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2/5/2016

Computer Vision CS8690/ECE8690
Assignment 1: Canny Edge Detector

Introduction:

Edge detection is critical to computer vision to provide feature extraction, texture analysis and object segmentation. The canny edge detector has an added ability to handle noise that other edge detectors do not have. A good edge detector has the ability to find “true” edges in an image. I present my work on creating the canny edge detector.

Implementation:

I load the image and apply the a gaussian blur to the image with a custom passed sigma, to handle any noise present. Next, I apply the sobel derivative over the blurred image, to get the derivatives of the x and y dimensions. I then must create the x and y derivatives used to produce Gradient image using the sobel filter (1st derivative filter). The equation to produce the gradient (magnitude) is $\sqrt{dx(r,c)^2 + dy(r,c)^2}$ commonly called the the euclidean distance. Next I must find the possible edges that are produced from doing the gradient, thus I apply a non maximum suppression. I use the formula atan2 on the derivative of the x and derivative of the y, and split that result into 8 discrete directions. Thus I then compared the mirror points versus the current points to figure out if its that is the maximum intensity, if that is larger than its angle mirrors I pick that as the edge intensity. After the non maximum intensity stage, I do a connected component of the edges after the non maximum suppression with low and high thresholds to find the “true” edges.

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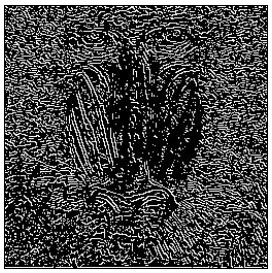
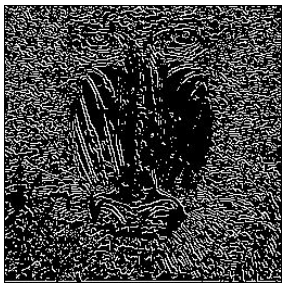
Results Mandrill Sigma 1.0:

Source **Gradient of Mandrill** **Non Maximum Suppression**



Thresholds (Low, High):

(1,1) (1,32) (1,64) (1,128)

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Results Building Sigma 1.0:

Source **Gradient**

Non Maximum Suppression

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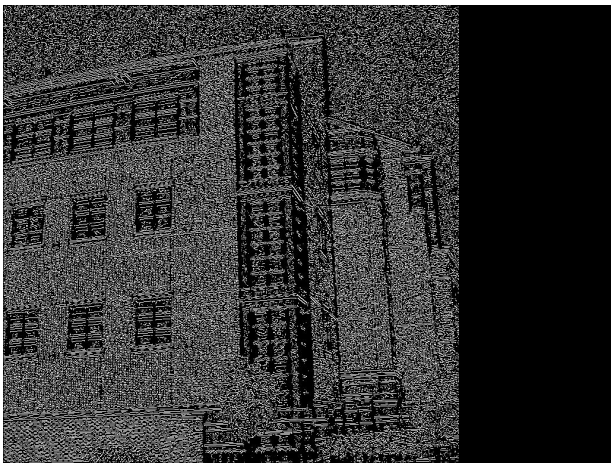
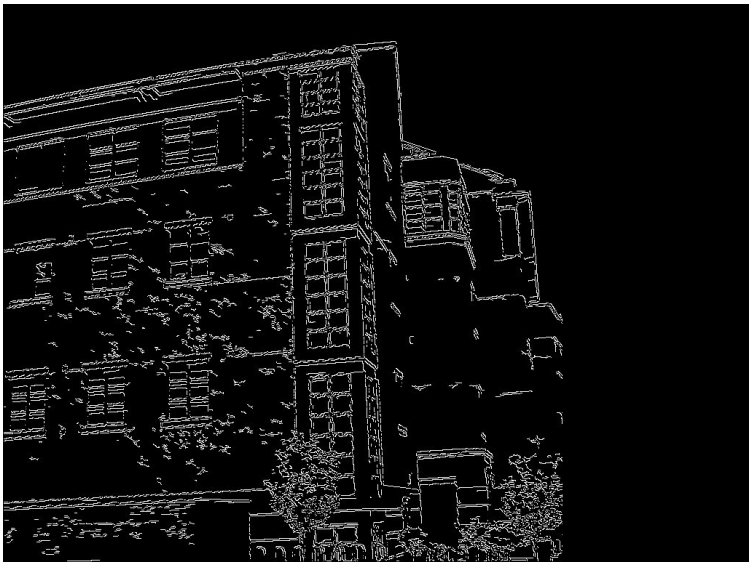
Thresholds (Low, High):

(1,1)



(1,64)

(1,128)



Results Mandrill Sigma 2.0:

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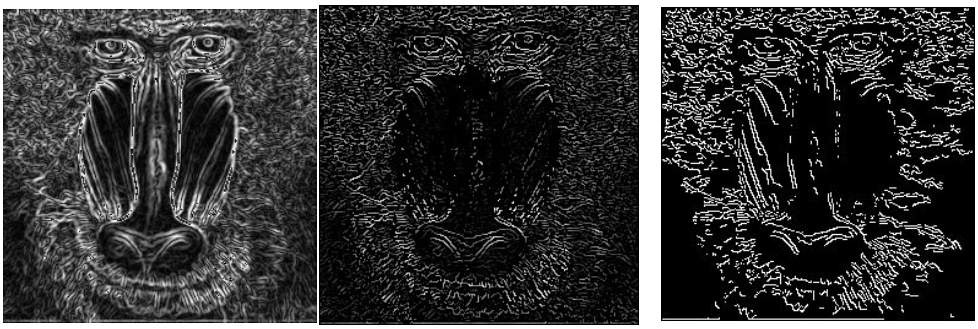
Results Mandrill Sigma 1.0:



Conclusion:

As one can see, if the gradient of the edges are not thick after the gradient calculation, those edges are sometimes removed in non suppression and/or in the Hysteresis thresholding. However, you can help avoid that if you have a low enough threshold value. A note that is overlooked is that gaussian blur can remove weak edges early that one may want to keep. As shown above, in the thresholds sections of both the building and mandrill. As you increase the max threshold, which is used to force the requirement of what is a considered a strong edge (true edge), you see that the number of edges decreases. If the low threshold is low and the high threshold is low, you can have too many false edges, as seen in the mandrill (1,1) and mandrill (1,32) and building (1,1).

I believe that If you increase the sigma of the gaussian blurring, the number of edges drops much more during the gradient image creation. That will cause a loss of sharp edges that become dull with a large sigma. I do have an example with a 2.0 sigma. The sigma is a magic parameter that must be tested to ensure, proper “true” edge detection. I do need more time to look experiments with different sigmas.

I believe if the threshold low is 32 intensity and the high is 128 intensity, you will get good true edge detection using the canny edge detector.