 3: Handwritten grayscale six

As visible in the image above, the six is a little thick with the white circle in the middle not that evident.

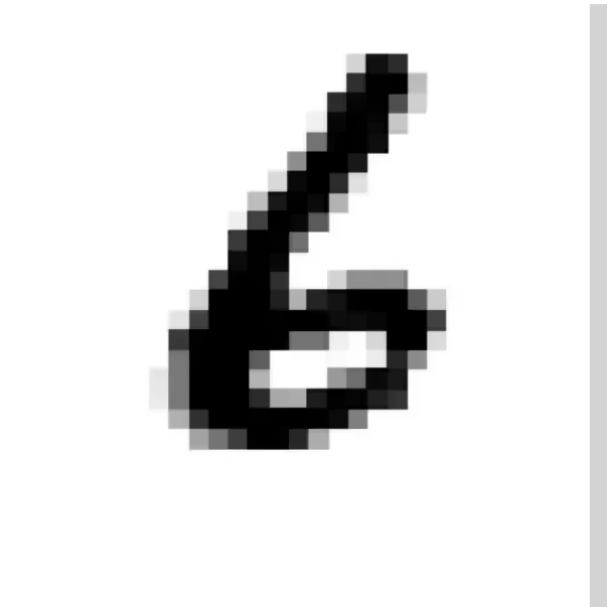

Figure 4: Dilated six

After dilating the image with a structuring element that is a square of size 15 (SE10.txt), we get a sharper six.

We chose this structuring element because we saw that the six was formed using square blots. We decided to use a larger structuring element because the image is very pixelated and we wanted to see a clear circle in the center of the six.

A possible use case for this would be feature extraction. A classification algorithm could more efficiently extract features that maps the digit as a six.

Experiment 3: Cell segmentation

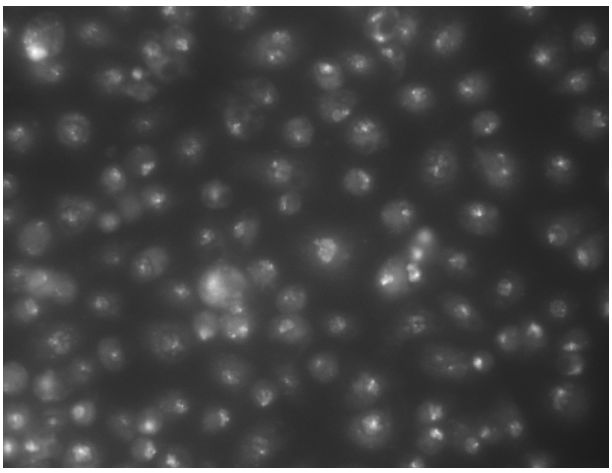

Figure 5: Original image

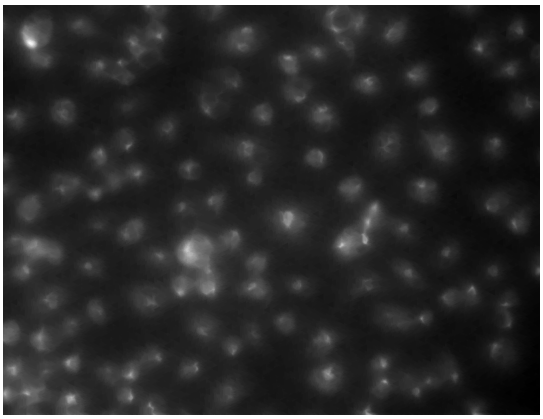

Figure 6: Erosion

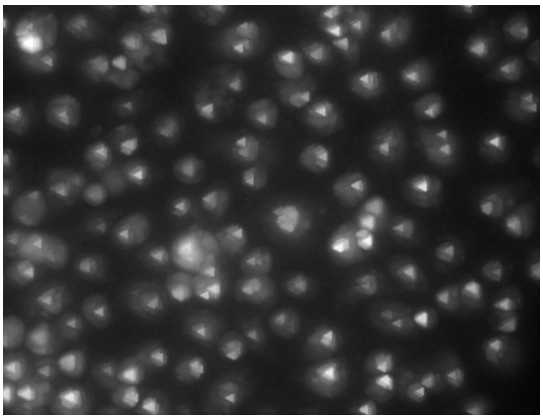

Figure 7: Dilation

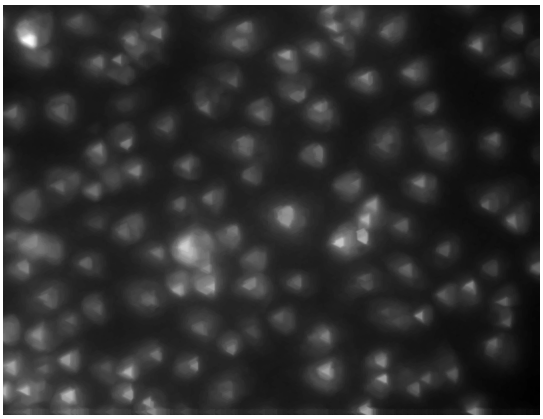

Figure 8: Opening

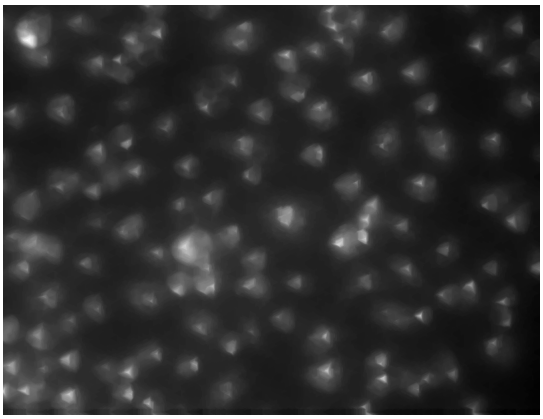

Figure 9: Closing

For these operations we used a parallelogram structuring element(SE11). We chose this shape for this image as there are a lot of circular structures that we wanted to highlight. There is a lot more contrast in the images that had the operations done on them; helping clearly segment each cellular structure.

The dilated image has the clearest segmentation between structures. However, the opened image also shows clear segmentation while not having as jarring of a contrast.

Experiment 4: Haemoglobin noise filtering and cell filling

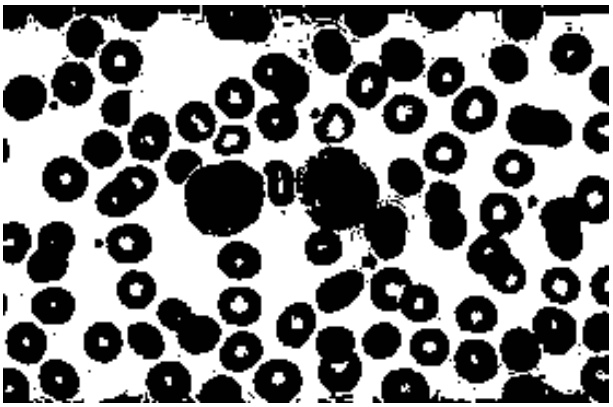

Figure 10: Original image

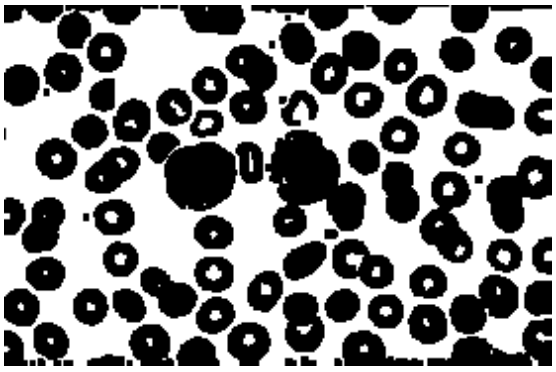

Figure 11: Closing

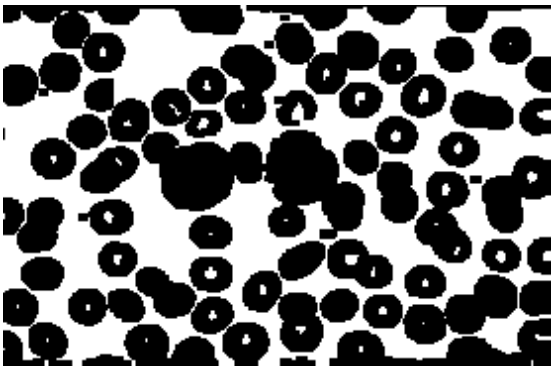

Figure 12: Erosion of closed image