STEVENS INSTITUTE OF TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE

CS 558 Computer Vision

Homework Assignment I

EDGE DETECTION

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Numpy is used to input the image. Then, I designed gaussian filter by taking sigma values from user. The gaussian filter is designed using the following gaussian function.

$$f(x,y) = A\exp\left(-\left(\frac{(x-x_o)^2}{2\sigma_X^2} + \frac{(y-y_o)^2}{2\sigma_Y^2}\right)\right)$$

Followed by convoluting the Gaussian filter throughout the image for each pixel. The new resulting image formed after convolution is blurred image.

Following the gaussian filter, the image undergoes the Sobel Filter. The sobel filterX and FilterY is used and convoluted on each pixel of Image.

And the resulting values I_x and I_y are used to derive the maximum gradient of the image.

$I_{(x,y)} = \sqrt{(I_x^2 + I_y^2)}$

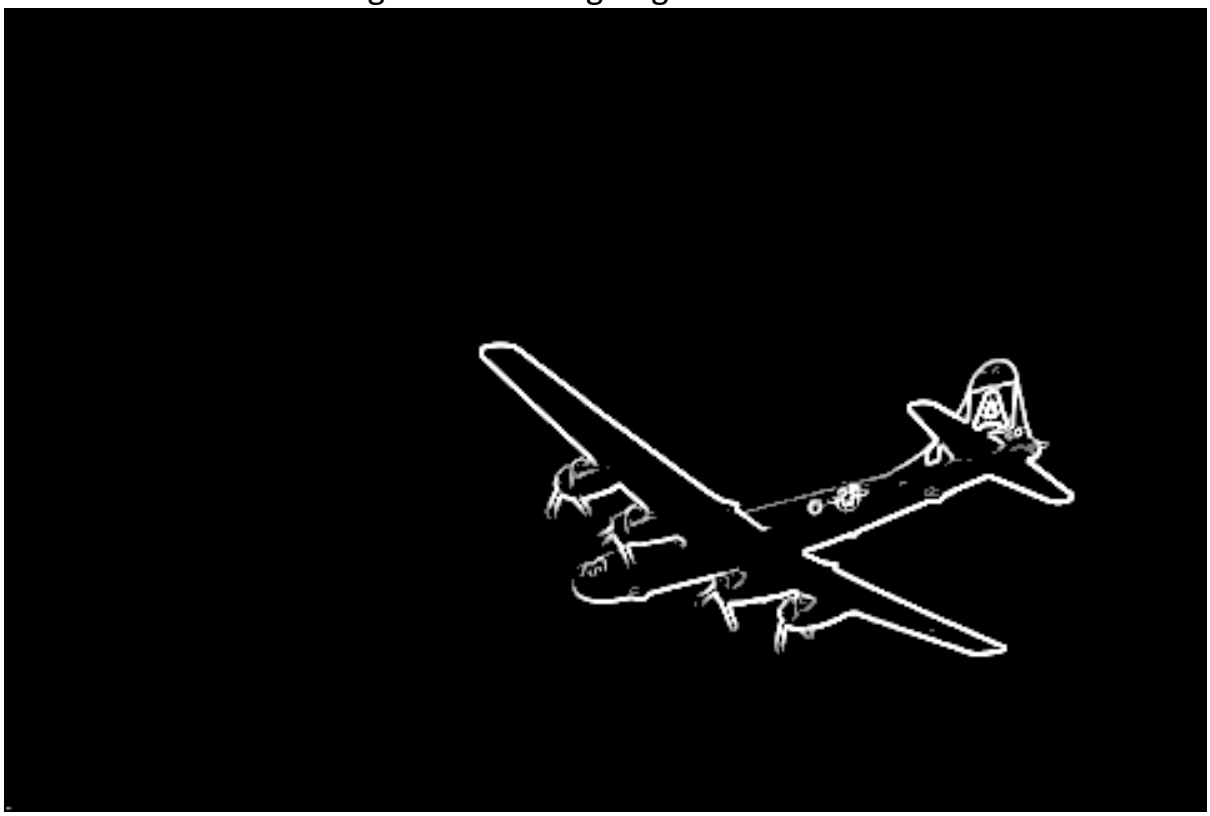
The resulting image is Maximum gradient Image. And after the Maximum gradient image is formed, it undergoes the non-Maximum Suppression where each pixel is decided whether they will have maximum gradient value or 0 as a value. For that, the angle of that pixel is derived from two intensities i.e. I_x and I_y. And depending the closeness of the angle to the direction of pixel is decided. Furthermore, the pre and post pixel of that pixel is checked to determine if the pixel survives. (Note: to run the cell in Python Notebook please press Shift + return)

The following Images are result of each functions.

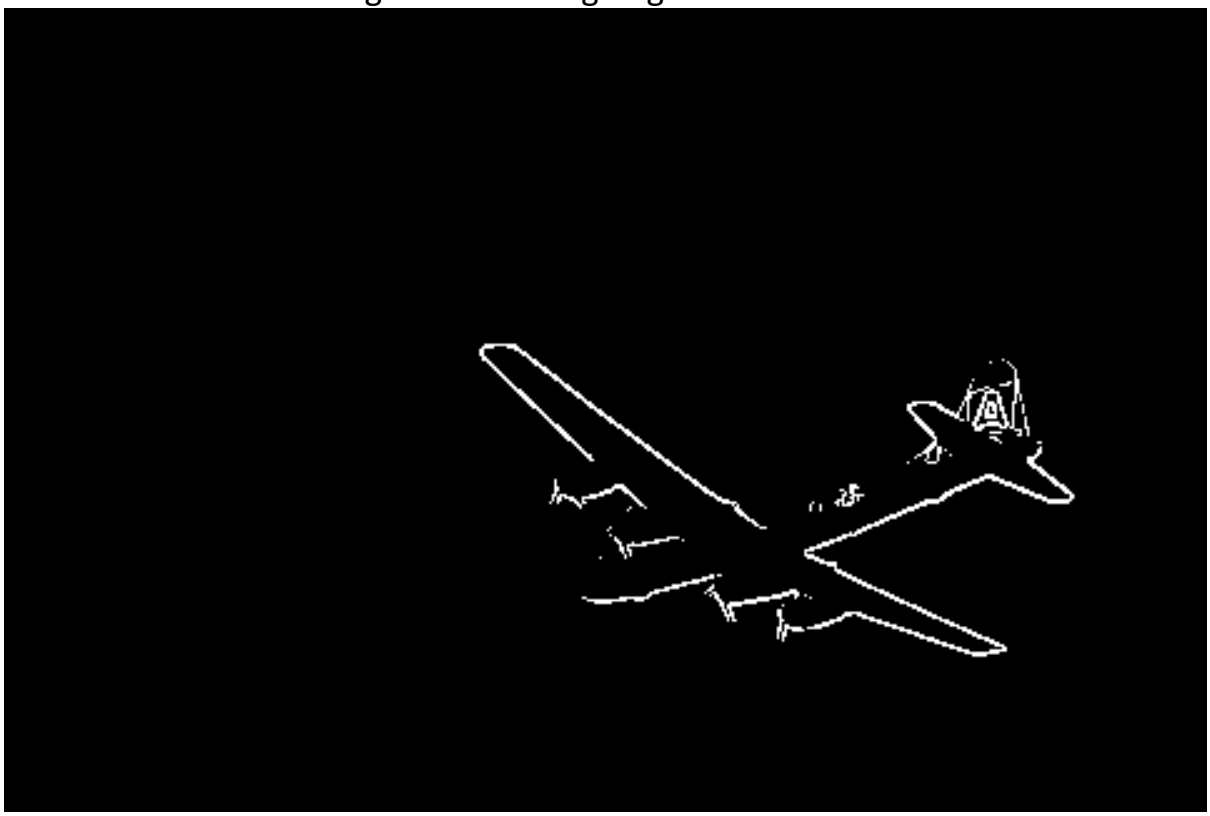
Original Plane Image

Plane image at sigma = 5

Maximum Gradient image after undergoing Sobel Filter with Threshold of 100.

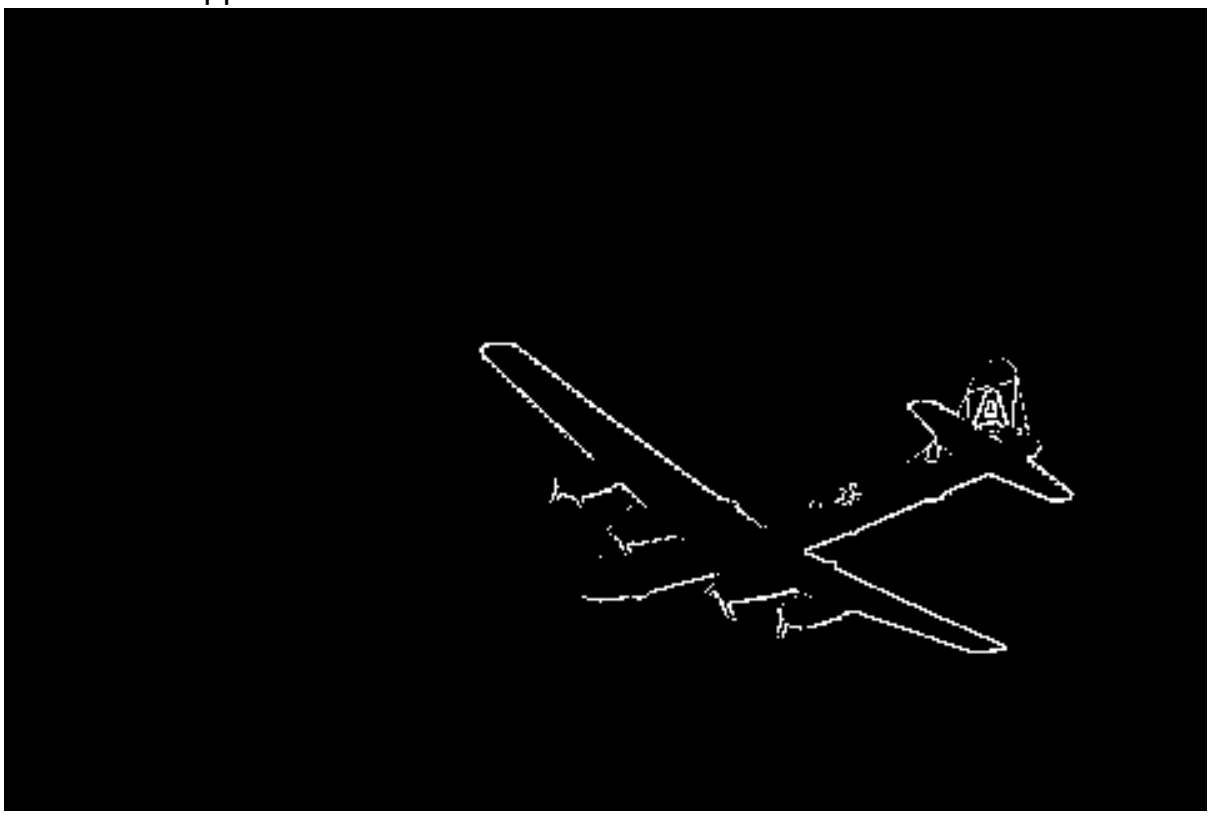


Maximum Gradient image after undergoing Sobel Filter with Threshold of 250.



Maximum Gradient Plane image of threshold 100 after undergoing Non Maximum Suppression

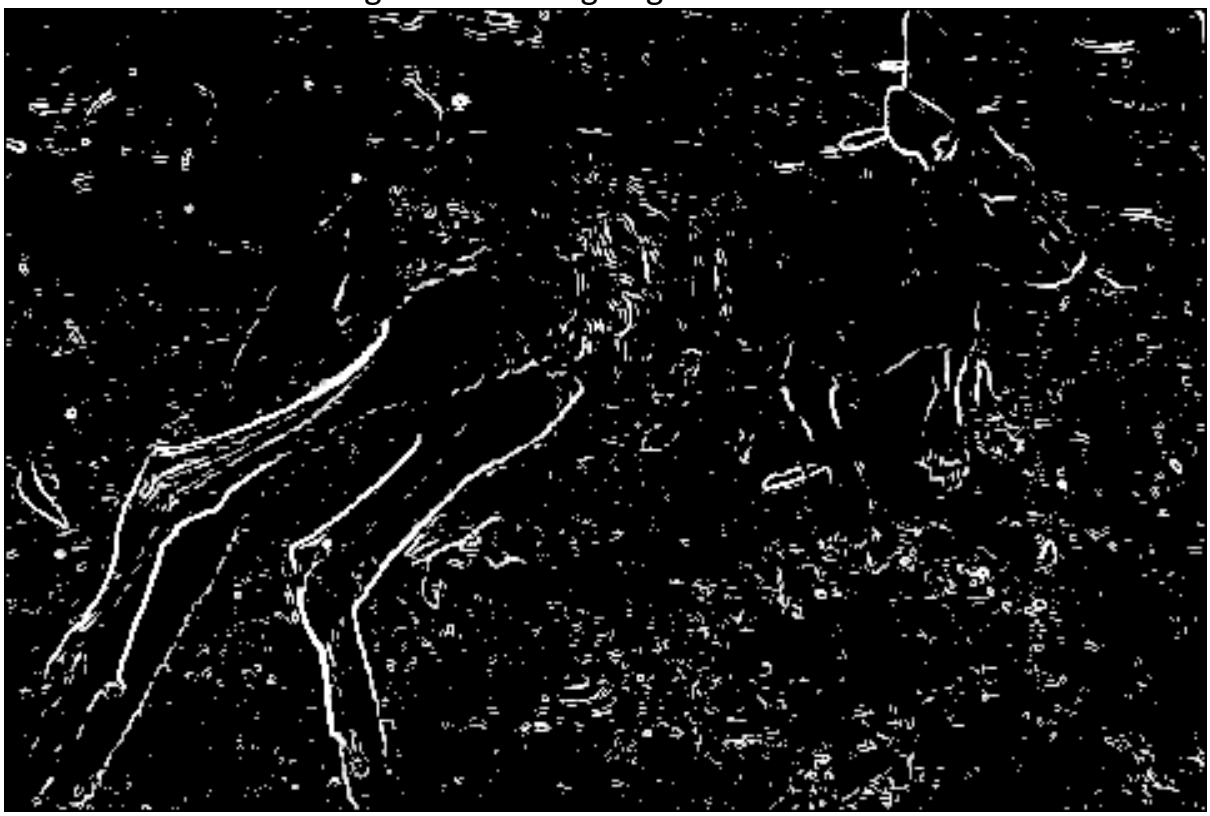
Maximum Gradient Plane image of threshold 250 after undergoing Non Maximum Suppression



Original Kangaroo Image

Kangaroo image at sigma = 4

Maximum Gradient image after undergoing Sobel Filter with Threshold of 170.



Maximum Gradient image after undergoing Sobel Filter with Threshold of 196.

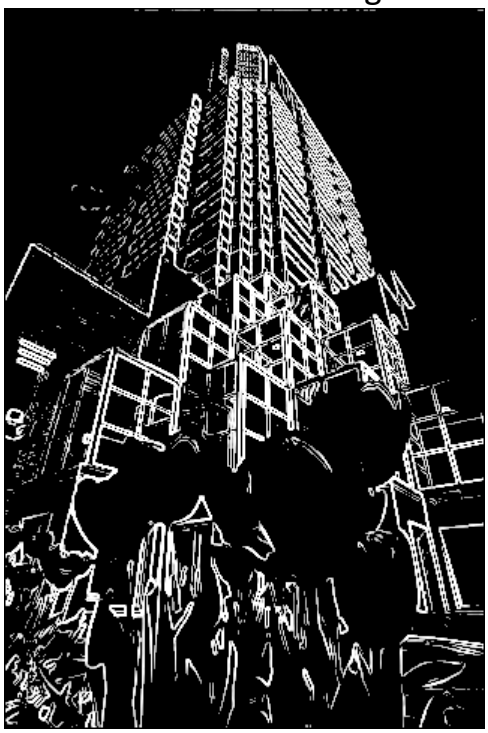
Maximum Gradient kangaroo image of threshold 170 after undergoing Non Maximum Suppression

Maximum Gradient kangaroo image of threshold 196 after undergoing Non Maximum Suppression.

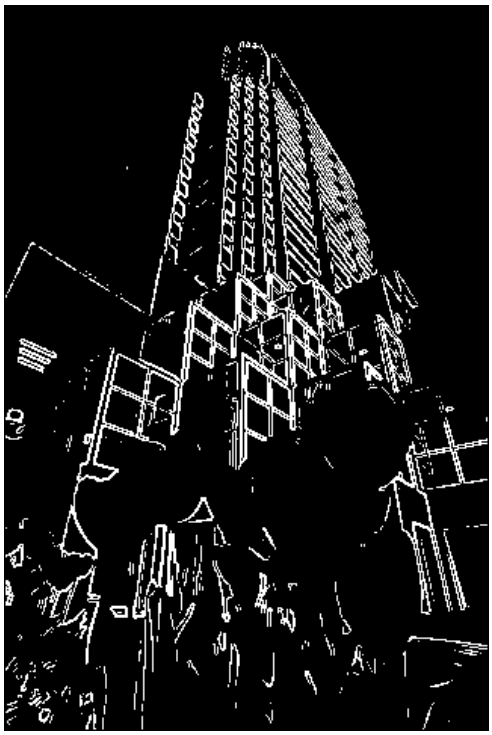
Original Image of Red

Red Image with sigma 3

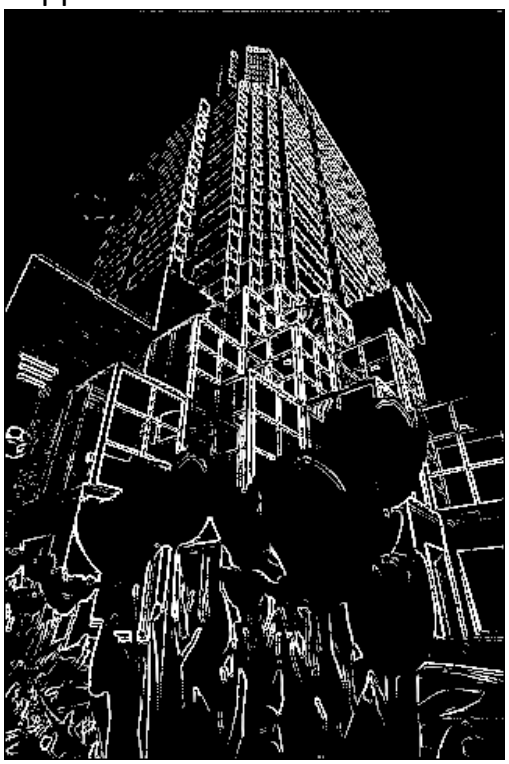
Maximum Gradient image after undergoing Sobel Filter with Threshold of 150.



Maximum Gradient image after undergoing Sobel Filter with Threshold of 250.



Maximum Gradient Red image of threshold 150 after undergoing Non Maximum Suppression.



Maximum Gradient Red image of threshold 250 after undergoing Non Maximum Suppression.