Computer Vision CSE 473/573
Project 3

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1. Morphology image processing

(a) The two morphological image processing algorithm that are being used are:
Here A is the image and B is the structuring element (3X3 1's). Implemented erosion Dilation, open and closing.

Algorithm one
(A o B) ● B:
res_noise1.jpg

Algorithm two :

(A ● B) o B
res_noise2.jpg

(b)

I compared the two image by subtracting the first algo from the second, and second from the first. In case they are same both the result will be black (Empty image). But following is the result. Hence they are not the same. Following is the result of second algorithm minus the first algorithm. From this we can tell that the second algo produces a slightly bigger image than the first. First minus second was a completely black image, meaning either it is confined inside second algo or exactly same, but with the below result we can conclude that they **are not same.**

Algo two result - Algo one result

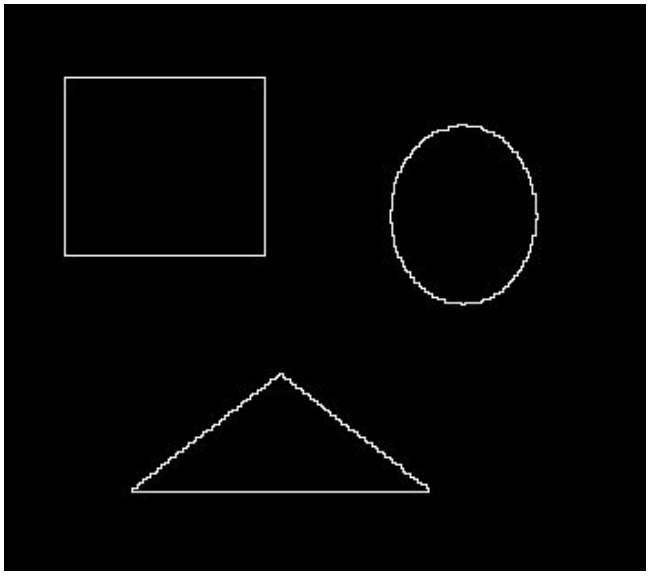
Algo one result - Algo two result

(c)

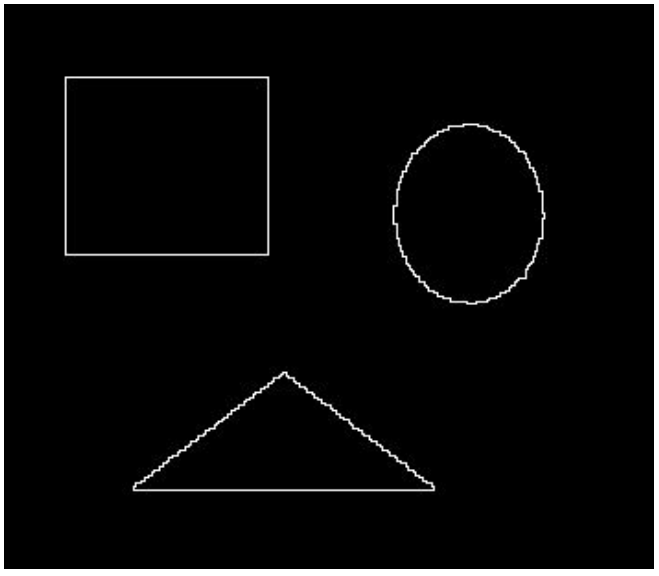
Boundary extraction was done by subtracting the noiseless image and its eroded image
Let the noiseless image be A.

A - (A ! B)

res_bound1.jpg (Using result of Algo 1)



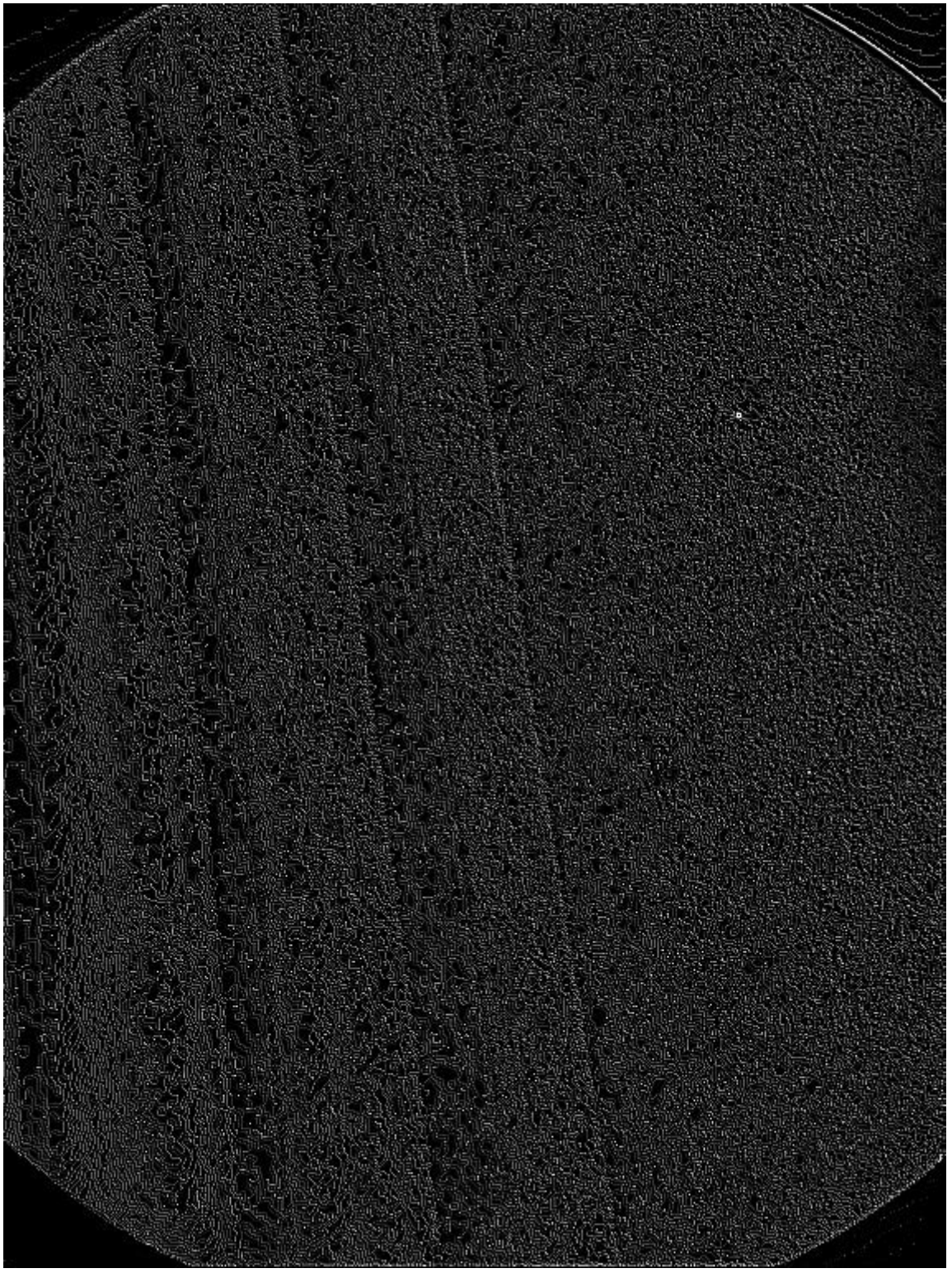
res_bound2.jpg (Using result of Algo 2)



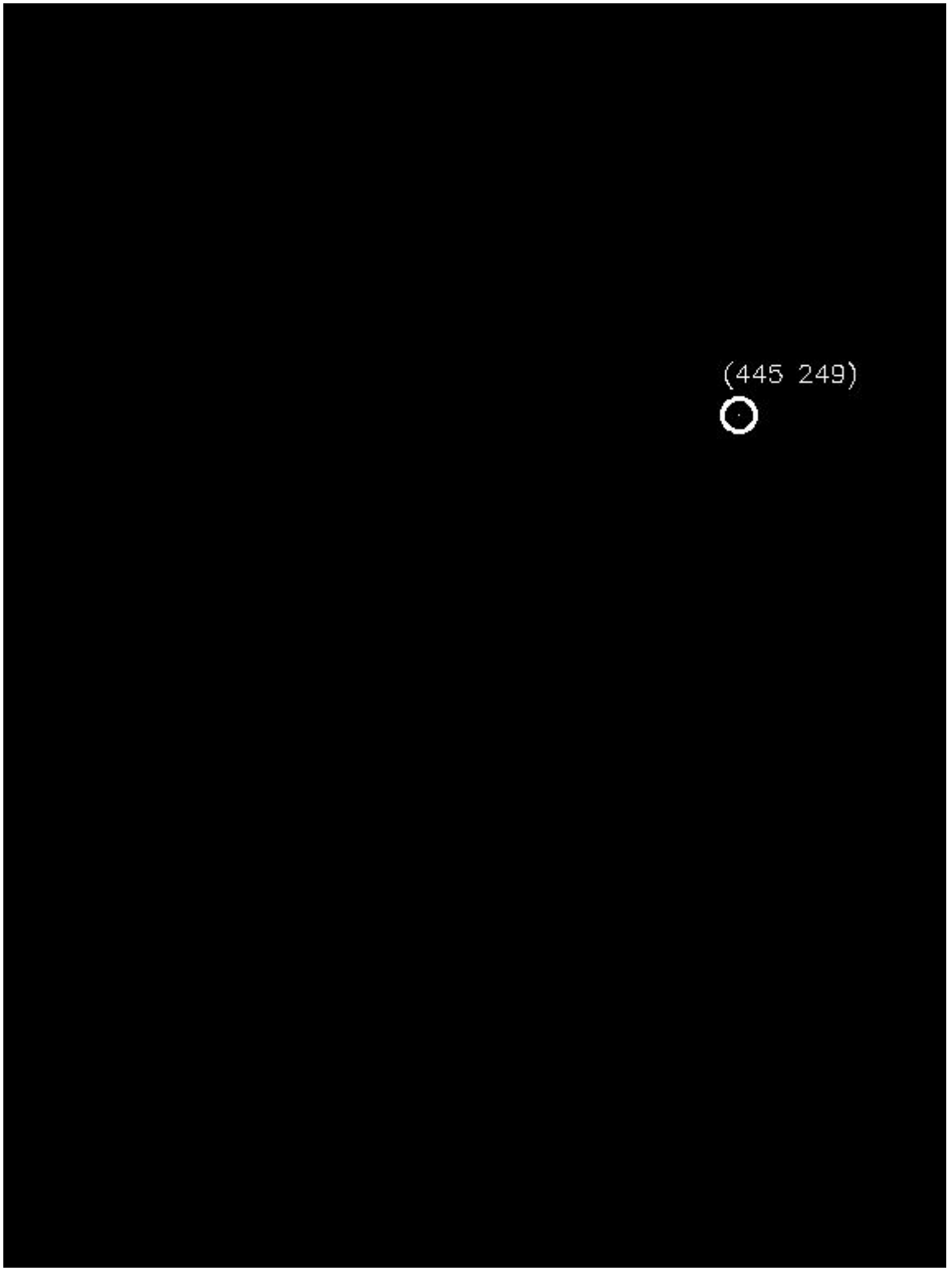
2. Image segmentation and point detection

(a) Point detection was done by convolving the image with [-1,-1,-1][-1,8,-1][-1,-1,-1] matrix, and then threshold the image such that we get the brightest point in the image. Got only one point: (249, 445).

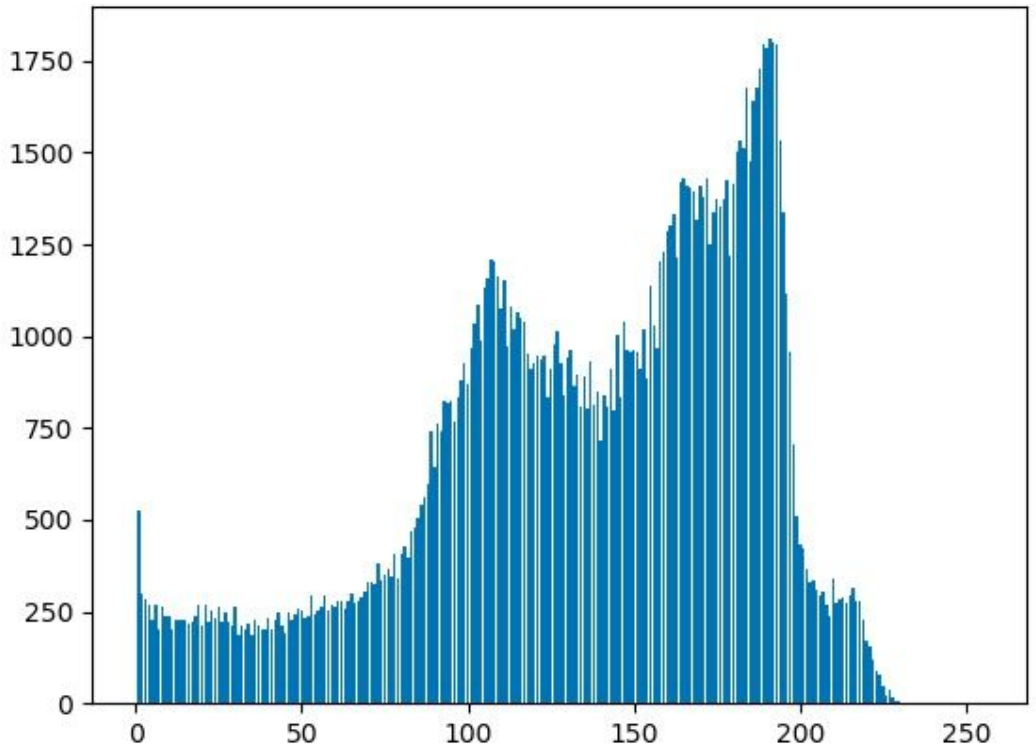
Result of mask:



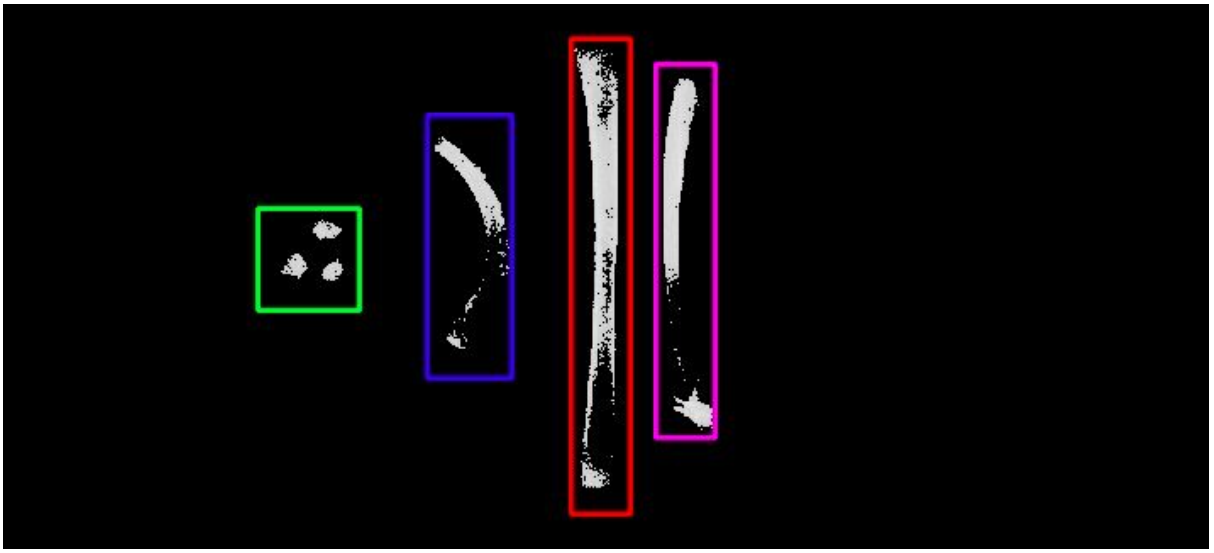
Result of point detection:



(b) First step was to plot the pixel grey intensity in the histogram. We can see the image that the bones are the brightest parts in the image, the flesh is also white but still less brighter the the bone fragments, but the flesh area is much greater than the area of the bones. Hence one conclude that, if a histogram of all values above 0 (black), the bone fragments value will be after the peak in the histogram. Hence I used the same approach, one can observe that peak in around 195-198. Hence I choose a value ranging from 203-210, this could segment out the bone fragments.



res_segmentaion.jpg



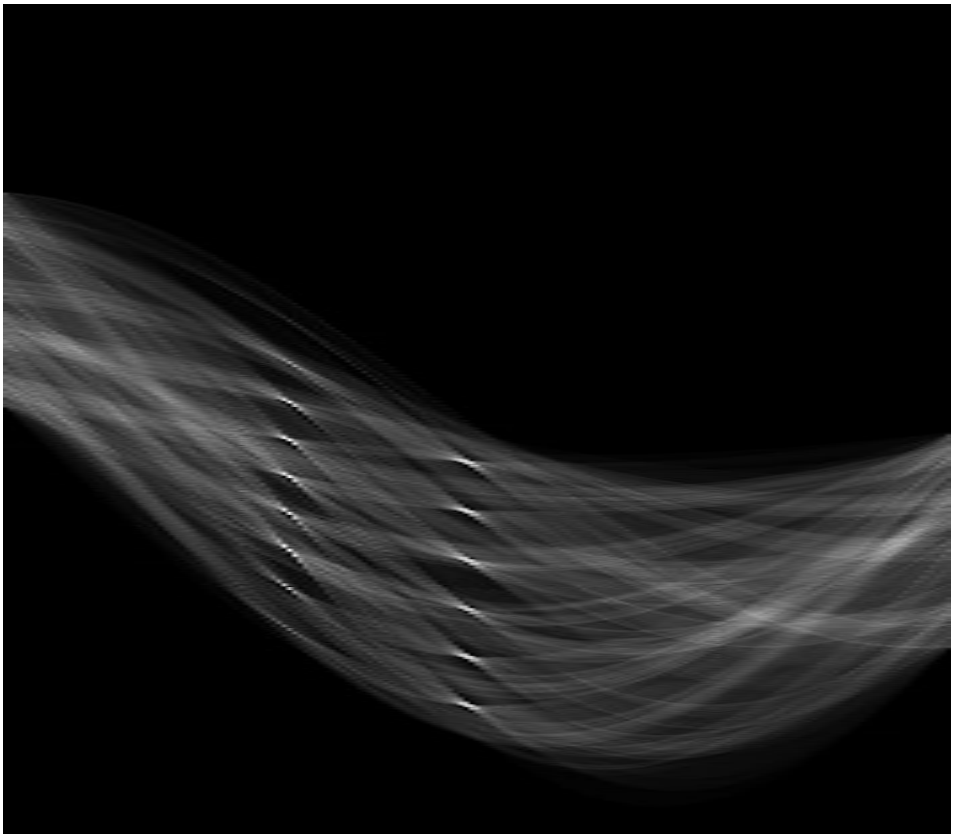
Box Color	Top left corner	Bottom right corner
Green	(150,120)	(210,180)
Purple	(250,65)	(300,220)
Red	(335,20)	(370,300)
Pink	(385,35)	(420,255)

3. Hough transform

Following is the Algorithm used to implement (a) and (b) :

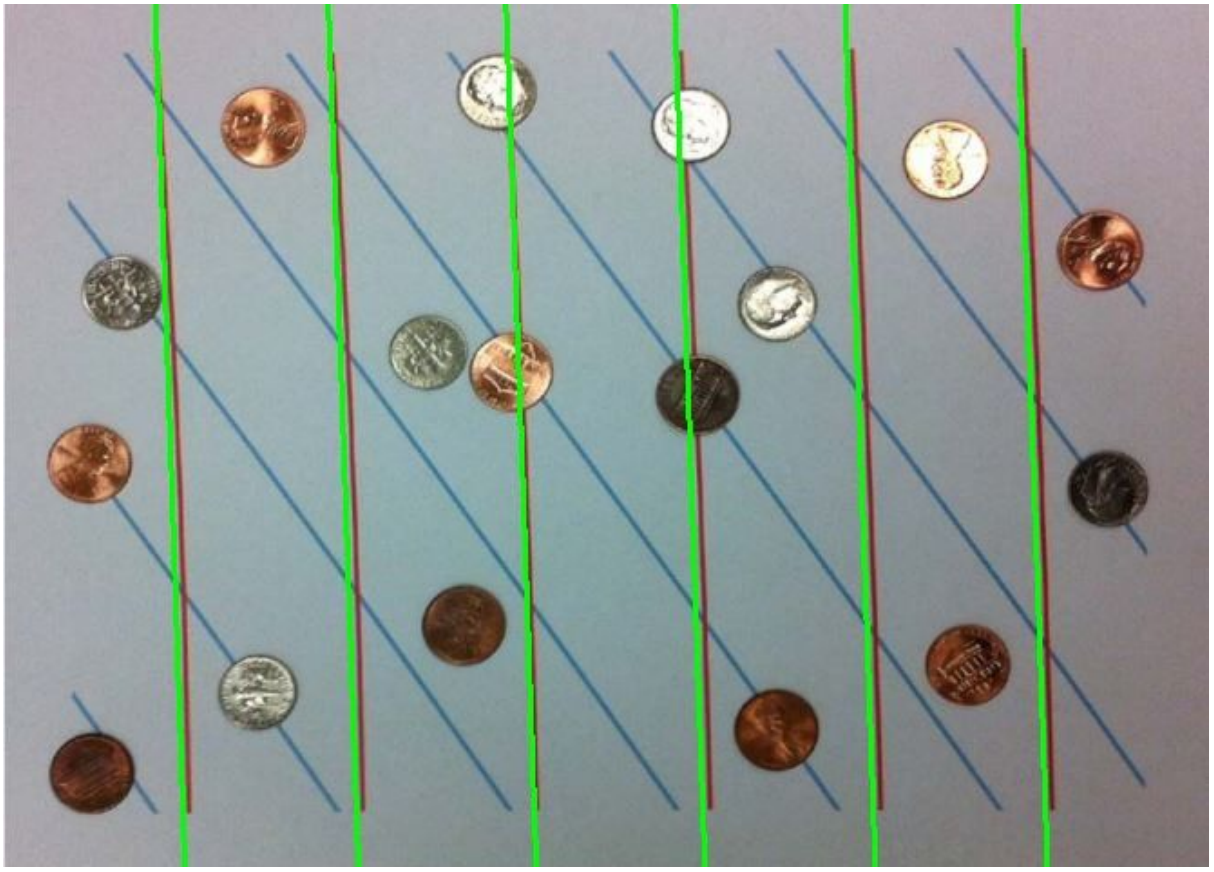
- Apply sobel for edge detection (own implementation).
- Apply global thresholding (own implementation).
- Initialize accumulation matrix (theta (-90 to 90) , rho) all zeros.
- Scan through each pixel in image, find rho for all theta from (-90 to 90) and increment the position of rho , theta position in accumulation matrix.
- Now filter out the max intensity points in required theta , say for (a) its vertical so theta is in between -2 - 2.
- Next using the theta and rho, plot the line in the normal image

Rho - Theta plot , brightest points are our lines



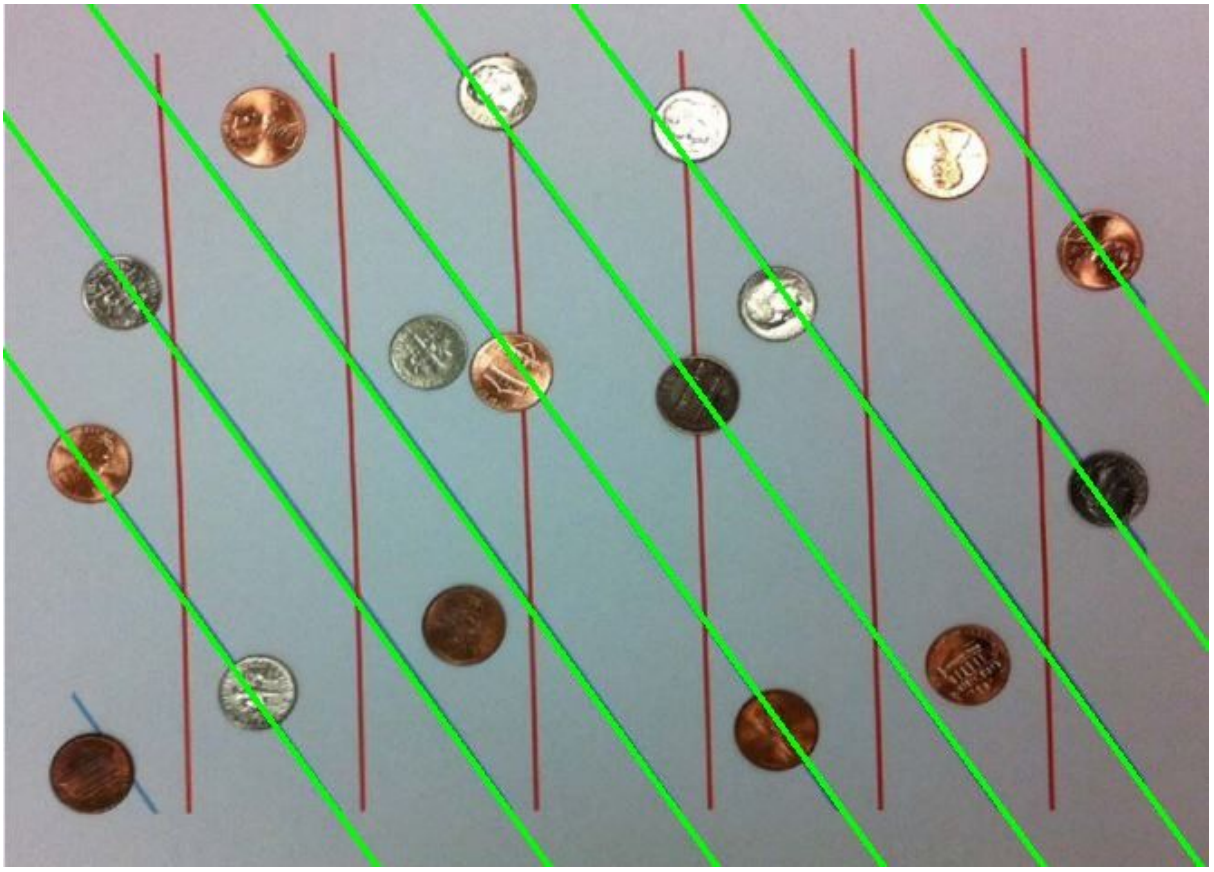
(a) Red Line Detection **No. of red line detected: 6/6**

red_line.jpg



(b) Blue Line Detection (Theta -36) **No. of red line detected: 8/9**

blue_line.jpg

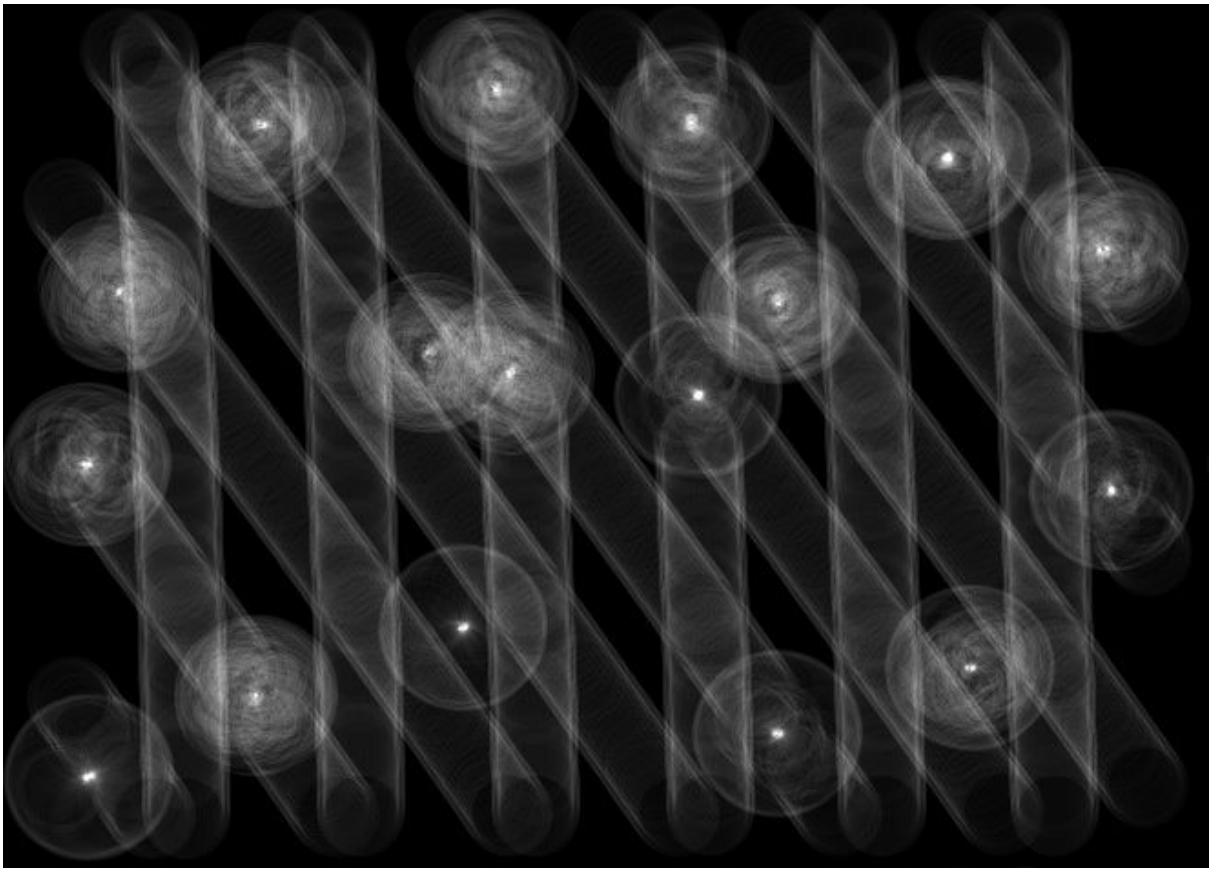


(c) Bonus circle detection

Following is the Algorithm used to implement circle detection:

- Apply sobel for edge detection (own implementation)
- Apply global thresholding (own implementation)
- Initialize accumulation matrix a, b plane to all zeros
- Scan through each pixel in image, find a and b for all theta from (0 to 360) using a fixed approx radius(can be updated depending on the results) at each point, and increment the point by 1 in a, b. A very beautiful observation can be seen here as all the points in the circumference of the circle will results in circles which will converge at the the center of the circle, making it the brightest point.
- Now pick the brightest point (highest value points) and draw circles around them, this will result in circles around any circular object in the image, here it is the coins.

ab plane image, we can see here that the coin centers are the brightest points.



coin.jpg **No. of red line detected: 17/17**