**REPORT 2**

This report is prepared to introduce Canny Edge Detection algorithm basically.

**INTRODUCTION**

Canny edge detection algorithm is one of the most powerful algorithms to detect edges. This algorithm consists of 6 steps fundamentally. These are:

1. Gray- Scale Image Conversion
2. Gaussian Blur
3. Intensity Gradients
4. Non-maximum Suppression
5. Double Thresholding
6. Edge Tracking by Hysteresis

**GRAY-SCALE IMAGE CONVERSION**

Convert RGB image to gray scale image. This step was introduced in Report 1.

**GAUSSIAN BLUR**

Gaussian blur performs blurring on the image. It provides noise elimination. Gaussian blur formula is applied on the image to remove noise from the image and also it removes little details on the image. Therefore, sigma () value that represents standard deviation should be chosen properly for the problem. Gaussian blur formula as given below:



**INTENSITY GRADIENTS**

The gradients can be determined by using filter where  is the image.



Taking the derivatives, the edges which belongs to image can be detected.

Magnitude and angle of directional gradients can be calculated as shown below:



**NON-MAXIMUM SUPPRESSION**

The magnitude of image results thick edges. Ideally, the final image should be with thin edges. By suppressing non-maximum values, we can obtain that results and it is better than thick ones. Non maximum suppression works by finding the pixel with the maximum value in an image. This process can be achieved by interpolating the pixels for better accuracy.

**DOUBLE THRESHOLDING**

After non-maximum suppression, we can face with edges which is not actually an edge. Double thresholding takes care of this. This process sets two thresholds, a high and low threshold. And the threshold values should be specified according to the problem. But general formula of it is as shown below:



In this step, all pixels with a value larger than the will be a strong edge. Similarly, all pixels less than the will be not an edge. All pixels with a value between and will be weak edges.

**EDGE TRACKING BY HYSTERESIS**

After double thresholding step, the strong and weak edges are obtained and non-edged ones are removed. Now, we need to determine which weak edges are actual edges. Edge tracking algorithm works as follows:

Weak edges that are connected to strong edges will be actual edges. On the other hand, weak edges that are not connected to strong edges will be removed.

Consequently, weak edges are set to 0 and get the final processed image.