ISE-309
HW-3
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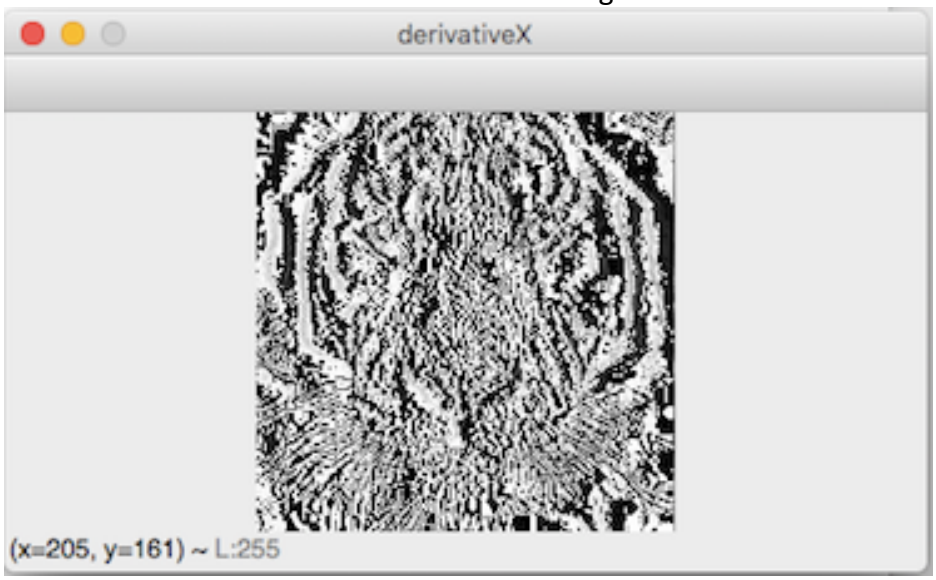
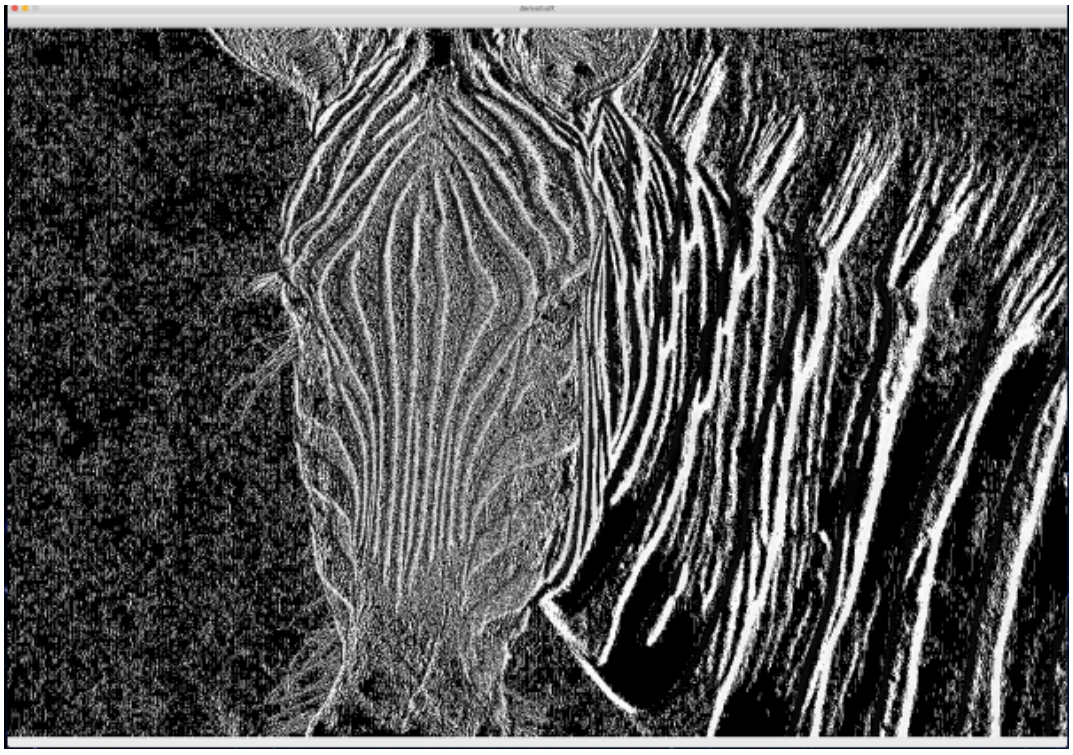
Q1)

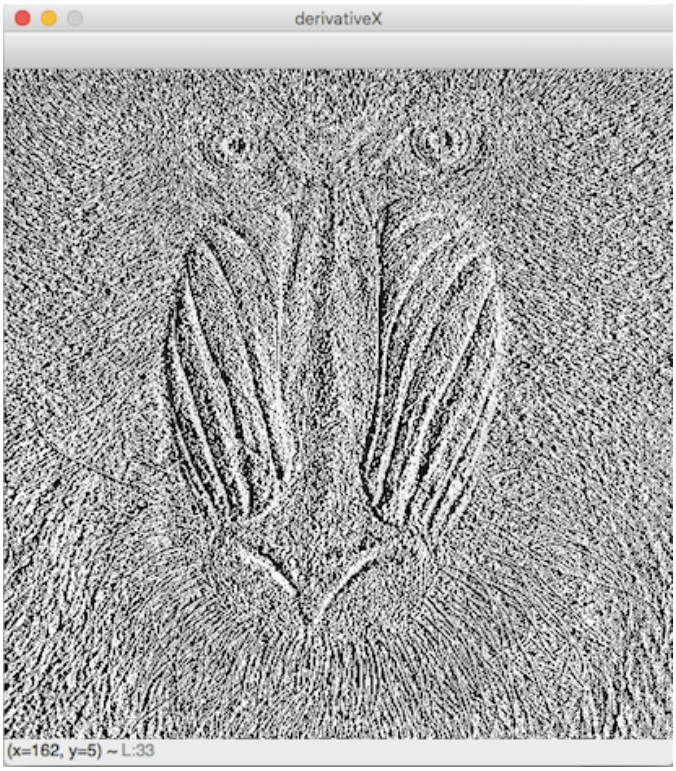
I convolved the images with Hx and Hy filters. By doing that, I found the x-axis and y-axis derivatives of each image.



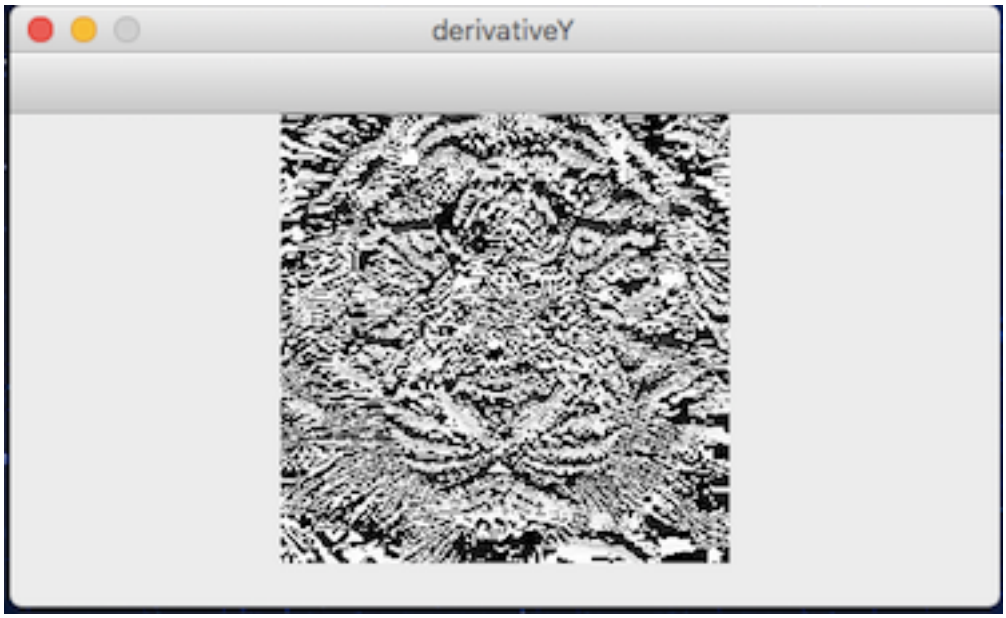
(x-axis derivative of figure 1)



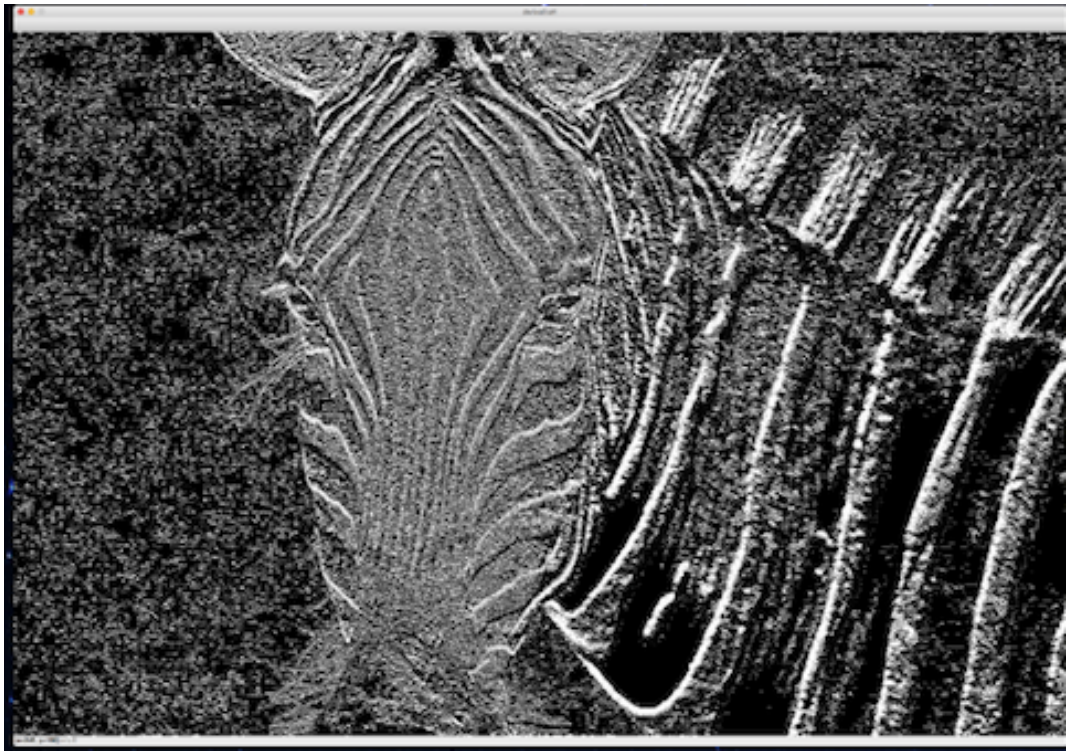
(x-axis derivative of figure 2)



(x-axis derivative of figure 3)



(y-axis derivative of figure 1)

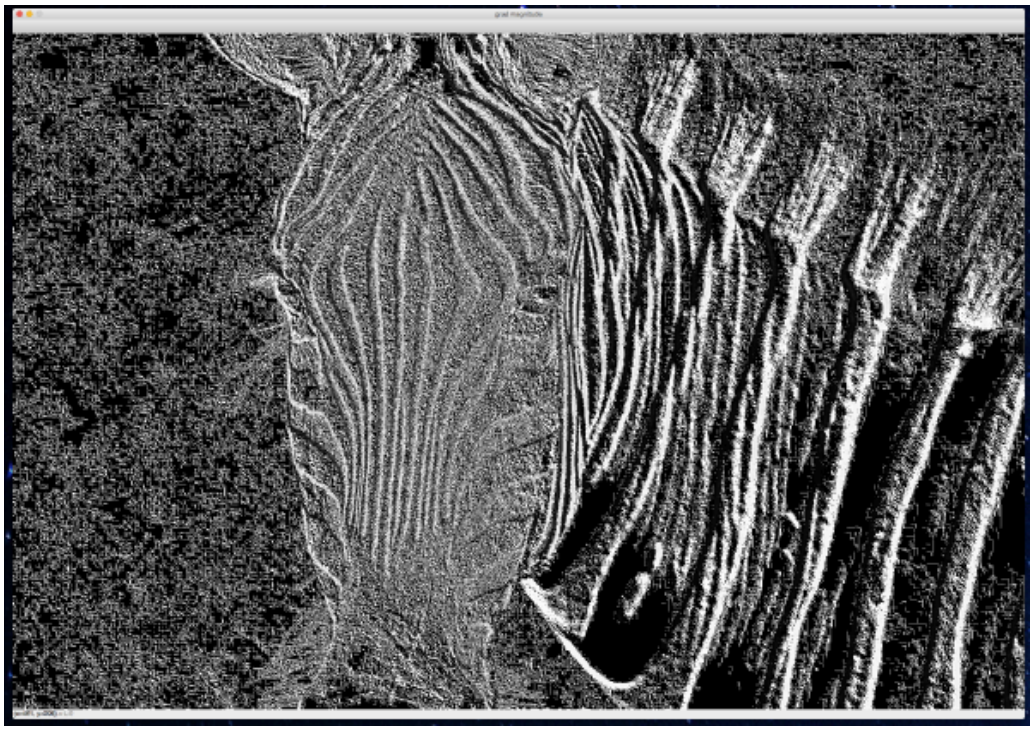


(y-axis derivative of figure 2)

(y-axis derivative of figure 3)

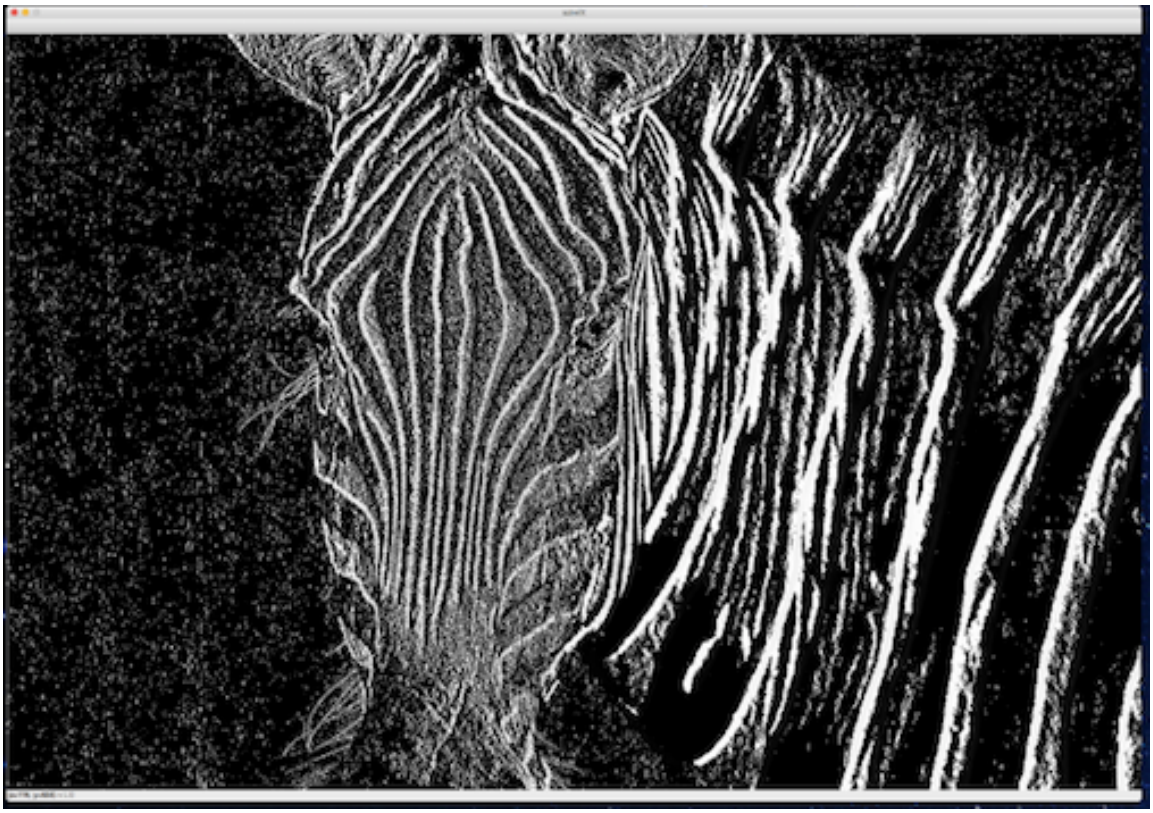
After that, I found the gradient magnitude of the images by summing up two convolved images which belong to x and y directions.

(gradient magnitude)

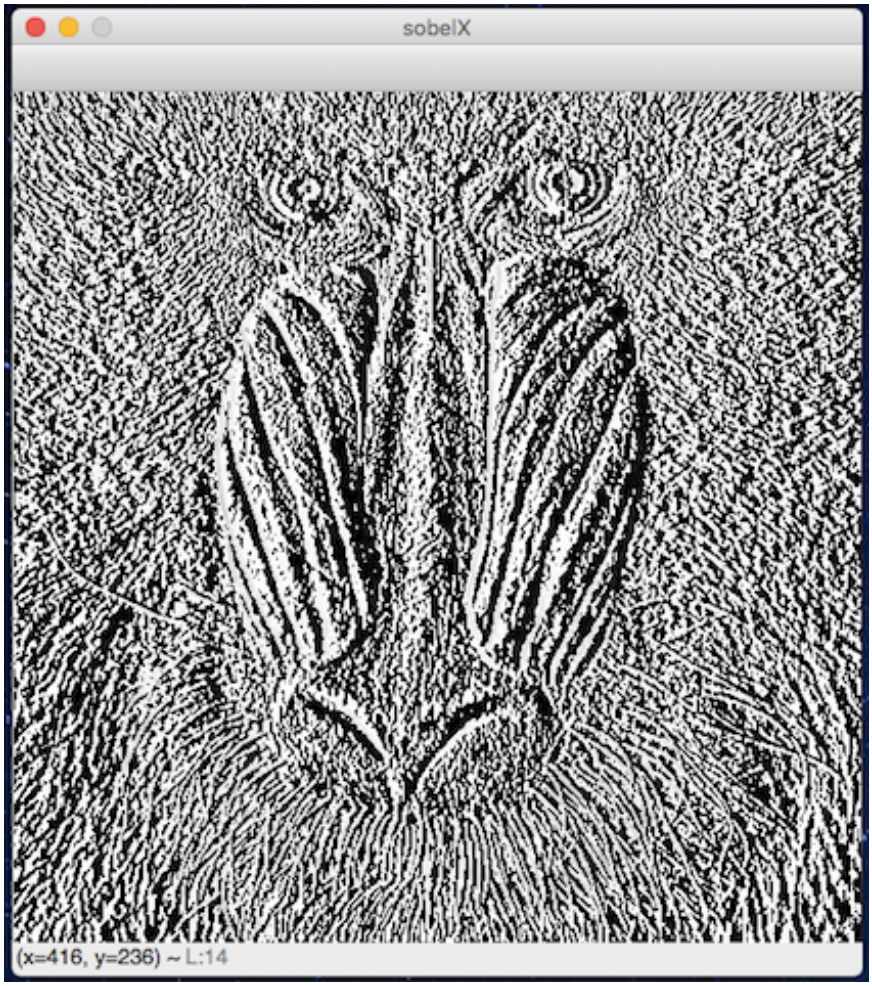

(gradient magnitude)

Q2) For this question I created the sobelx and sobely filters and I convolved the images with them. Sobel means; approximate derivative of Gaussian filter. By using Sobel filters, we clear the noise of the image to find the edges more accurately.

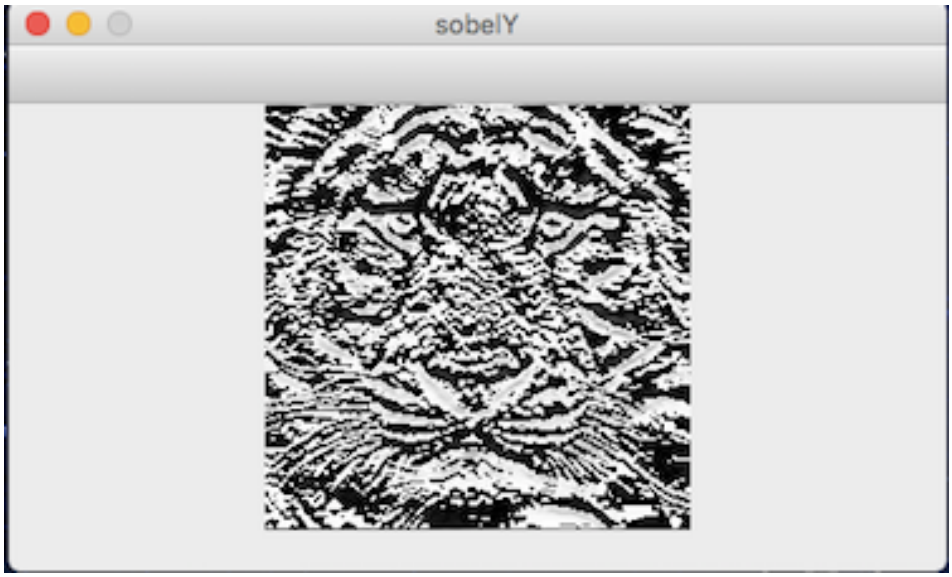
(image that convolved with sobelx)



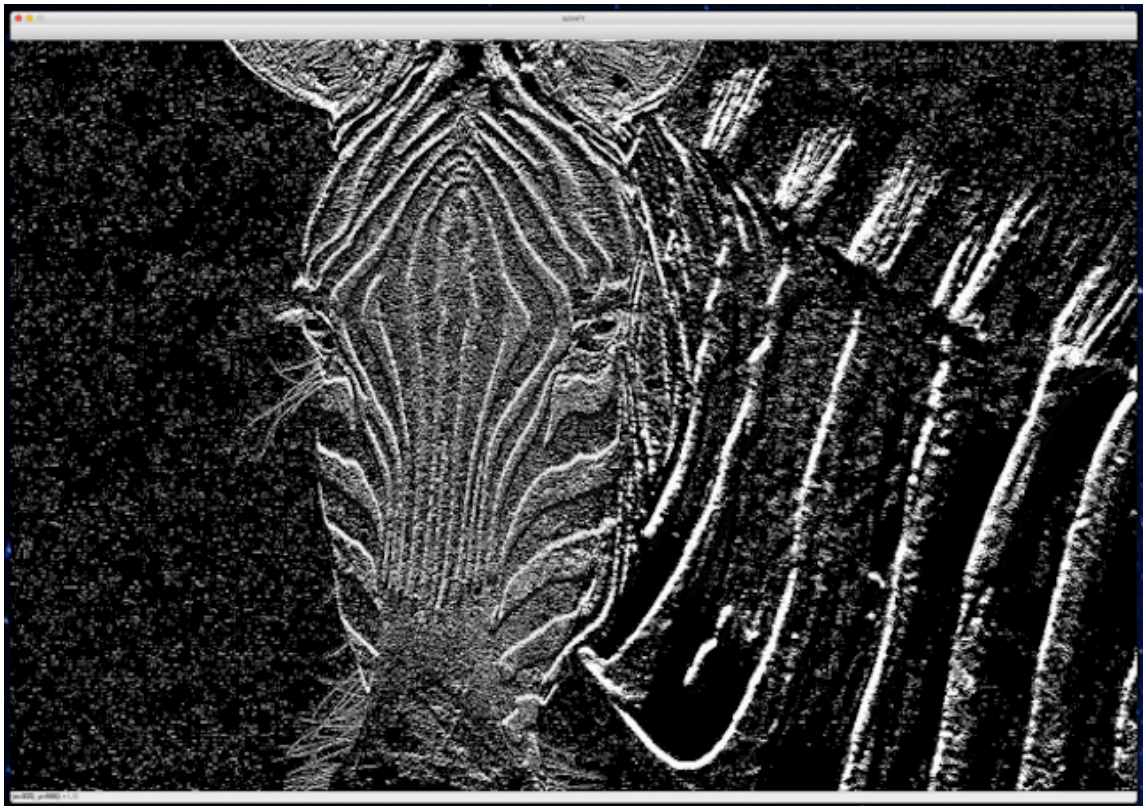
(image that convolved with sobelx)



(image that convolved with sobelx)



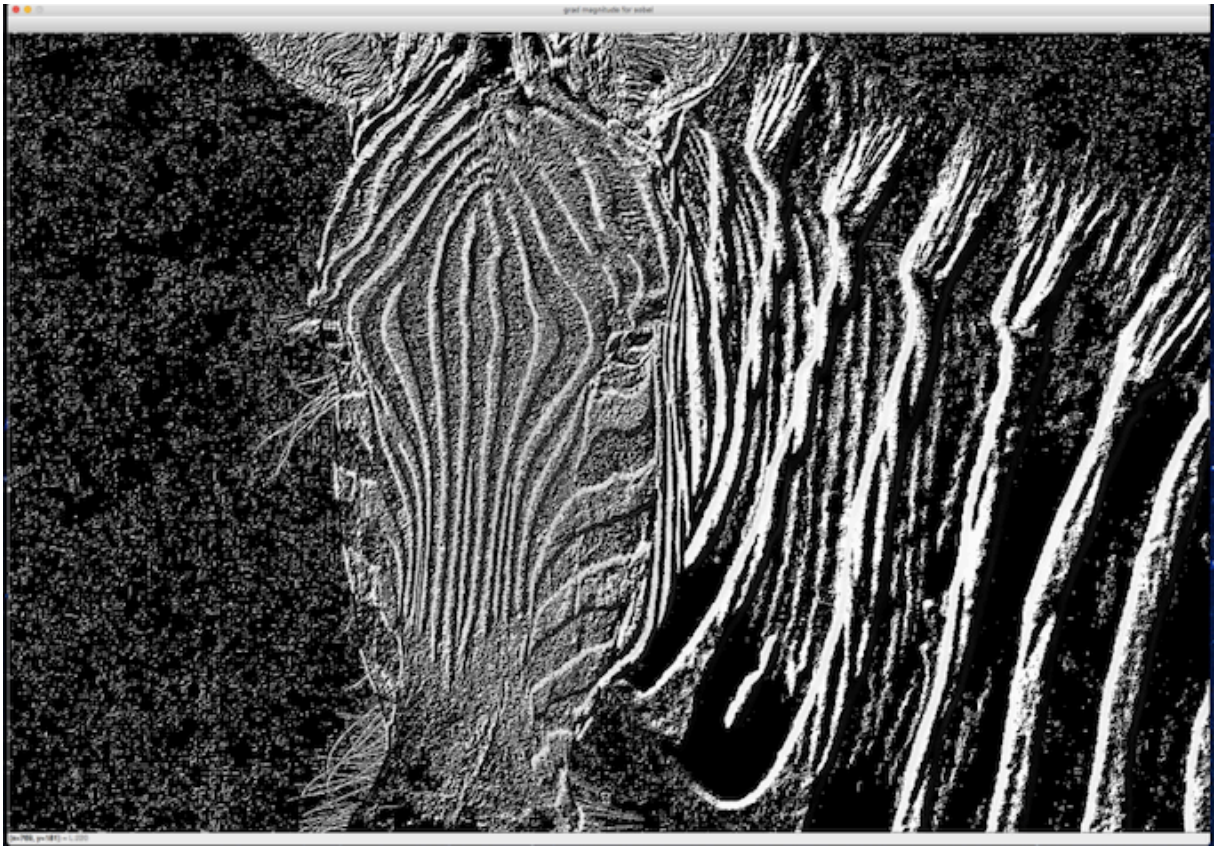
(image that convolved with sobely)



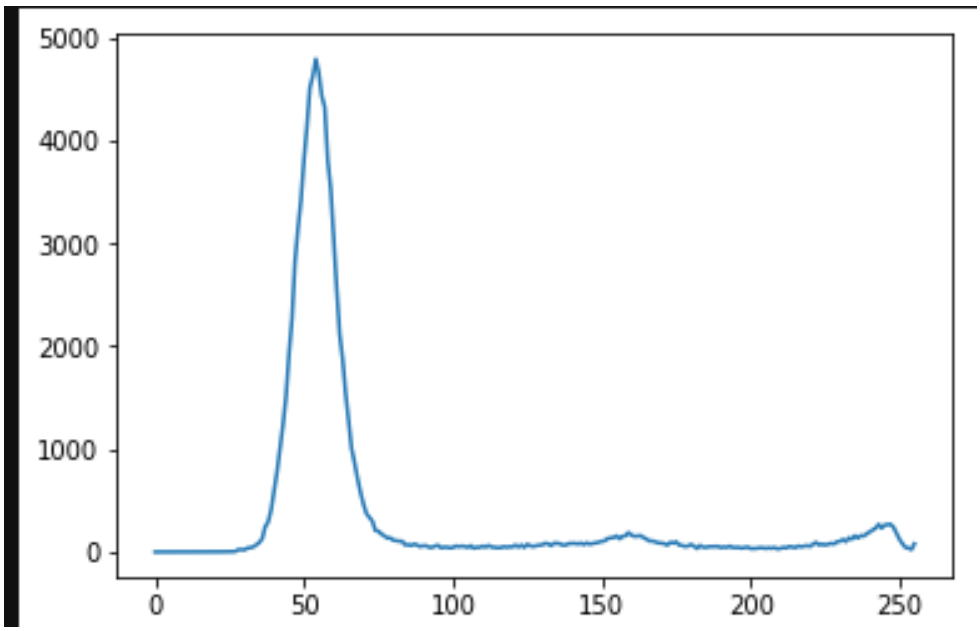
(image that convolved with sobely)

(image that convolved with sobely)

After that, I found the gradient magnitudes of the images.

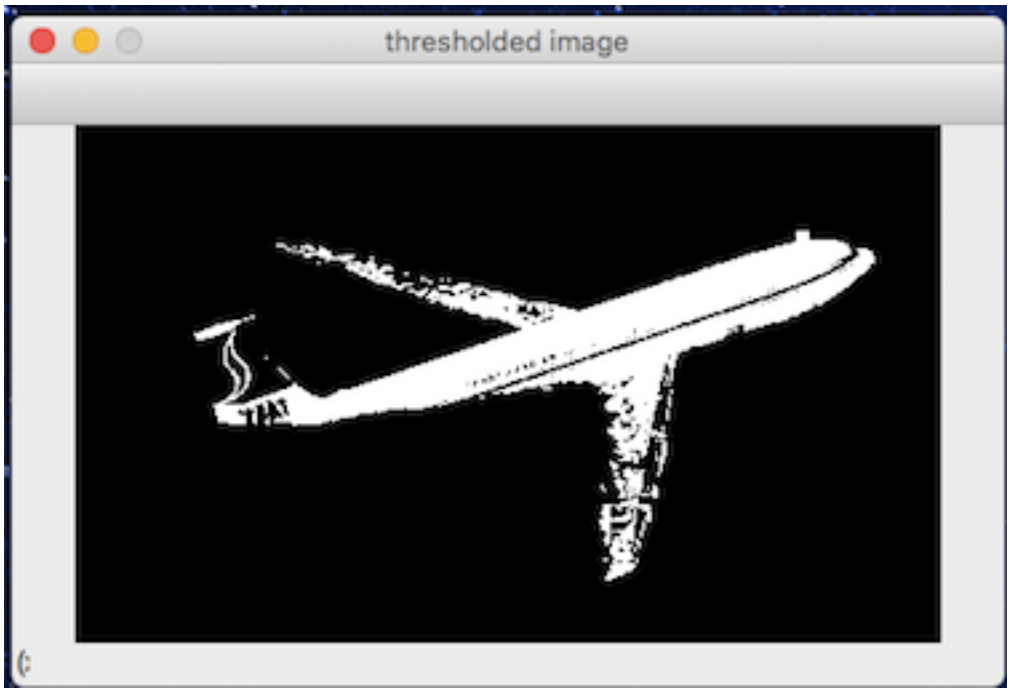


Q3) In this question, I plotted the histogram of the image. By calculating it, I found the number of appearance of each color in the image.

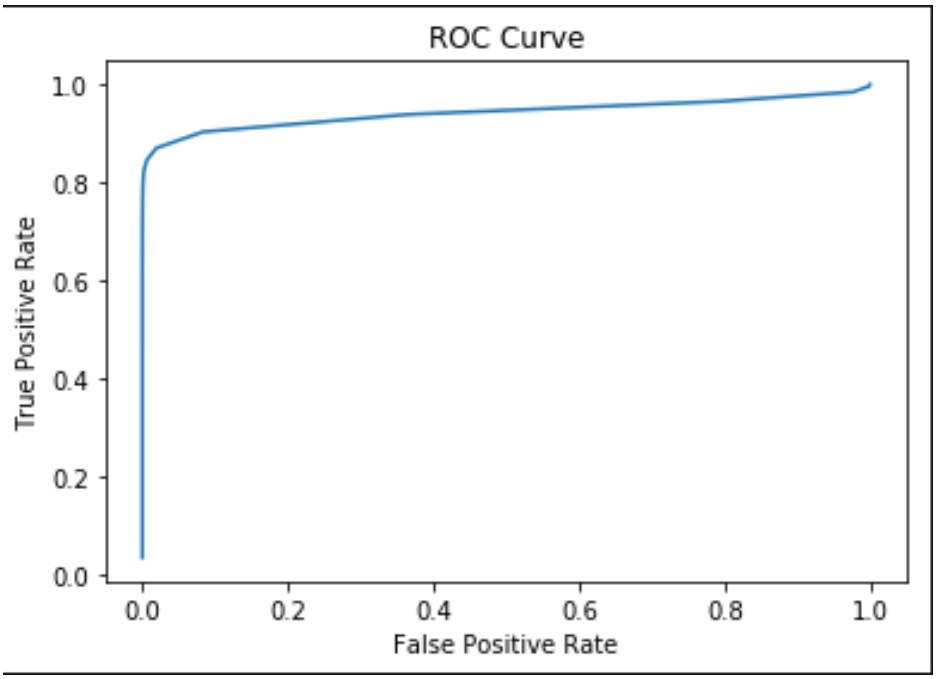


(x-axis: colors , y-axis: appearance)

After that, I wrote a thresholding algorithm by inspiring from Otsu's thresholding algorithm. In my algorithm, by using the histogram that I calculated before, I found the weight which gives how many times a color appeared. Then, I calculate the mean value and variance by using weight value. This algorithm gave me the threshold value. After that, I compared my threshold value with the image and updated my image.
Here is the thresholded image:



4) In this question, I calculated true positive, false positive, true negative and false negative values by comparing the ground truth image with my thresholded image. After that, I calculated the positive(fn+tp) and negative(fp+tn) values. For ROC curve, I calculated the true positive(fp/neg) and false positive rates(tp/pos).



My ROC curve shows the pairs of true positive rates and false positive rates of the thresholded image. We should choose the threshold from the left corner side for the best threshold value.