

Assignment 1

CS 455/555

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Purpose:

To understand how to use different image processing tools. I used OpenCV 3.4.2.

To understand and implement different ways to enhance an image given the following concepts:

- Histogram equalization
- Histogram transformation
- Negative Imaging
- Binary Images
- Enhanced Images
- Image thresholding
- Image pixel connectivity
- Region detection

To Run:

On command line type: make (This will make the executable file assign1)

Next type: ./assign1 (All the images presented in this file will then be displayed)

To Remove Executable File:

On command line type: make clean

Notes:

On question 3(b) coordinates 1,2 and 2,2 were used as bottom-left coordinates as said in class. However, on power-point these coordinates represented upper-left coordinates.

Methods to obtaining Images

Method for creating histogram:

- Create an array of length 256, and initialize it all to 0
- Obtain the value of intensity for each pixel, and increment this corresponding value in the array by 1.

Method for displaying histogram:

- Get the histogram array that needs to be displayed
- Create a blank image with size 512p by 400p
- Find the maximum intensity available in the image, and normalize the histogram intensity based on that
- Then plot the graph using the line function

Method for Negative Imaging:

- Change each value of pixel of image to:
 $255 - [\text{pixel_value}]$

Method for creating enhanced image:

- Calculate intensity probability by getting the intensity values for each pixel, and dividing by total pixels
- Calculate the cumulative frequency of each pixel by adding to the value of previous Intensity
- Calculate cumulative distribution probability by dividing previous cumulative array by total pixels
- Multiply cdf by the number of bins for each pixel
- Replace each pixel with the enhanced pixel

Method for creating binary image:

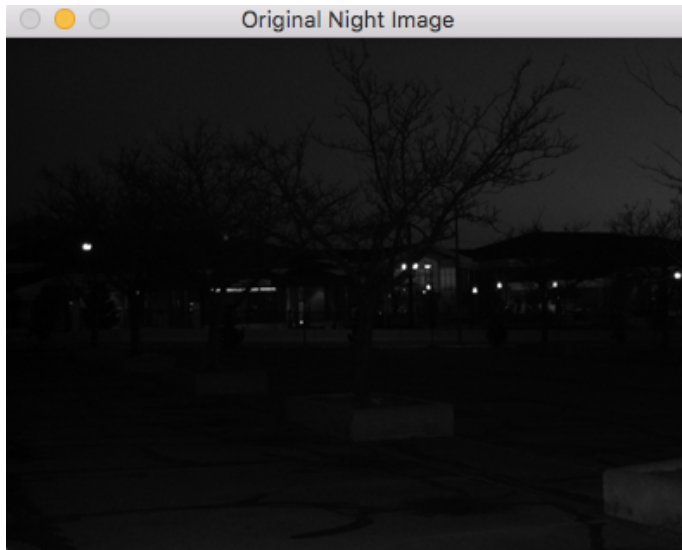
- Finding threshold by calculating the average of pixels
- If individual pixel is less than the threshold, change the pixel to 0
- If individual pixel is greater than the threshold, change the pixel to 255

Method for region detection of image:

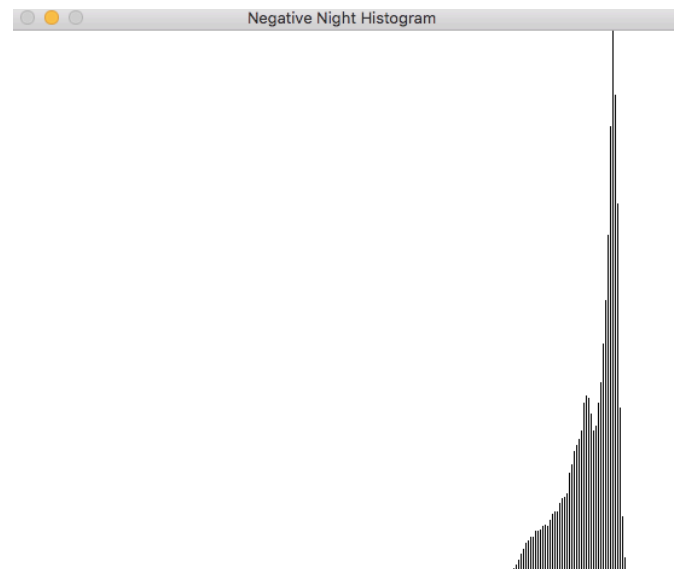
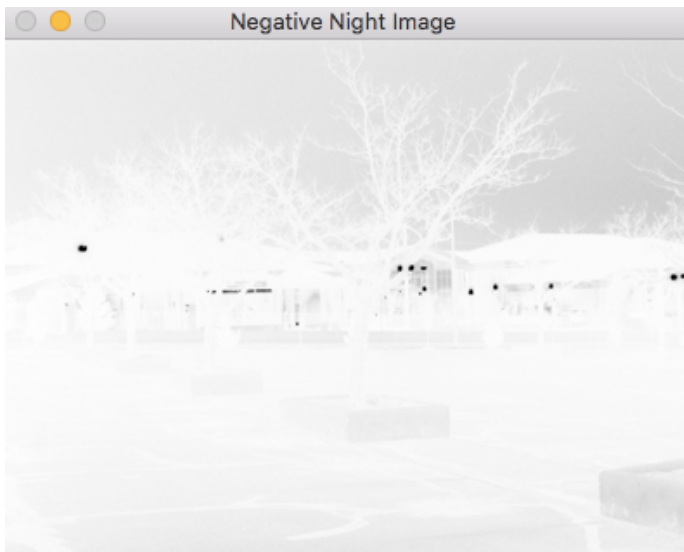
- Color each region with 120, but keep track of the minimum region and maximum region
- Use queue to do a breadth first search on the pixels to see which pixels have been visited and which have not – to be colored.
- If not visited, color the pixel with the specified amount
- Once all pixels have been visited, color the minimum and maximum regions accordingly

Results:

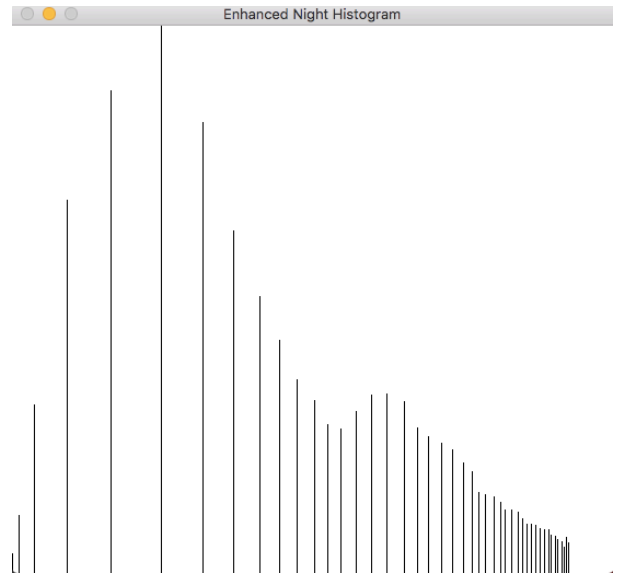
Original Night Image:



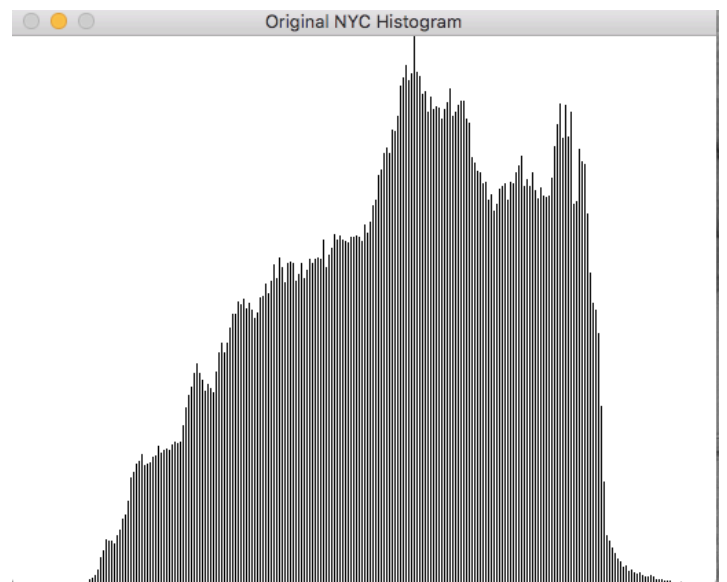
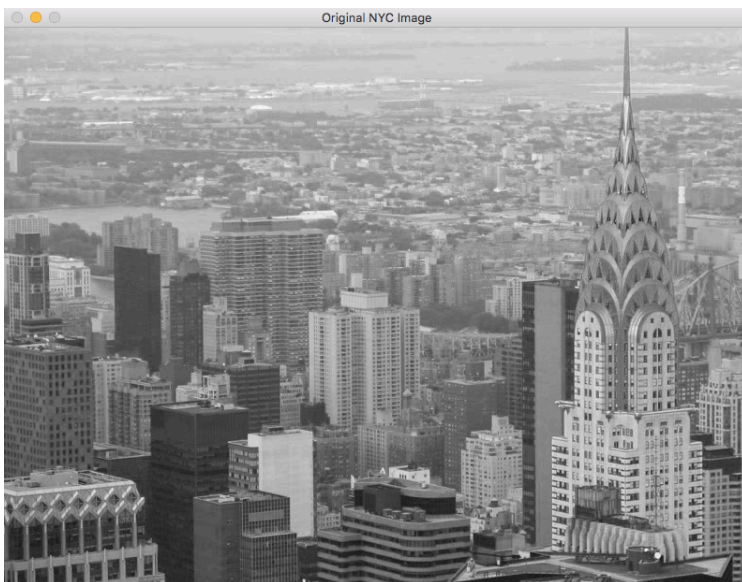
Negative Night Image:



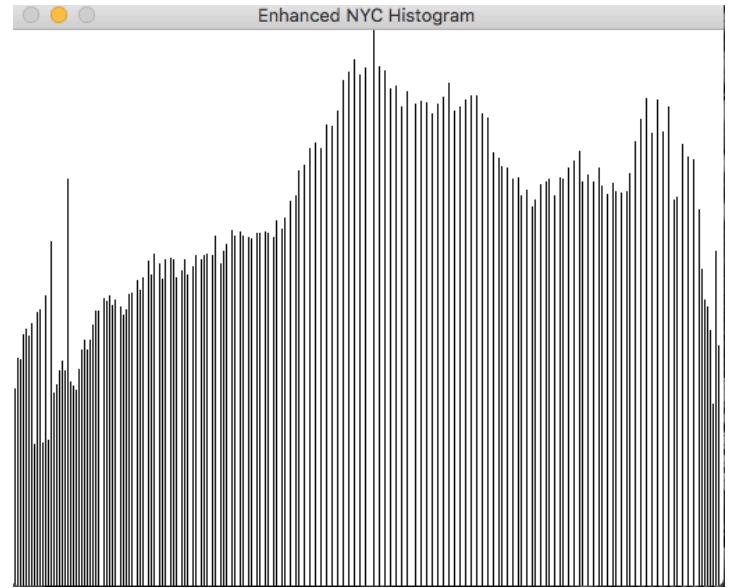
Enhanced Night Image:



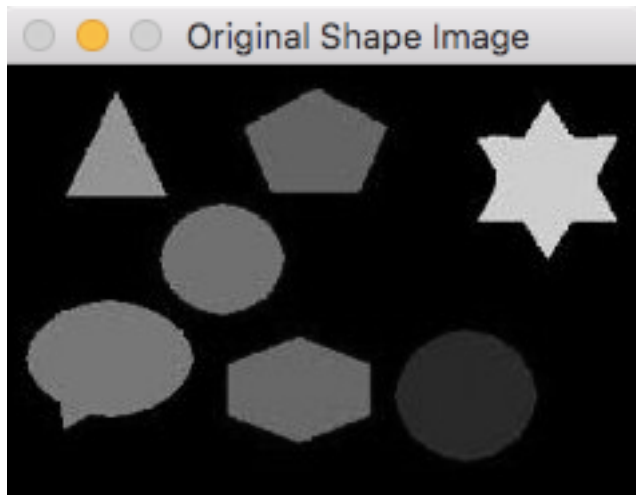
Original NYC Image:



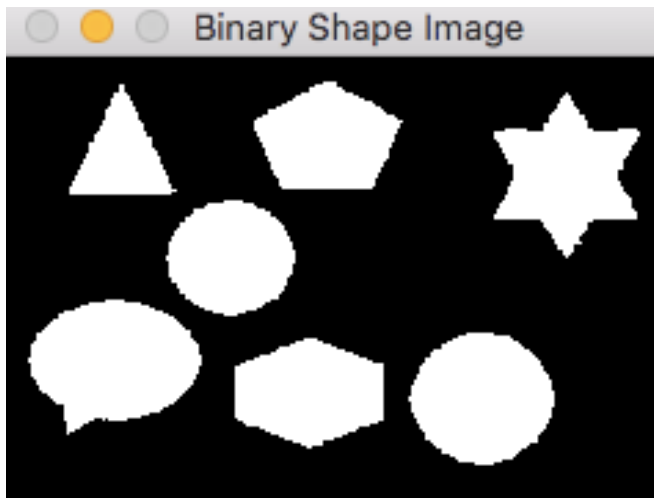
Enhanced NYC Image:



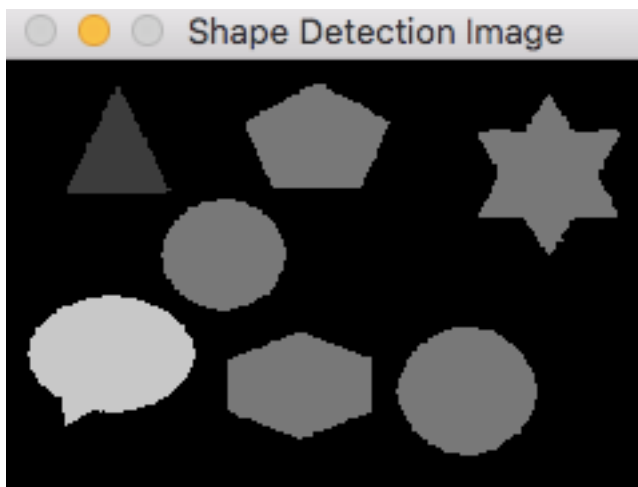
Original Shape Image:



Binary Shape Image:



Region Detection Shape Image:



Original Panic Image:



Binary Panic Image



Enhanced Panic Image:



Threshold Values:

Shape:

Threshold Value: 32

Panic:

Threshold Value: 31