CSE 6367 Assignment #3

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Problem 1

(a) Roberts Edge Detector

In this problem we need to write a MATLAB function that implements Roberts edge detection. For Robert edge detection, we need to convolute the grayscale image with two filter,

$$G_x = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$

$$G_y = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$$

After convoluting the images, by taking root of sum of the squares of each convolution we get, the magnitude of the Gradient and by arctan of the y directed and x directed gradient, we get the direction of the gradient.

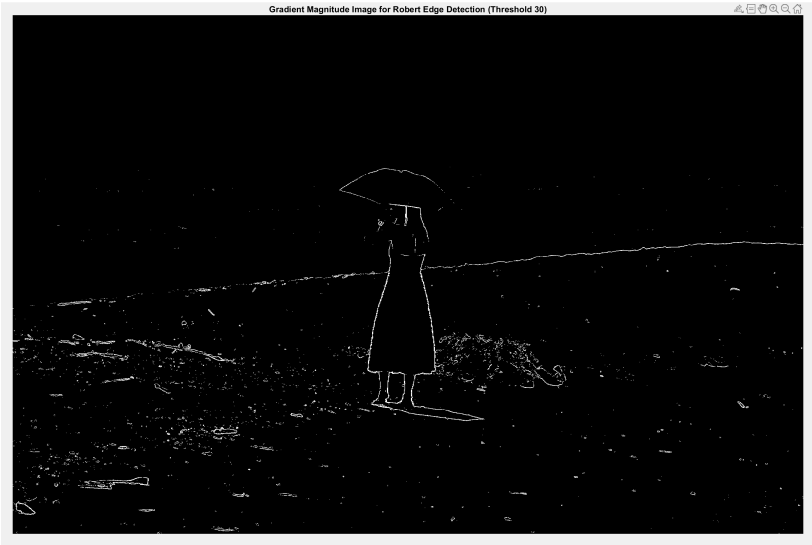
$$Grad_x = Im. * G_x$$

$$Grad_y = Im. * G_y$$

$$Grad_{mag} = \sqrt{Grad_x^2 + Grad_y^2}$$

$$Grad_{dir} = \arctan\left(Grad_y / Grad_x\right)$$

(a) RGB Image



(b) Gradient Magnitude Image

(c) Gradient Direction Image

Figure 1: Actual Gray Scale image, Gradient Magnitude Image(Thresholding=30), Graadient Direction Image for Roberts Edge Detection.

(b) Sobel Edge Detector

In this problem we need to write a MATLAB function that implements Sobel edge detection. For Robert edge detection, we need to convolute the grayscale image with two filter,

$$G_x = \begin{pmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{pmatrix}$$

$$G_y = \begin{pmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{pmatrix}$$

After convoluting the images, by taking root of sum of the squares of each convolution we get, the magnitude of the Gradient and by arctan of the y directed and x directed gradient, we get the direction of the gradient.

$$Grad_x = Im. * G_x$$

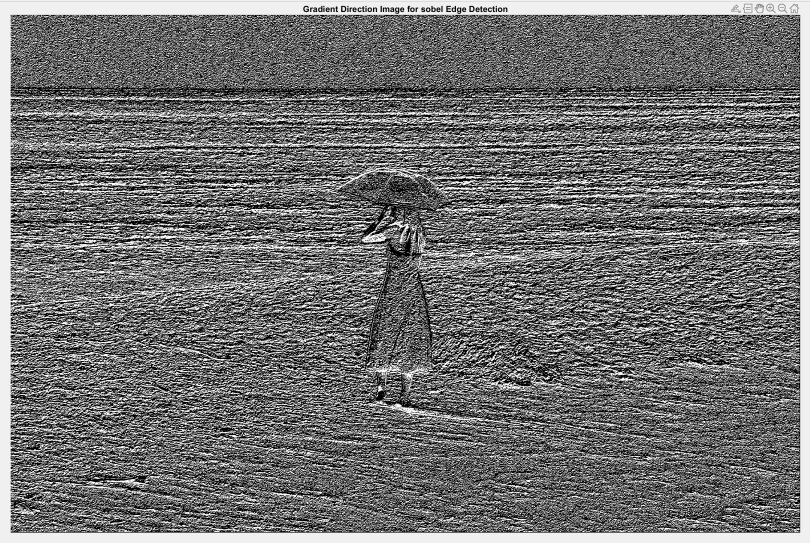
$$Grad_y = Im. * G_y$$

$$Grad_{mag} = \sqrt{Grad_x^2 + Grad_y^2}$$

$$Grad_{dir} = \arctan\left(Grad_y / Grad_x\right)$$

(a) RGB Image

(b) Gradient Magnitude Image



(c) Gradient Direction Image

Figure 2: Actual Gray Scale image, Gradient Magnitude Image(Thresholding=75), Graadient Direction Image for Sobel Edge Detection.

(b) Prewitt Edge Detector

In this problem we need to write a MATLAB function that implements Prewitt edge detection. For Robert edge detection, we need to convolute the grayscale image with two filter,

$$G_x = \begin{pmatrix} -1 & 0 & 1 \\ -1 & 0 & 1 \\ -1 & 0 & 1 \end{pmatrix}$$

$$G_y = \begin{pmatrix} -1 & -1 & -1 \\ 0 & 0 & 0 \\ -1 & -1 & -1 \end{pmatrix}$$

After convoluting the images, by taking root of sum of the squares of each convolution we get, the magnitude of the Gradient and by arctan of the y directed and x directed gradient, we get the direction of the gradient.

$$Grad_x = Im. * G_x$$

$$Grad_y = Im. * G_y$$

$$Grad_{mag} = \sqrt{Grad_x^2 + Grad_y^2}$$

$$Grad_{dir} = \arctan\left(Grad_y / Grad_x\right)$$

(a) RGB Image

(b) Gradient Magnitude Image

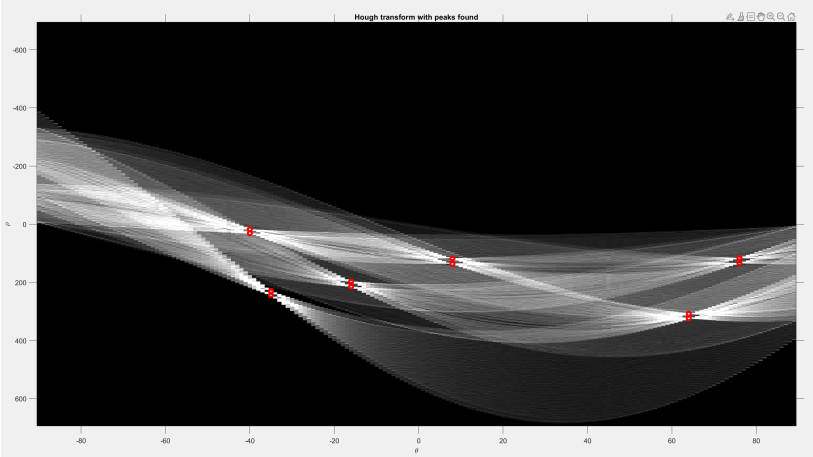
(c) Gradient Direction Image

Figure 3: Actual Gray Scale image, Gradient Magnitude Image(Thresholding=30), Graadient Direction Image for Prewitt Edge Detection.

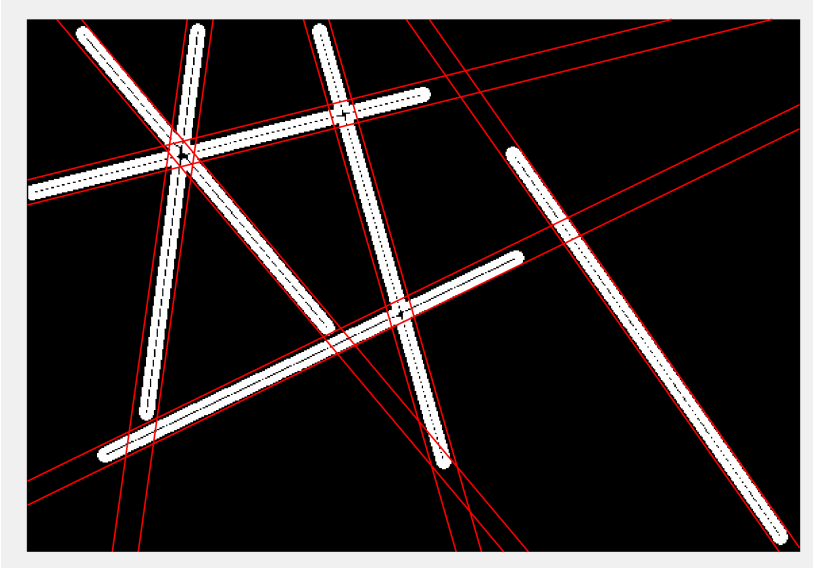
Problem 2

Hough Transform

For this particular problem, we need to implement Hough Transform. For this particular problem , we need to first implement edge detection by "sobel.m", my sobel edge detector, then used the edge detcted image to find the lines joining the edges.



(a) Hough Peaks



(b) Hough Lines

Figure 4: Hough transform

Extra Question: Otsu's method for performing automatic image thresholding

In this problem, we need to implement Otsu's method for performing automatic image thresholding. This thresholding value is used for converting the grayscale image to conveet to a binary image. My matlab file "otsu.m" implemented this on two Imges "cat.jpg" and "umbrella_woman.jpg". the result is given below:

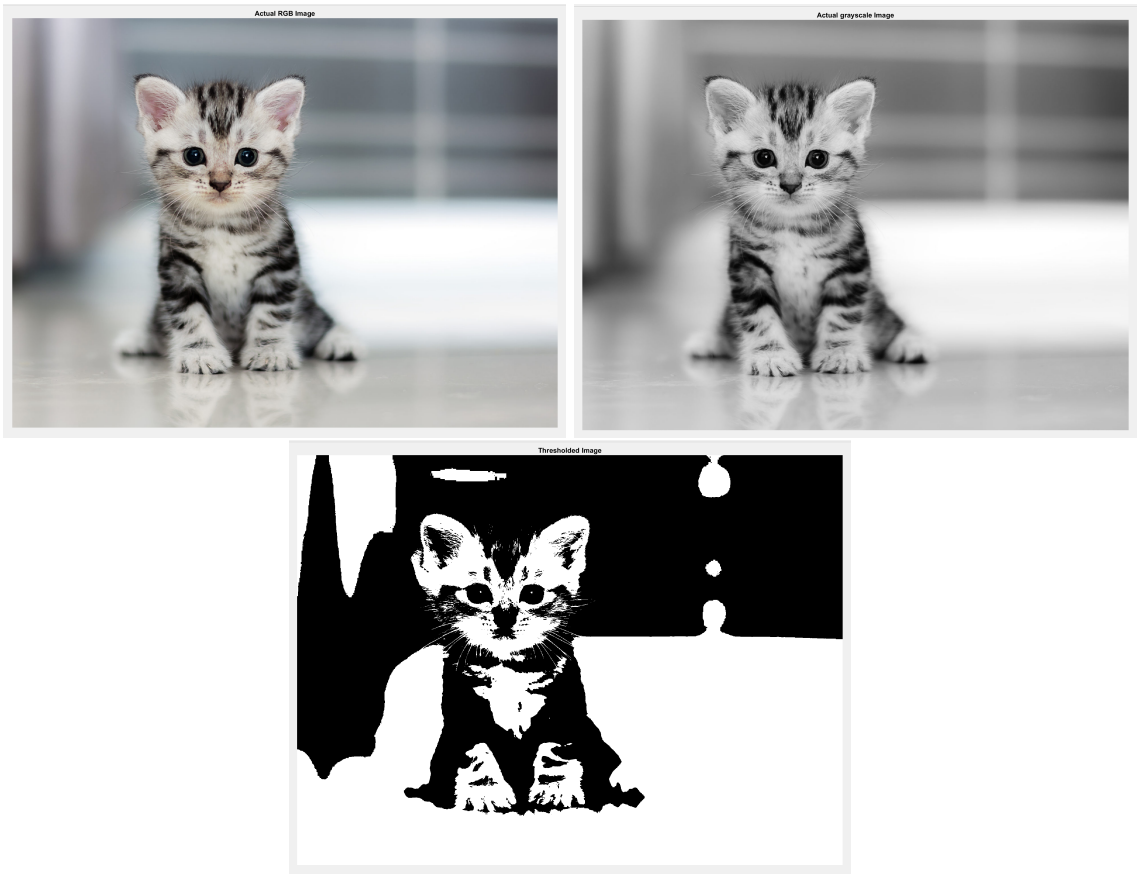


Figure 5: Actual RGB, Grayscle and Thresholded Image(Thresholding= .636719)

Figure 6: Actual RGB, Grayscle and Thresholded Image(Thresholding= .617188)