

Samuel Steinberg

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ECE472

## Homework 5

The purpose of this assignment was to take the “blobs” sample image and carry out an edge detection. This would result in a clean image with the blobs outlined with thin black lines. To achieve this, the image first needed to be cleaned. By using the ImageJ algorithm ‘Make Binary’ the default auto threshold will be determined by analyzing the histogram of the image. To calculate this, the thresholding algorithm divides the image into objects and background, and then takes a test threshold to compute the average of pixels above and below the threshold. It then computes the average, increments the threshold, repeats, and stops when the threshold is larger than the composite average. Below is the equation as given by ImageJ:

$$threshold = (average\ background + average\ objects)/2$$

The result of the algorithm (implemented as `getAutoThreshold()` in `ImageProcessor`) is a stark contrast of black blobs on a white background (only grayscale values are 0 and 255) since all pixels below the final threshold are converted to black and all above are converted to white. This algorithm was also chosen because thresholding works well with images of stark foreground/background contrasts. See Figure 1 below:

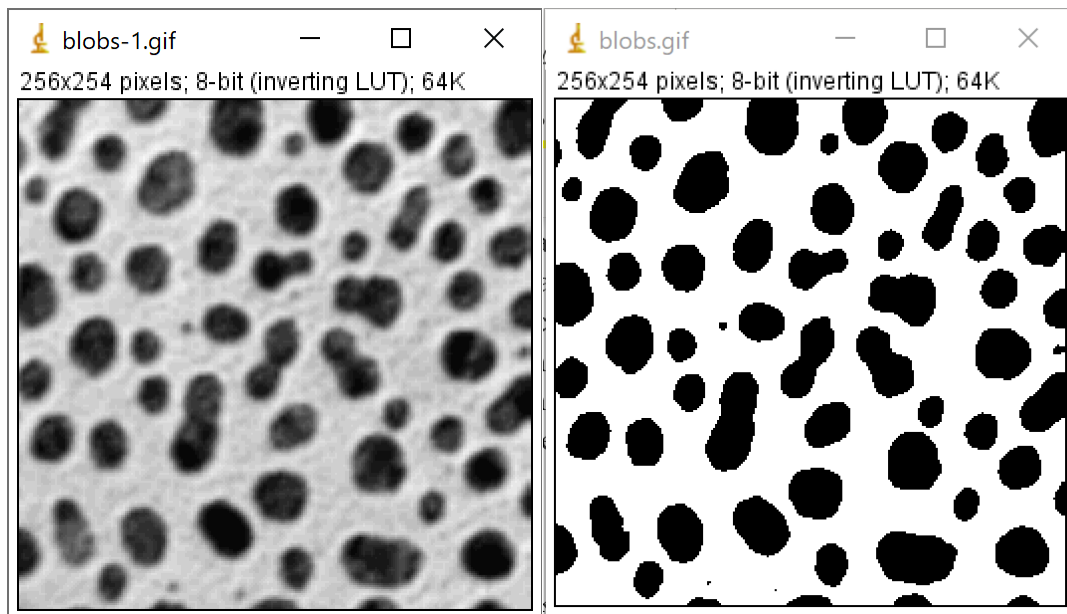


Figure 1: Original on left, after thresholding with ‘Make Binary’ run on right.

Next, ImageJ’s ‘Find Edges’ algorithm was utilized to find sharp changes in pixel intensity. In their algorithm, ImageJ uses a Sobel edge detector where two 3x3 convolution kernels generate horizontal and vertical derivatives, with the final image being a product of combining the two derivatives using the square root of the sum of squares. Inside the image the

result is a hollowing out of the black pixels in the blobs, since there was not a large enough (or any) contrast difference between the interior. This will give the desired result:

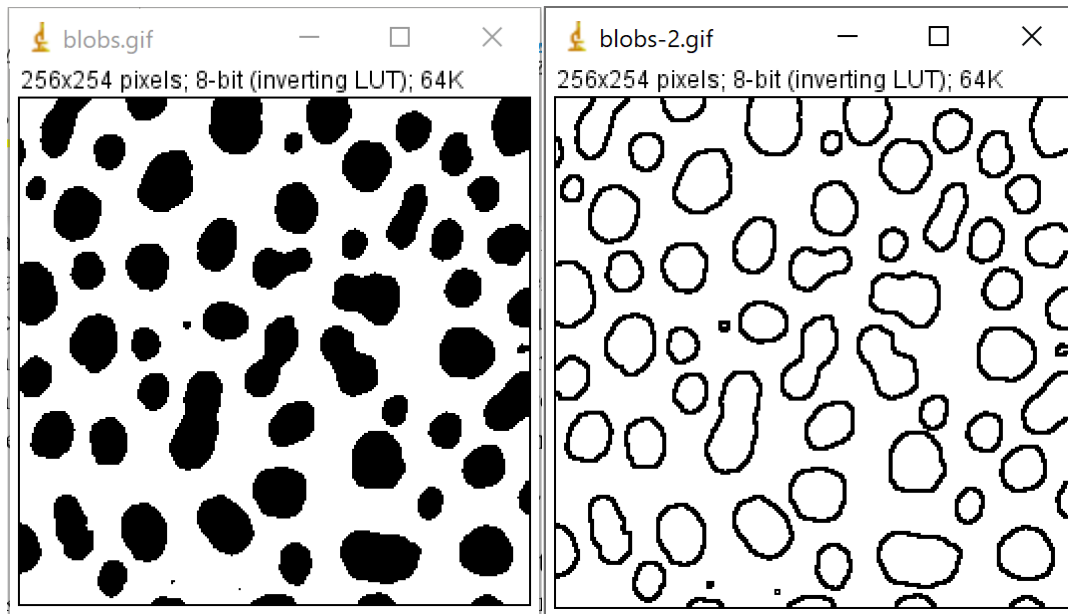


Figure 2: On the left is the binarized image, while the right image is the result of the edge detection

The absolute before/after contrast is shown in Figure 3 below:

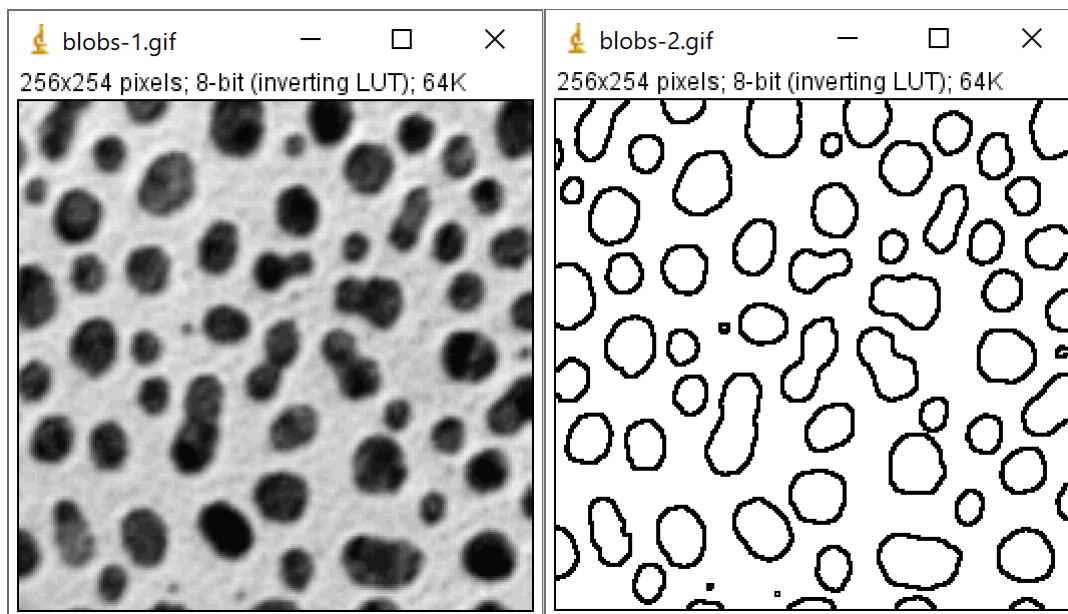


Figure 3: On left is the original "blobs", the right image is the result after running the algorithms