Assignment 2

Answer 1)

(a) Image 'clown.jpeg' was imported

(b) Image was converted to grayscale

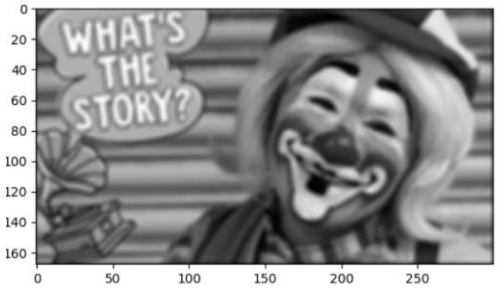
(c) The image was blurred or smoothed using gaussian filter as discussed in class.

a. We prepared a Gaussian kernel of size 5x5 using the below formula

$$\frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{x-\mu}{2\sigma^2}}$$

b. We convolved the Gaussian Kernel obtained with the image. In order to get the resultant image of same size we padded the original image.

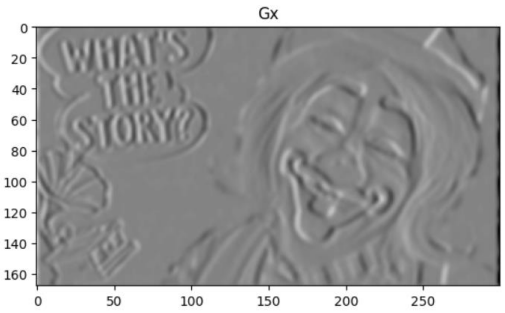
c. The result obtained:

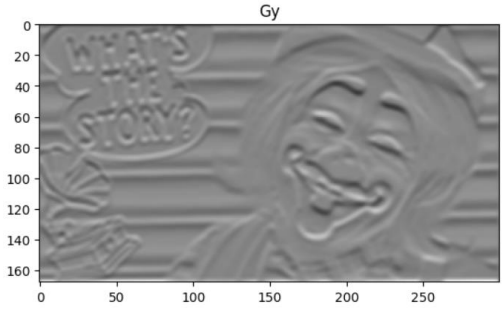


(d) The sobel edge detector was used. We used two convolution kernels to get Gx and Gy gradient magnitude of image. The two kernels were discussed in class and are as follows:

$$\begin{matrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{matrix} \quad \text{and} \quad \begin{matrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{matrix}$$

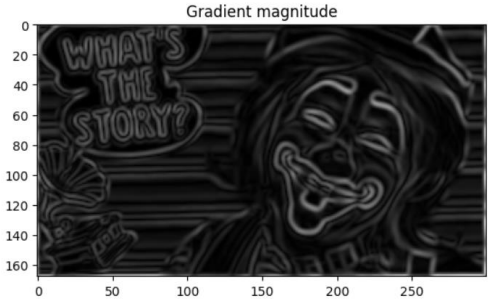
Was convolved with the image output obtained from step3 i.e. after Gaussian filter and results obtained are as follows:



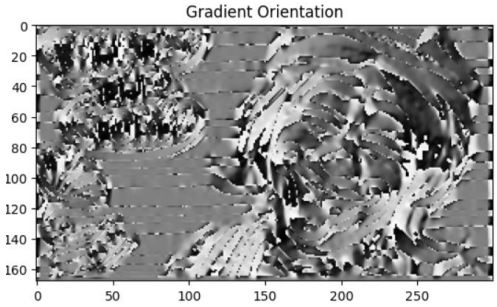


Both the above images have prominent edges either in y or x direction respectively.

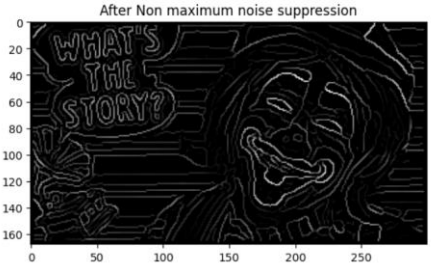
Two outputs were obtained:
Gradient magnitude



Gradient orientation



(e) The gradient magnitude and orientation outputs of Sobel detector was further used and non maximum peaks were suppressed by comparing with neighboring pixels' intensity.



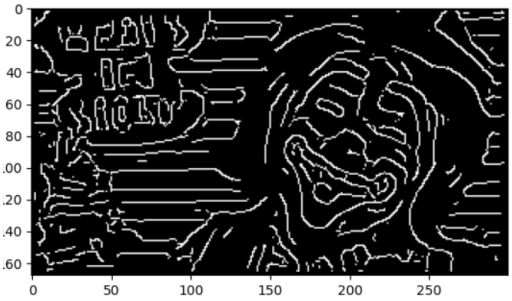
(f) Final step involved was thresholding. It involved taking out threshold using median of the image magnitude and then comparing with the intensities of each pixel to assign it strong value(255) or weak value(0). Final result obtained:

Answer 2

The code was cleaned and used to get output of Question 2. The standard deviation was changed to 3.

With kernel 5x5 we got output:

With kernel 9x9 we got output:



I chose Gaussian filter after looking https://stackoverflow.com/questions/16165666/how-to-determine-the-window-size-of-a-gaussian-filter

Observation:

As compared to Answer 1 final output Answer 2 final output has more blurring as standard deviation has increased and edges more distorted.