Jacob O'Quinn
CAP 5415
Assignment 1

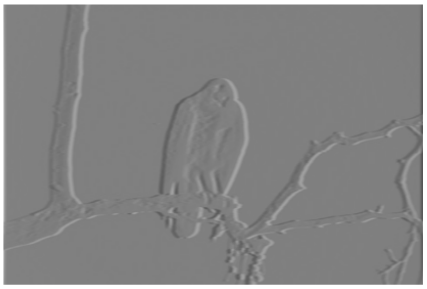
I have attached my code and a data file of some of the images I used when testing my algorithm. I included my original python notebook I used to work on the assignment and just the python code itself. I selected three images and predefined sigmas for each that I believe worked well. I broke my code up using the 8 different steps provided and tried to match the 6 images from the instructions as much as possible.

1) The image is read in from the data file
2) Call getGaussian() which returns a 1D array of the selected length and with the sigma selected by the user.
3) 1D central difference arrays are created to be used as a derivative mask.
4) The image is convolved with a Gaussian array in x and y direction. Note that my convolution function only does horizontal convolution, thus I simply rotate images 90 degrees if I want to do the y direction.
5) The "blurred" images from the previous step are also convolved with the derivative masks from step 3. (this does result in some values being negative, this doesn't impact any calculations but does require some mapping when displaying the images later on)
6) Magnitude of edge response is calculated by combining dIx and dIy.
7) Non-maximum suppression is used to make edges thinner. I used np.arctan2() to get the gradients. The current pixel value is only kept if it is greater than its two neighbors. Only the two neighbors perpendicular to the gradient are looked at.
8) To reduce false positive rate for edges, hysteresis thresholding removes edges below a low threshold and marks edges above a high threshold as an edge. Edges with values between low and high are only an edge if connected to an edge with a value above high. I decided to use a breadth first search to implement this algorithm

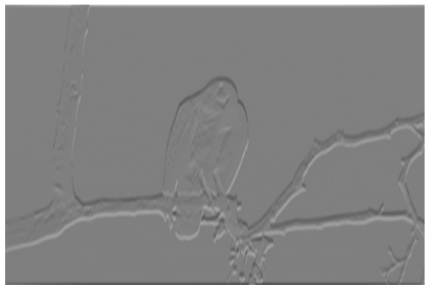
Horozontal Gaussian

Vertial Gaussian

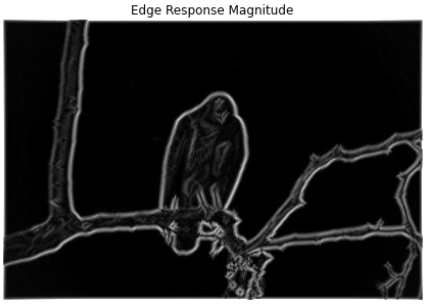
Horozontal Derivative



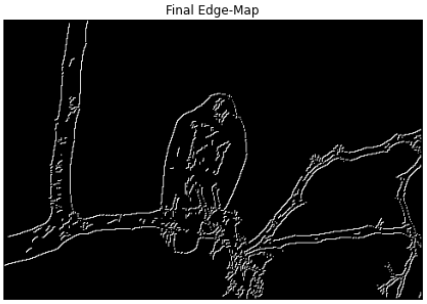
Vertical Derivative



Edge Response Magnitude



Final Edge-Map

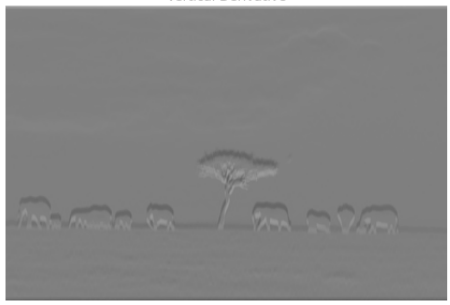


Horozontal Gaussian

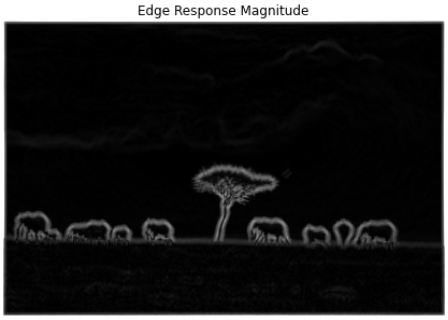
Vertial Gaussian

Horozontal Derivative

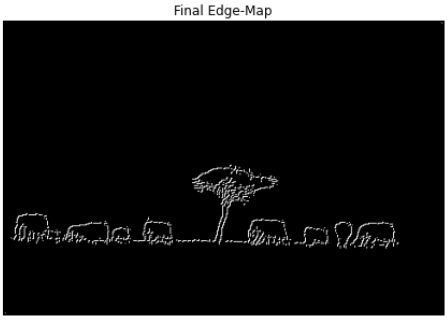
Vertical Derivative



Edge Response Magnitude



Final Edge-Map

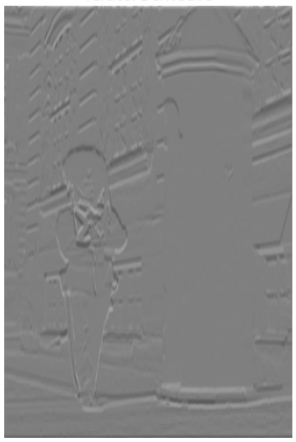


Horozontal Gaussian

Vertial Gaussian

Horozontal Derivative

Vertical Derivative



Edge Response Magnitude

Final Edge-Map

Sigma value adjustments (bird)

Sigma = 1	Sigma = 2	Sigma = 6
		

Sigma value adjustments (Queens Guard)

Sigma = 1	Sigma = 3	Sigma = 6