MP#5 Report

- **Target:**

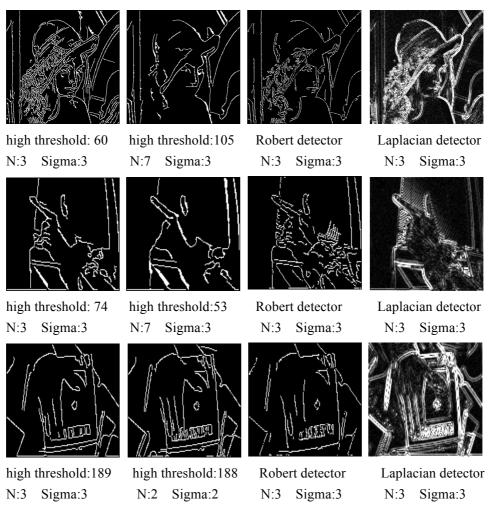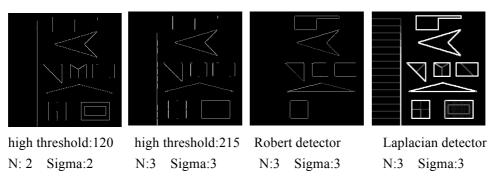The purpose of this MP is to implement the canny edge detector.

- **Technique:**

I use C++ with the OpenCV library to solve this problem. I use one data structure called IplImage to store the data of picture.

- **Algorithm description:**

To begin with, I read the image and change it into gray scale. Then I use the Gaussian Smoothing formula referenced from the textbook to filter that gray image. After that I use the matrix of Sobel operators to calculate gradients of x and y axis and the amplitude of the image. Then I use the interpolation method to implement the suppressing non-Maxima. In that process, we should consider four possible situations. After that, we can get the image of supposed edge points. Then, I build a histogram of it to get the high threshold. For the high threshold, I regard the 80% of the height is the high threshold, and the low threshold is the half of the high threshold. Then I threshold the image by using these two thresholds. Afterwards, I track the edge according to the eight directions of pixels. Finally, we can get the edges of the original image.

- **Result:**

| high threshold: 60 | high threshold:105 | Robert detector | Laplacian detector |
| N:3   Sigma:3 | N:7   Sigma:3 | N:3   Sigma:3 | N:3   Sigma:3 |

| high threshold: 74 | high threshold:53 | Robert detector | Laplacian detector |
| N:3   Sigma:3 | N:7   Sigma:3 | N:3   Sigma:3 | N:3   Sigma:3 |

| high threshold:189 | high threshold:188 | Robert detector | Laplacian detector |
| N:3   Sigma:3 | N:2   Sigma:2 | N:3   Sigma:3 | N:3   Sigma:3 |

| high threshold:120 | high threshold:215 | Robert detector | Laplacian detector |
| N: 2 Sigma:2 | N:3 Sigma:3 | N:3 Sigma:3 | N:3 Sigma:3 |

- **Result Analyze:**

Robert Cross operator determines edge more accurately but it is more sensitive to noise. Besides, it is obvious that the edge detecting through Robert operators is not smooth enough. As a result, the Robert Cross operator is suitable for those images which have little noise and have obvious edges.

If the noise spots are far away from the edge, then the outcome of Sobel operator is more distinct.

Laplacian operator is sensitive to noise too. The advantage of it is that it can handle well with any edges with complicated directions, such as curves.

Canny operator performs better in edge detection. The outcome of edges is more integrated than other operators. Also it is not sensitive to noise.