

# Assignment2 Report:

## EDGE DETECTION

CSE 691: Image and video processing

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## A. Implementation

1) Implement the following three steps of the Canny edge detection algorithm as we discussed in class:

i) *CANNY\_ENHANCER*

ii) *NONMAX\_SUPPRESSION*

iii) *HYSTERESIS\_THRESH*

### Processes

#### 1. Noise Smoothing

Suppress the noise using the gaussian filter implemented in Assignment 1. We need to specify the standard deviation.

#### 1. Edge Enhancement

Implement a filter to enhance the edge points. The value at edge pixel should be high.

#### 1. Edge Localization

In the local maxima found in step 2, determine which one should be remained as edges and eliminate the noises. First we need to thin the edges to 1 pixel width which is called non-max suppression. Then we apply two thresholds to keep the real local maxima.

## B. Experiment

2) Test your algorithm on images "Flowers.jpg", "Syracuse01.jpg" and "Syracuse02.jpg". Try different values of sigma. lower threshold and higher threshold. Compare and evaluate your results.

### Flowers.jpg

output of CANNY\_ENHANCER



with sigma = 2



**with sigma = 1**

**output of NONMAX\_SUPPRESSION**



with sigma = 1



**with sigma = 2**

### **Observation and decision**

Apparently, the output with sigma 1 is much better and makes edges stronger as we want. This is consistent with analysis in assignment1. So later on we use sigma 1 as default.

**output of HYSTERESIS\_THRESH**



with low threshold = 10, high threshold = 60



with low threshold = 10, high threshold = 80





with low threshold = 30, high threshold = 60



**with sigma = 2, low threshold = 10, high threshold = 60**

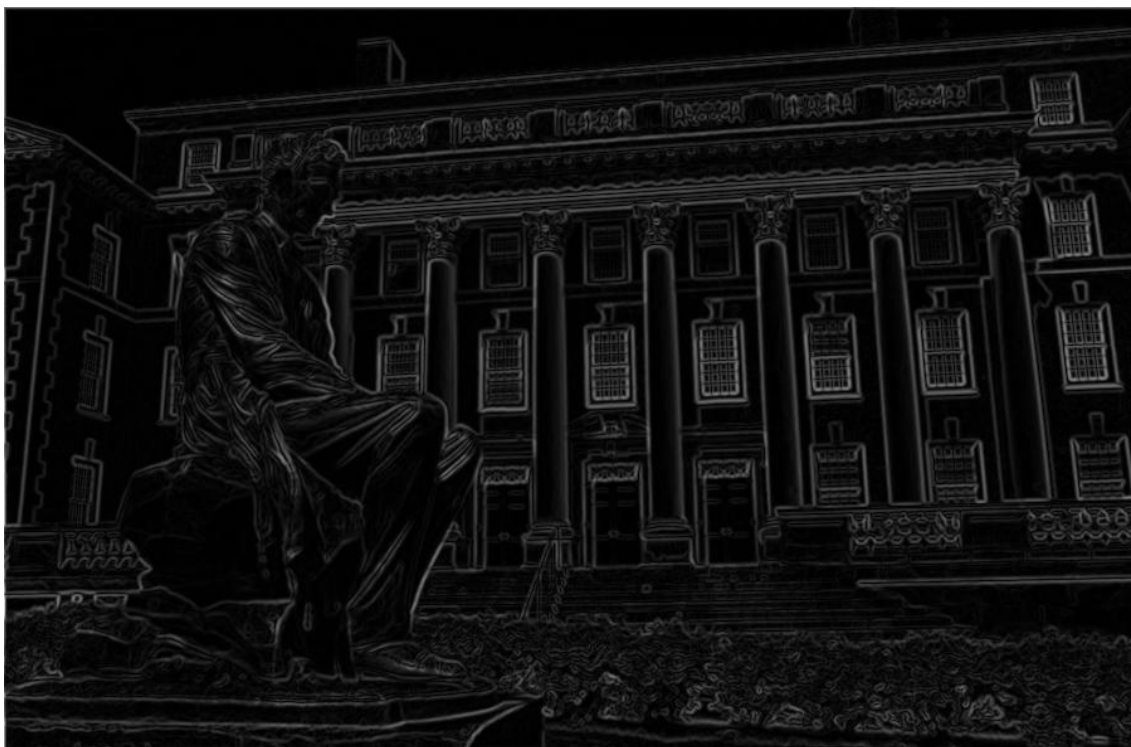
### **Observation and decision**

We apply different thresholds. With a high threshold 60, more edges are shown. So we choose 60 as the high threshold. When we choose the low threshold, 30 is better than 10 because 10 results in more details which is not useful information in edge detection. So 30 is chosen as low threshold.

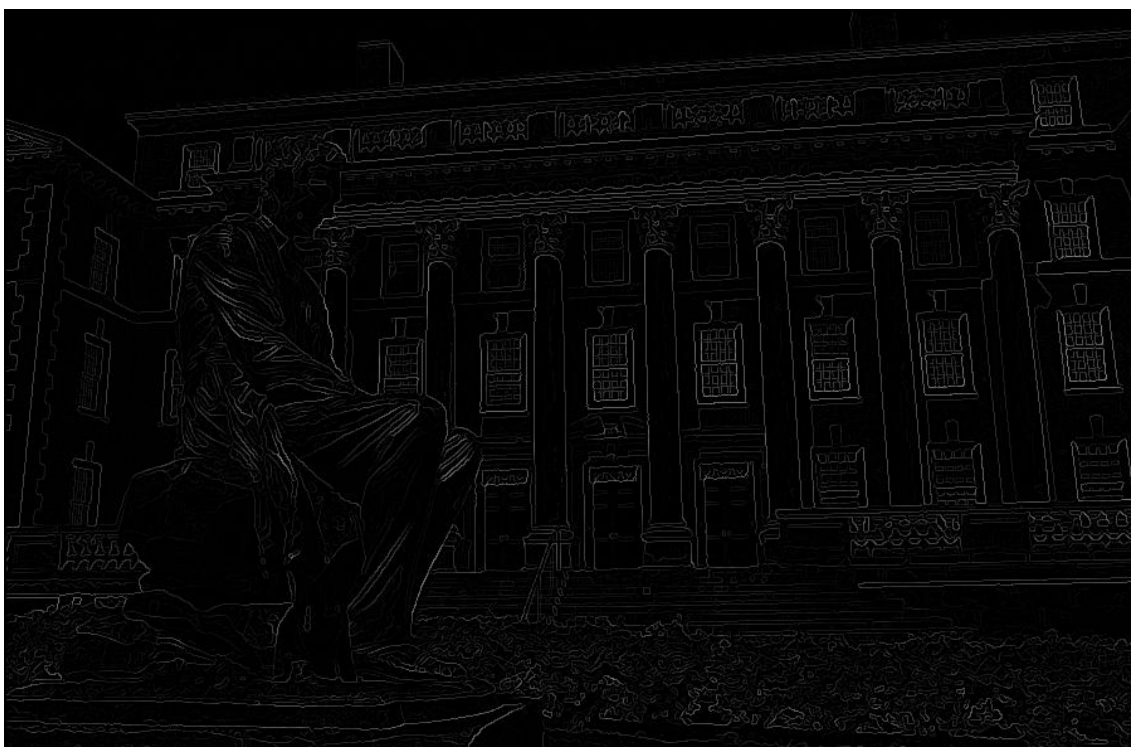
And we can see if the sigma gets greater, the edges will be more abstract which it's not what we want.

### **Syracuse\_01.jpg**

**output of CANNY\_ENHANVER**



output of NONMAX\_SUPPRESSION



**output of HYSTERSIS\_THRESH**



**with low threshold = 10, high threshold = 60**



with low threshold = 10, high threshold = 40



**with low threshold = 30, high threshold = 60**



**with sigma = 2, low threshold = 10, high threshold = 40**

### **Observation and decision**

This picture is not as strong as last one. So the threshold should be lower than the previous one. 40 gives us more edges so it is better. As for the low threshold, since the valid edge value is concentrated in a range, 10 and 30 is not very different. So 10 is chosen.

### **Syracuse\_02.jpg**

**output of CANNY\_ENHANVER**



**output of NONMAX\_SUPPRESSION**



**output of HYSTERESIS\_THRESH**





**with low threshold = 10, high threshold = 60**



**with low threshold = 10, high threshold = 30**



**with low threshold = 10, high threshold = 20**



**with low threshold = 1, high threshold = 20**

### **Observation and decision**

As for this image, the strength is much lower. So if we choose 60 as high threshold, very few edges are shown. Compared with 30, 20 is an appropriate choice. 10 is good for low threshold. The output is pretty good.

### **Another image**

3) Test your algorithm on a favorite image of yours.

**output of CANNY\_ENHANVER**



**output of NONMAX\_SUPPRESSION**



**output of Hysteresis\_Thresh**



with low threshold = 10, high threshold = 80



with low threshold = 10, high threshold = 40





**with low threshold = 10, high threshold = 30**

### **Observation and decision**

I choose the image in assignment1 as my last image. The main part in this image is person which is different from the previous three images. Consider the three outputs above. 80 can't offer many details we want. 30, however, gives too many details. 40 is a good choice for high threshold. Here I choose 10 as the low threshold because the output is good after comparison.

## Discussion and Conclusion

In this assignment, we implement the canny edge detection. First we apply gaussian filter to smooth the imported image. We want to remove as much noise as possible. So sigma must be small. According to the assignment1, we choose 1 as default sigma(the standard deviation of the Gaussian). If we increase the sigma, the picture get blurred and the output becomes more abstract. We get fewer edges with a greater sigma.

Then we choose different threshold depend on images. After CANNY\_ENHANCER algorithm, we enhance the edge-values. So we need to know in which range the edges points are located. We set high threshold less than the main point value then we can get the edges we want. As for the low threshold, the lower it is, the more details we get but it is not always good. So we usually choose a certain low threshold that gives us a reasonable edge detail.