Assignment 1 Final Report-Part 2

Q2)

a) Linear Contrast Stretching

File Name:-- myLinearContrastStretching.py

It contains two function to calculate linear stretching one for Grayscale Image and another for RGB Color Images

Mathematical formula used:--

For a given image I we calculate its max pixel value(max) and min pixel value(min)

Formula for GrayScale images:--

$$I(i,j) = ((I(i,j) - min)/(max - min)) * 256 + min$$

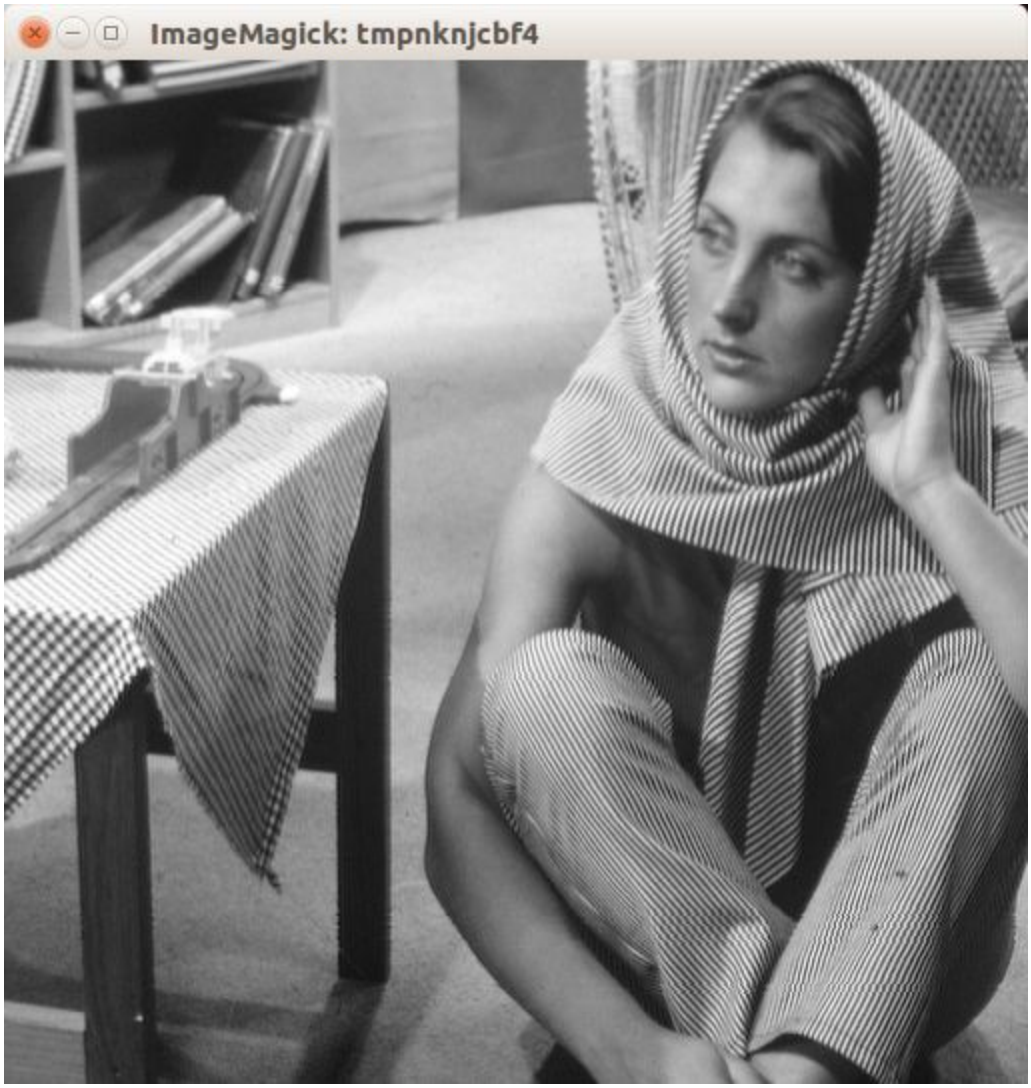
For RGB color images:--

$$I(i,j,k) = ((I(i,j,k) - min(k))/(max(k) - min(k)) * 256 + min(k)$$

Where k represents the channel

Results:--

Some of the images has no change after applying Linear Contrast Stretching because maximum pixel value for that image is 255 and minimum is 0.

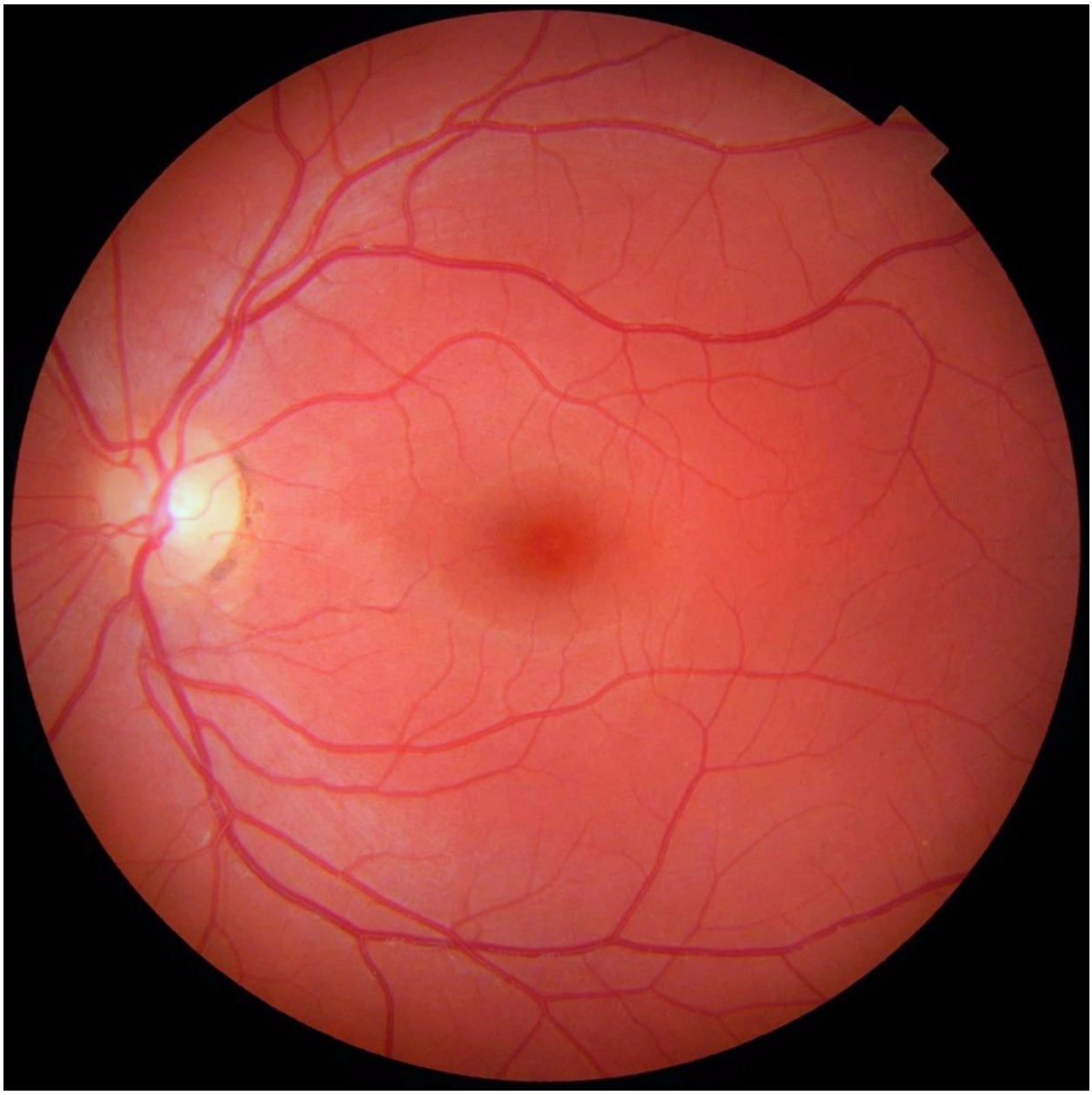


Linear stretching applied to barbara

Original Image

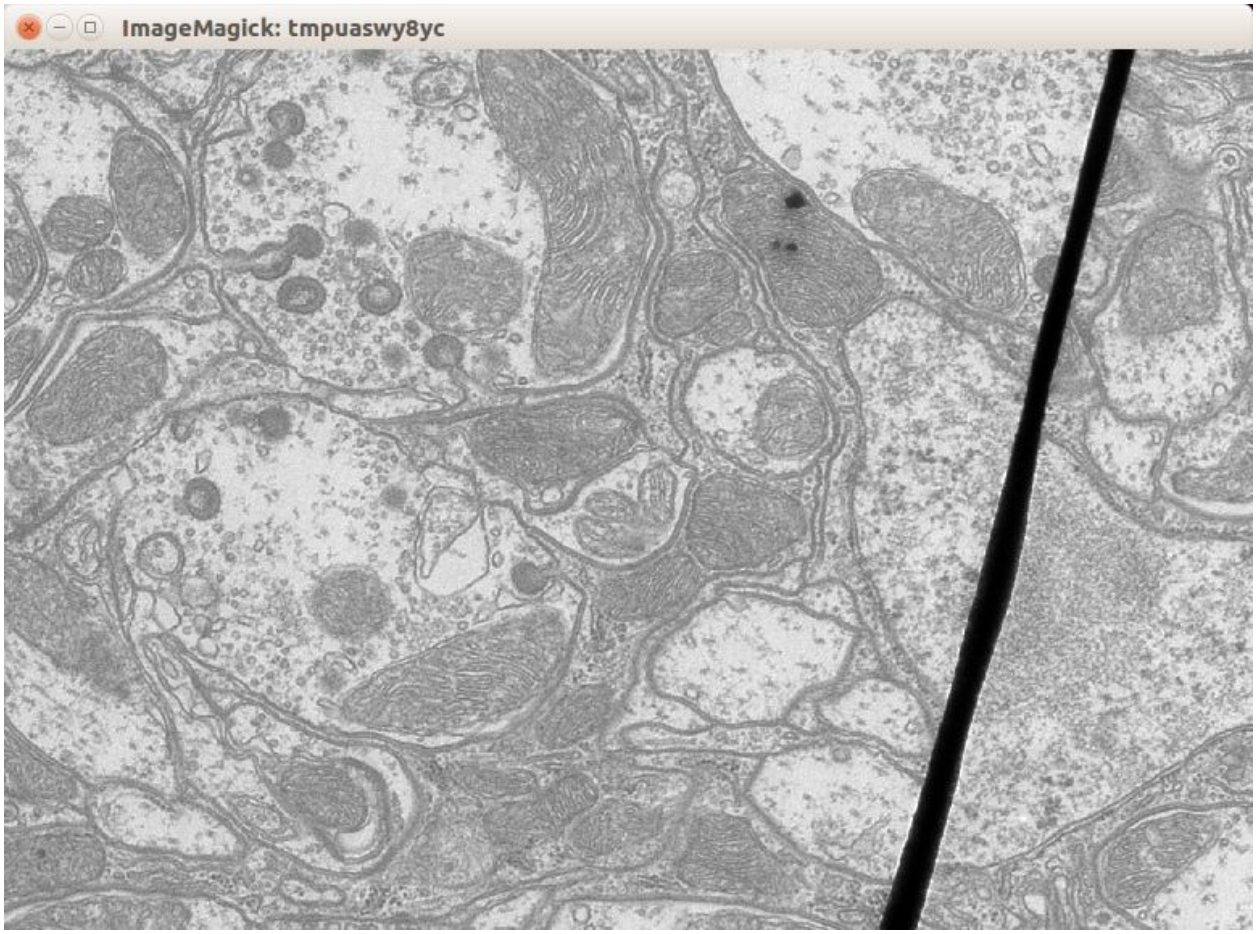
Original Image-- above

Image after linear contrast stretching--below

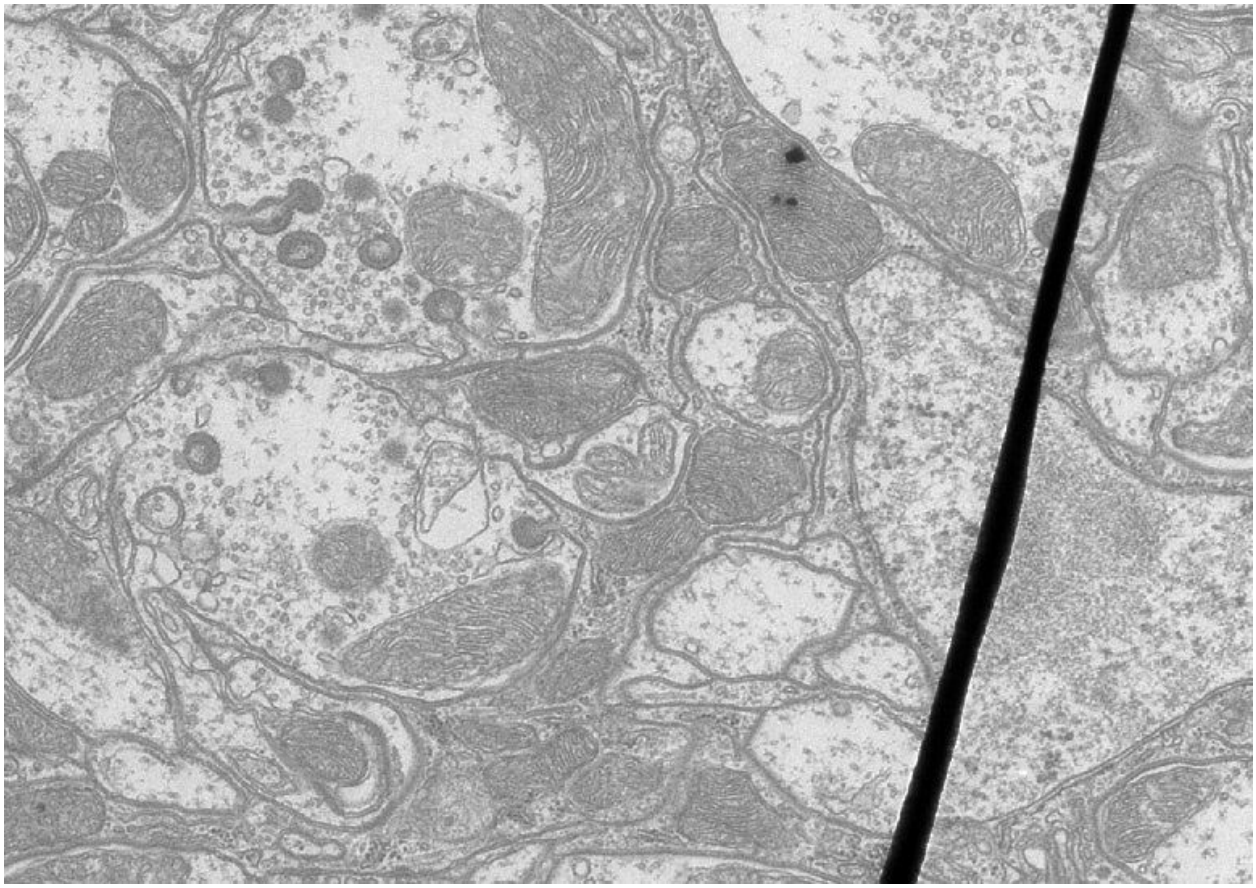


Linear Stretching applied to eye

Original Image



Linear stretching applied to TEM.png

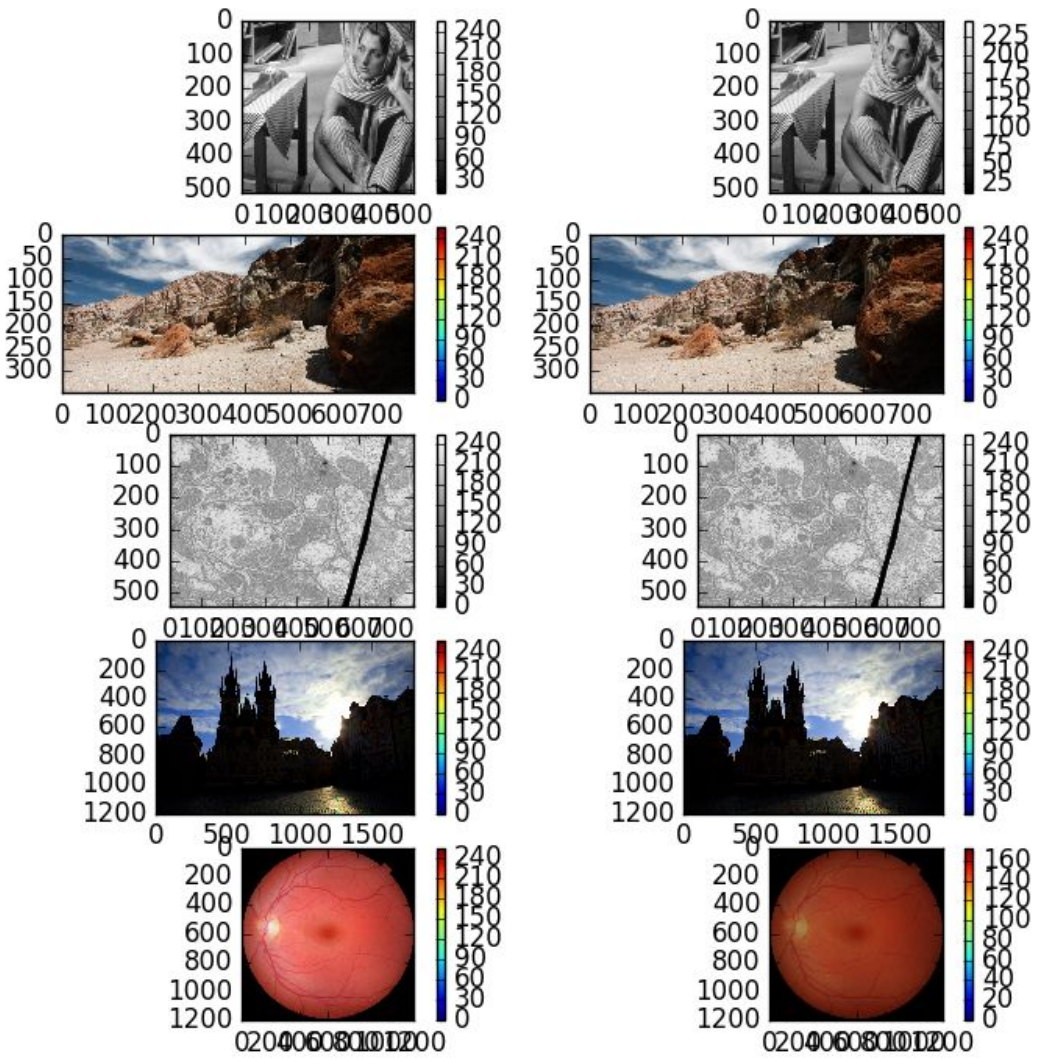


Original Image

After applying Linear Contrast Stretching

Original Image

Color Map :--



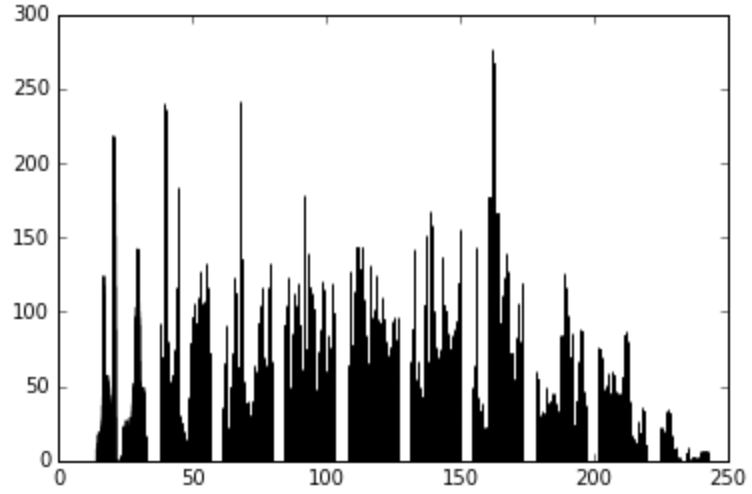
Right Side contains colorMap of original Images

Left Side contains colorMap of images after applying linear contrast stretching

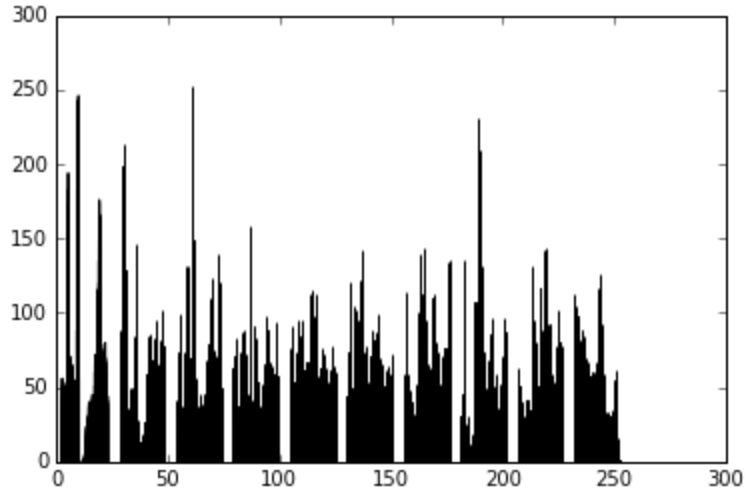
b) Histogram Equalization

File Name:-- myHE.py

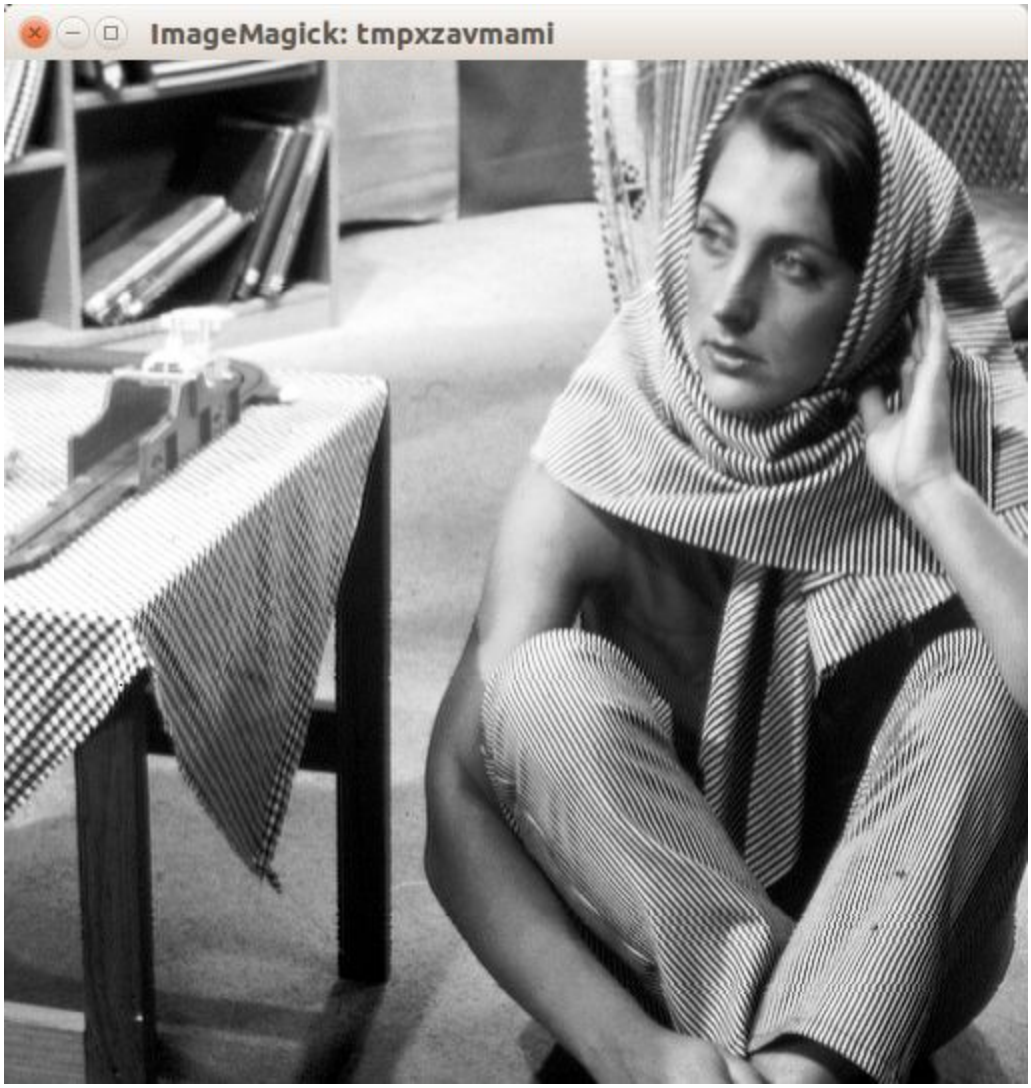
It contains two function to calculate histogram equalization one for Grayscale Image and another for RGB Color Images



Histogram of Original Barbara Image

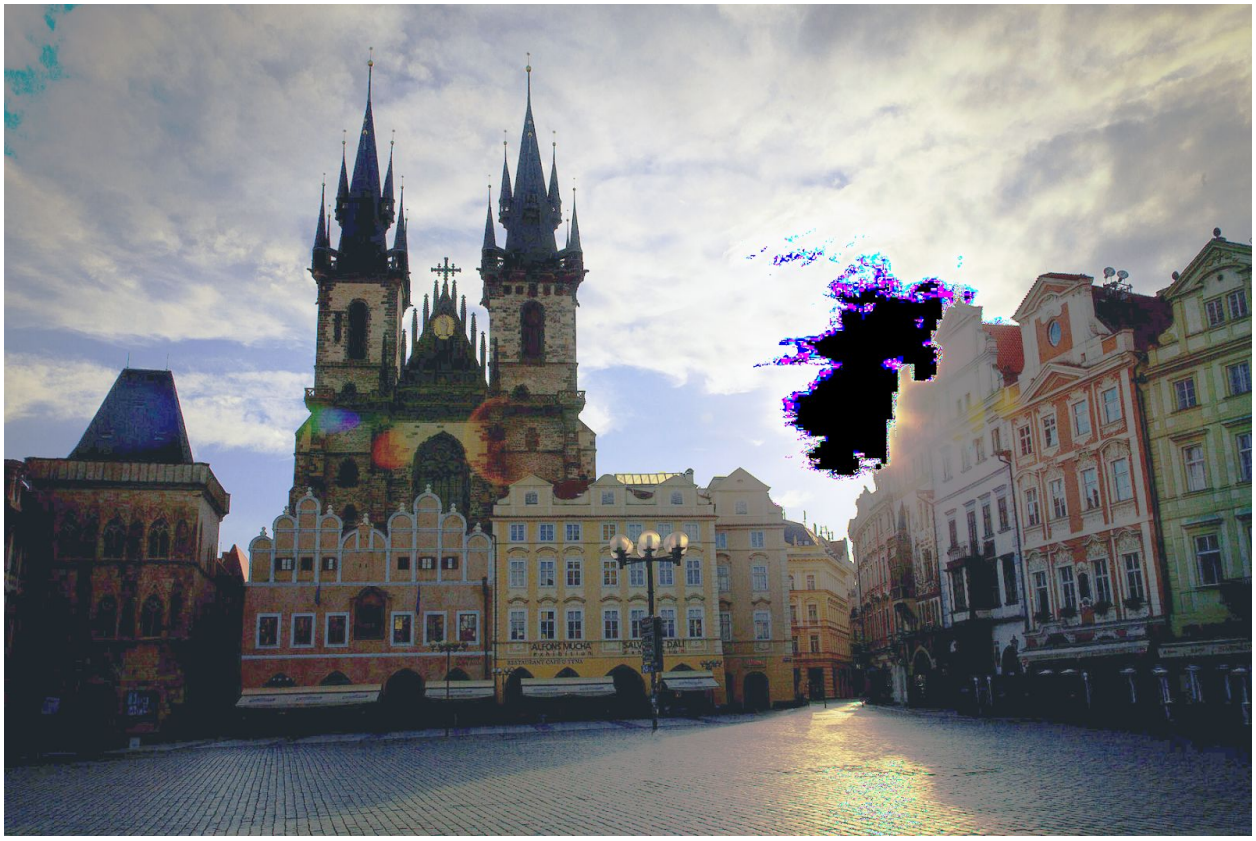


Histogram of Barbara image after applying Histogram Equalization



Barbara image after applying histogram equalization

Original Barbara Image



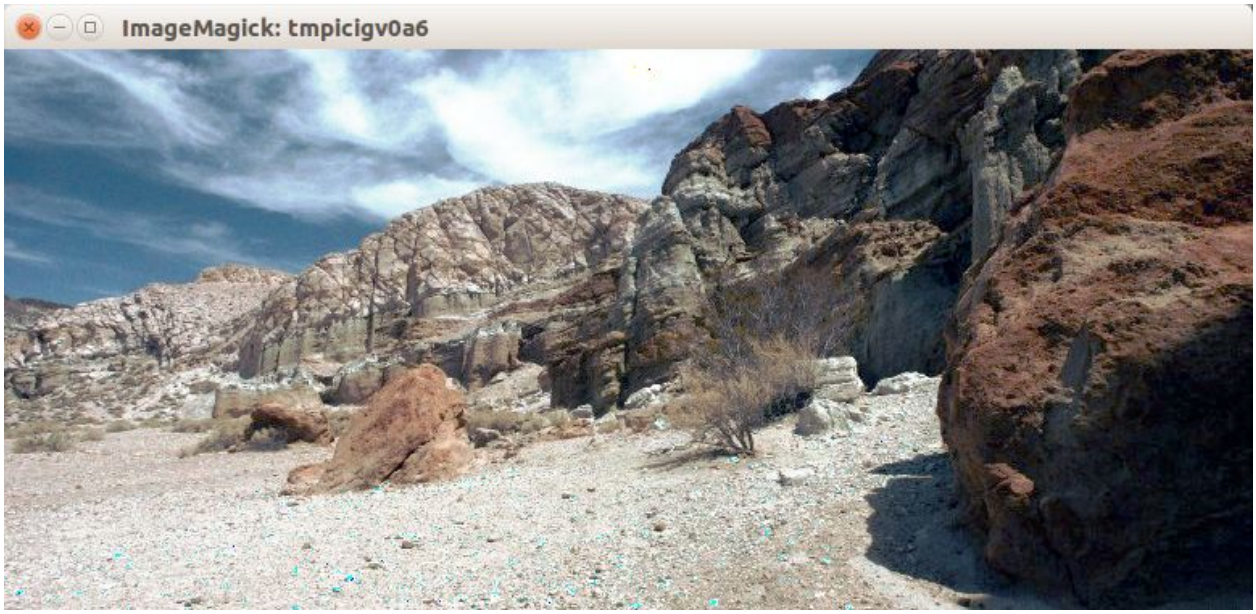
Church Image after applying histogram equalization

Original Church Image

We can see here , after applying Histogram equalization on church image,Its contrast is enhanced as compared to Linear contrast stretching algorithm

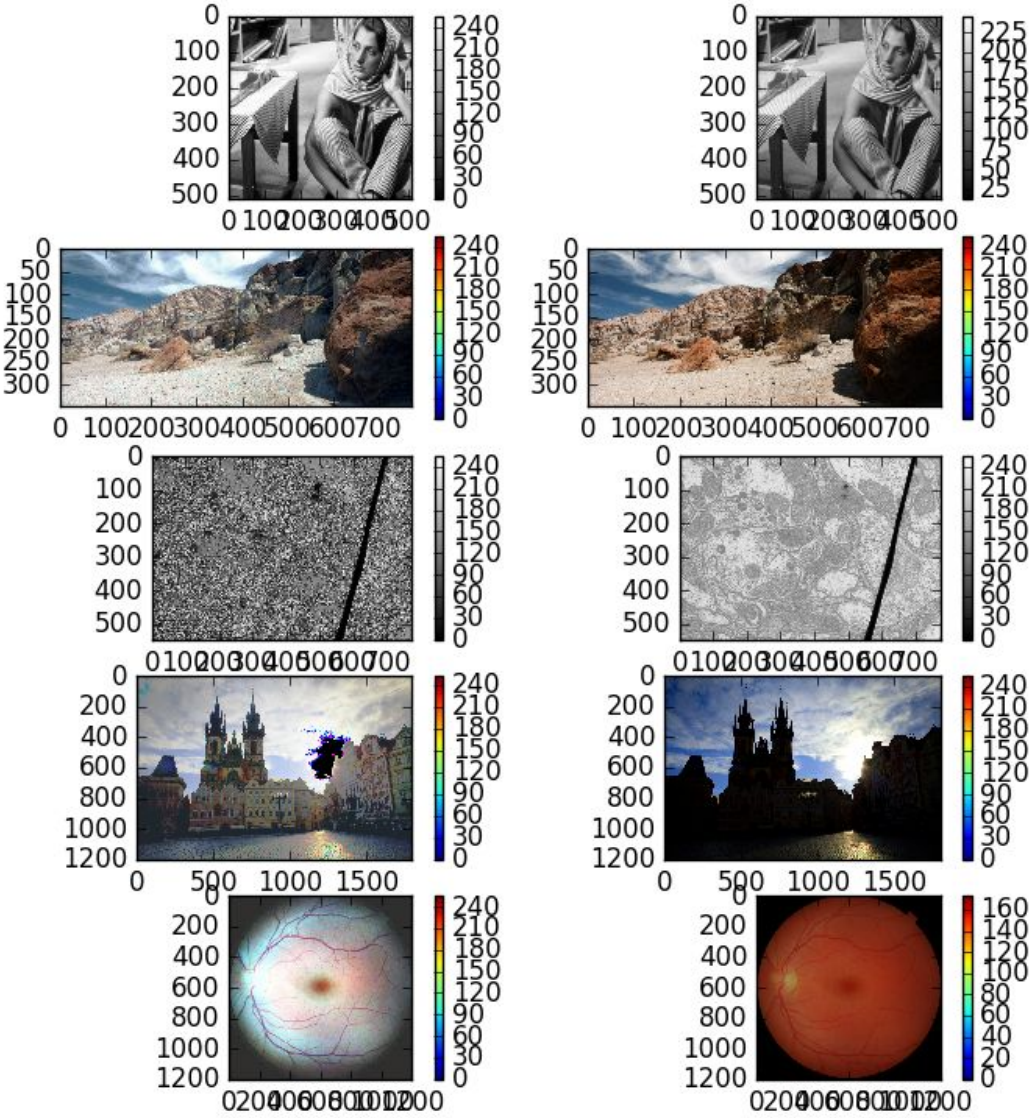
Histogram equalization performs good.

Original Canyon Image



Canyon image after applying histogram equivalent

Color Map:--



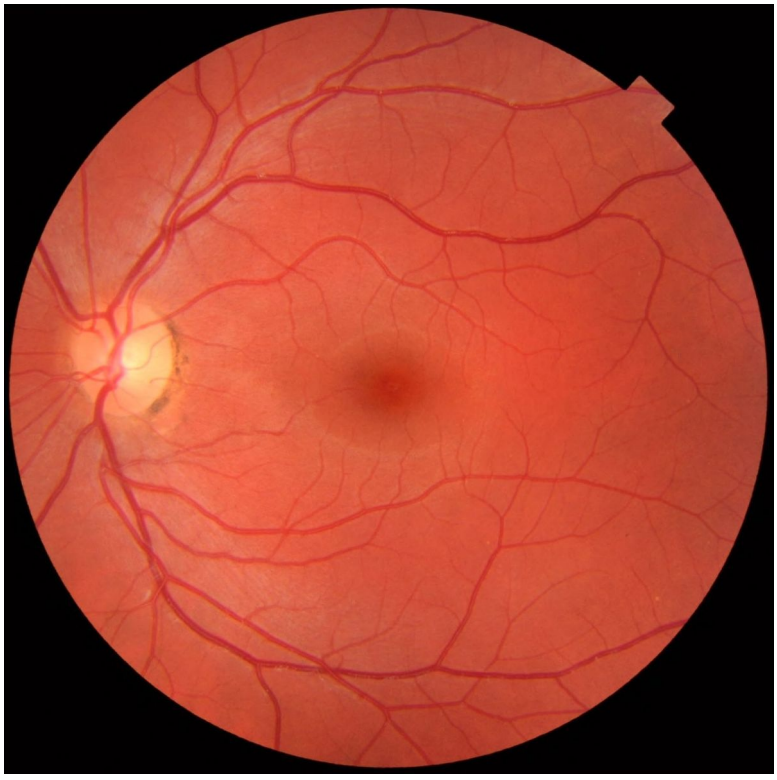
Color Map after applying histogram equalization
Left Side:-- histogram equalization applied images
Right Side:-- original images

Histogram equalization performed better than our linear contrast matching because if max and min values are 255 and 0 for any channel, then contrast stretching can not affect the image

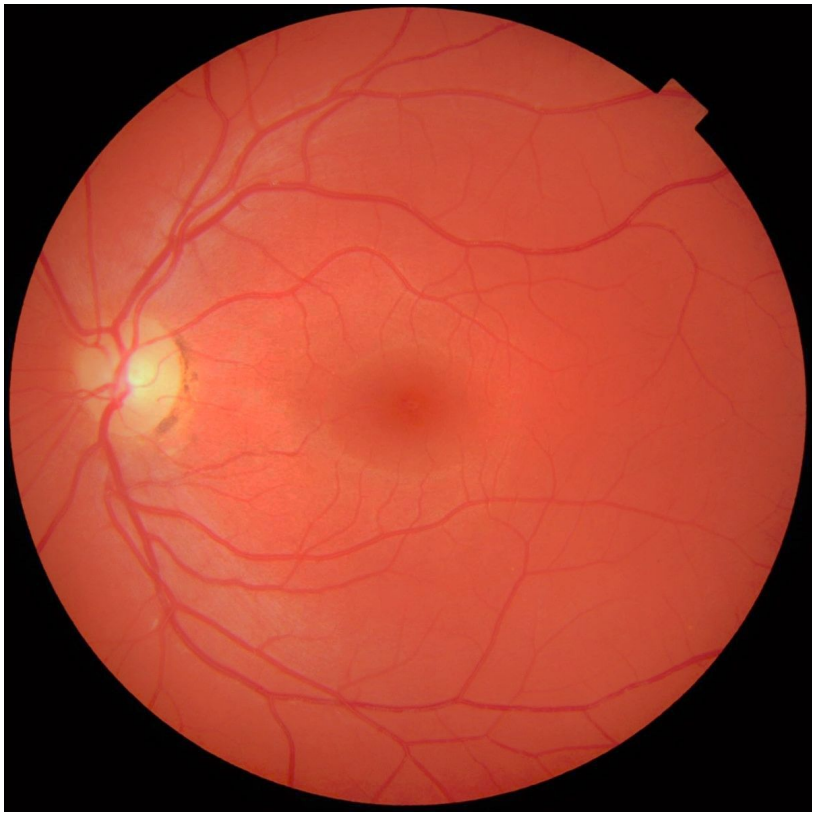
c) Histogram Matching:--
File Name:-- myHM.py

Contains function hist_match_color and hist_eq_color to compute histogram matching of a given input image

Retina Input image

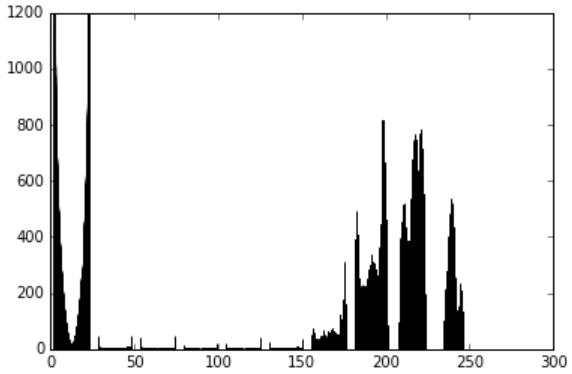


Retina Reference image

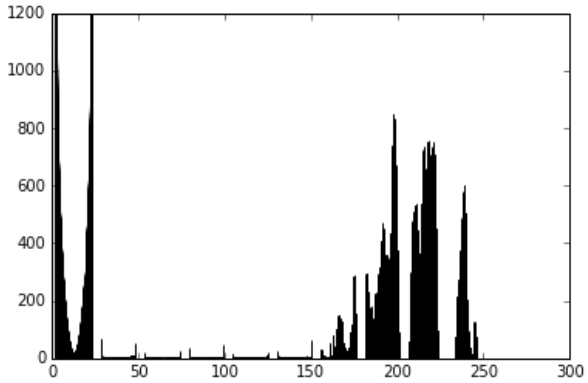


Output histogram matched image

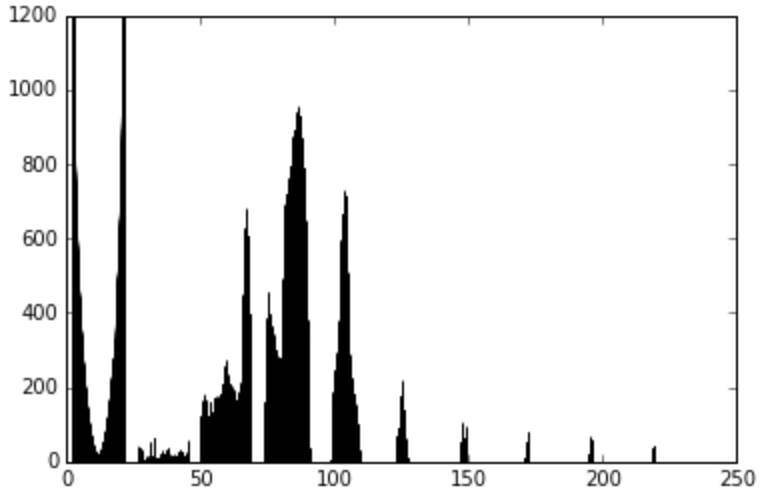
Histograms:--



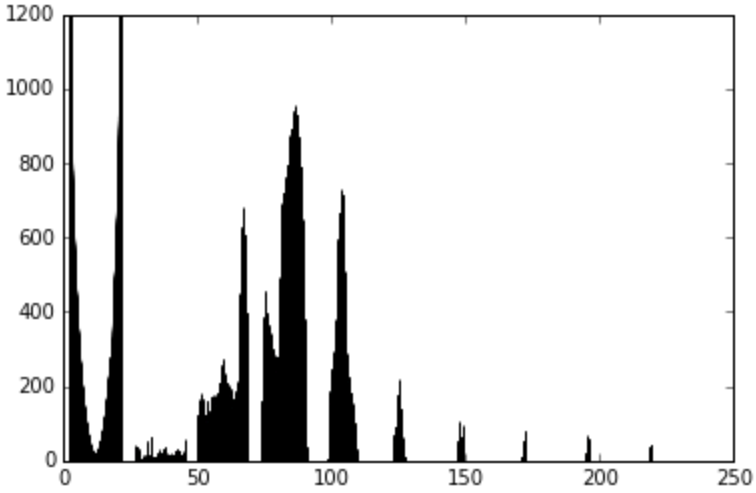
Histogram of histogram matched image (channel0)



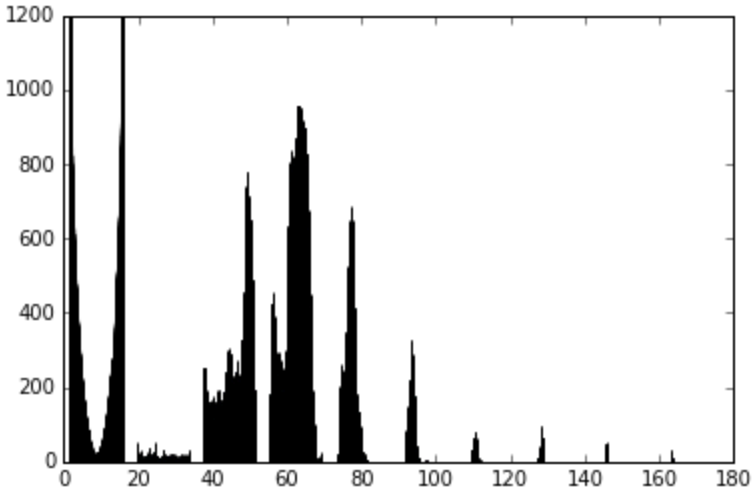
Histogram of referenced image channel0



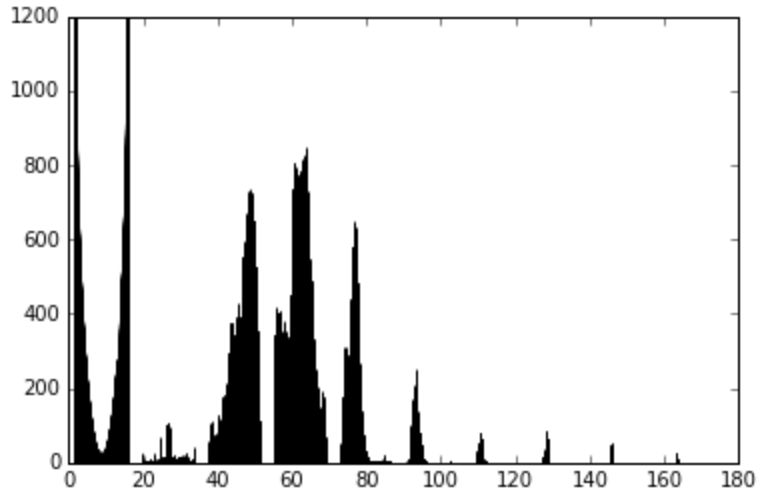
Histogram of histogram matched image (channel1)



Histogram of referenced image channel1



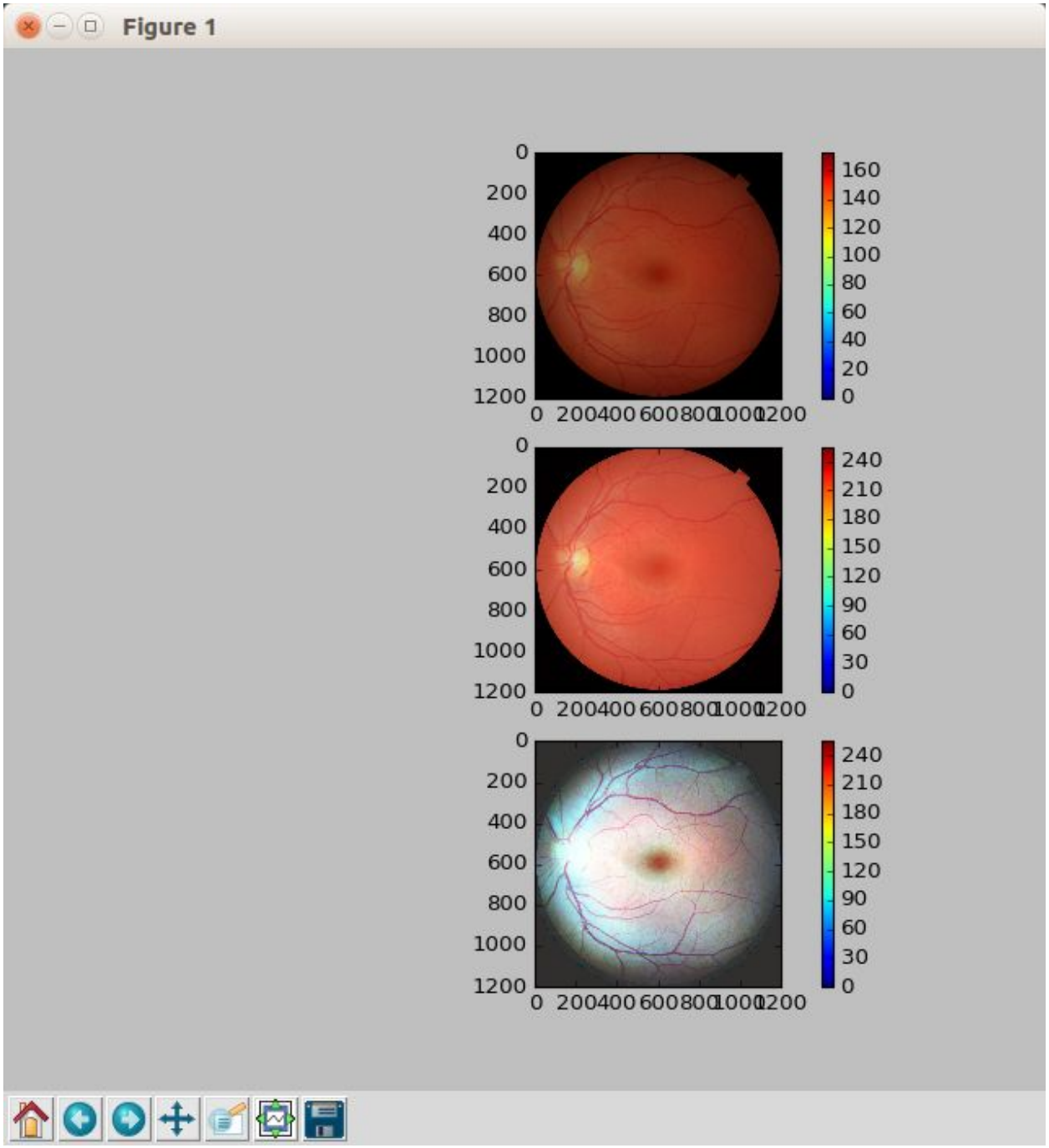
Histogram of matched image channel 2



Histogram of referenced image channel 2

Histogram matching performed better than histogram equalization as it tries to match the given cdf value with reference image.
Reference image provides an upper bound for our processing image.

The only drawback is getting a referenced image

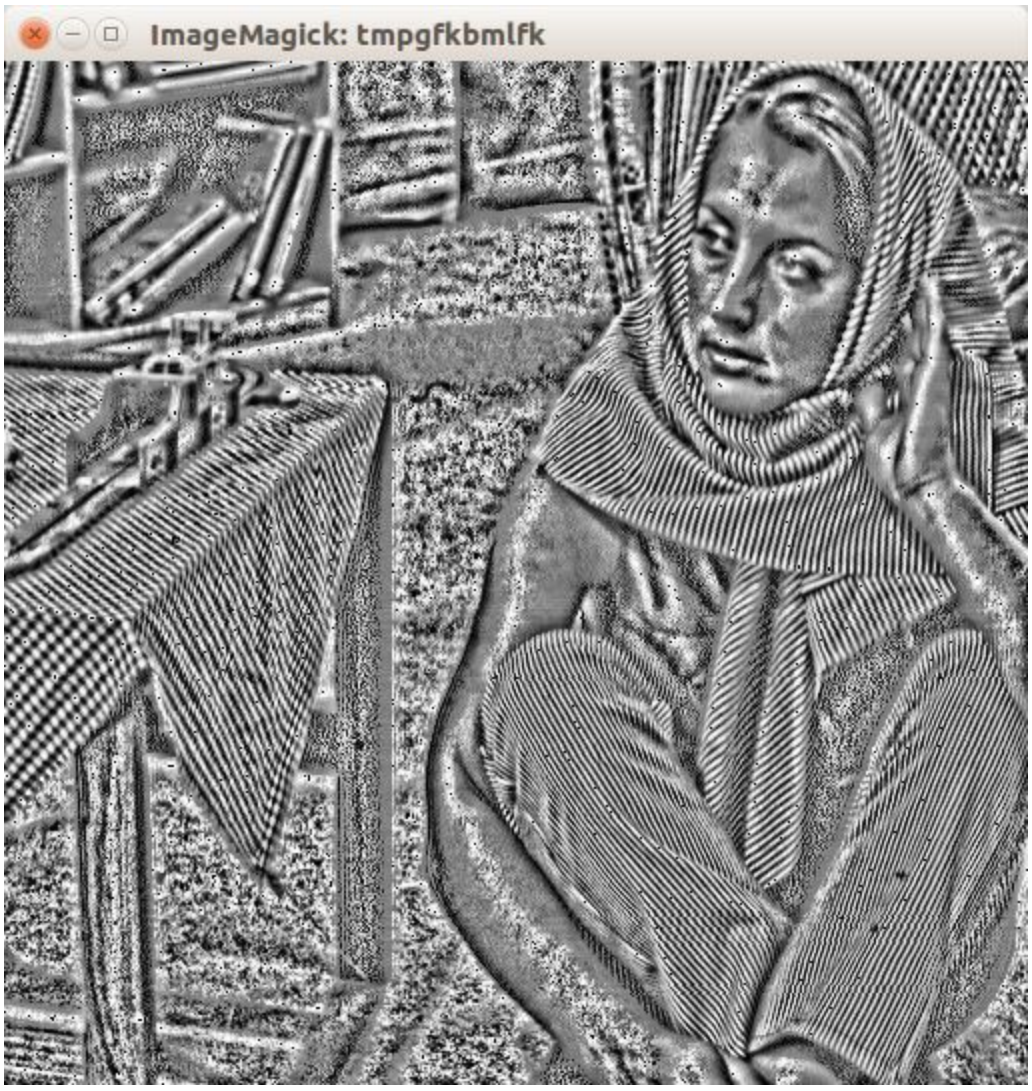


Color Map of histogram matching

d) Adaptive histogram equalization

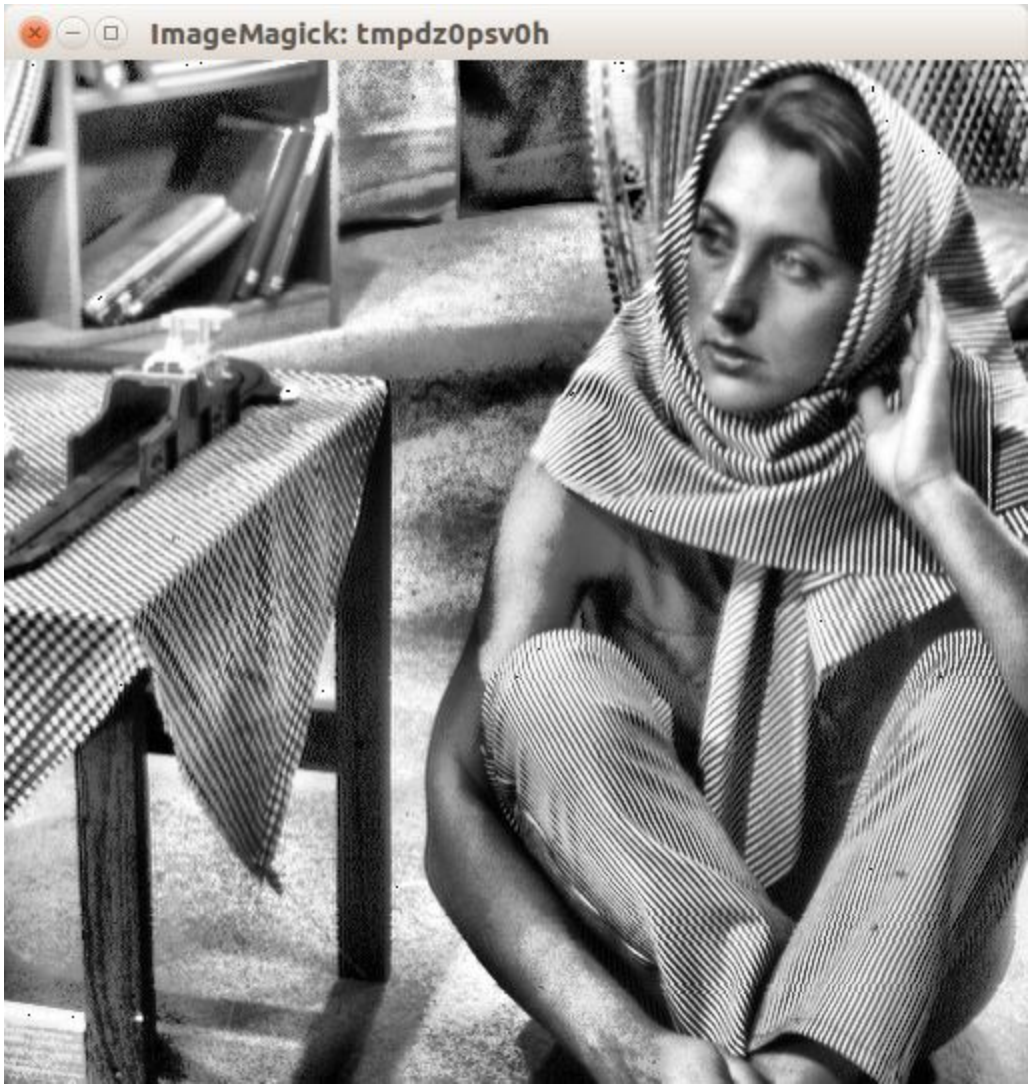
File Name:-- myAHE.py
Contains two function,one selects a window size and other performs histogram equalization on that window

Results:--

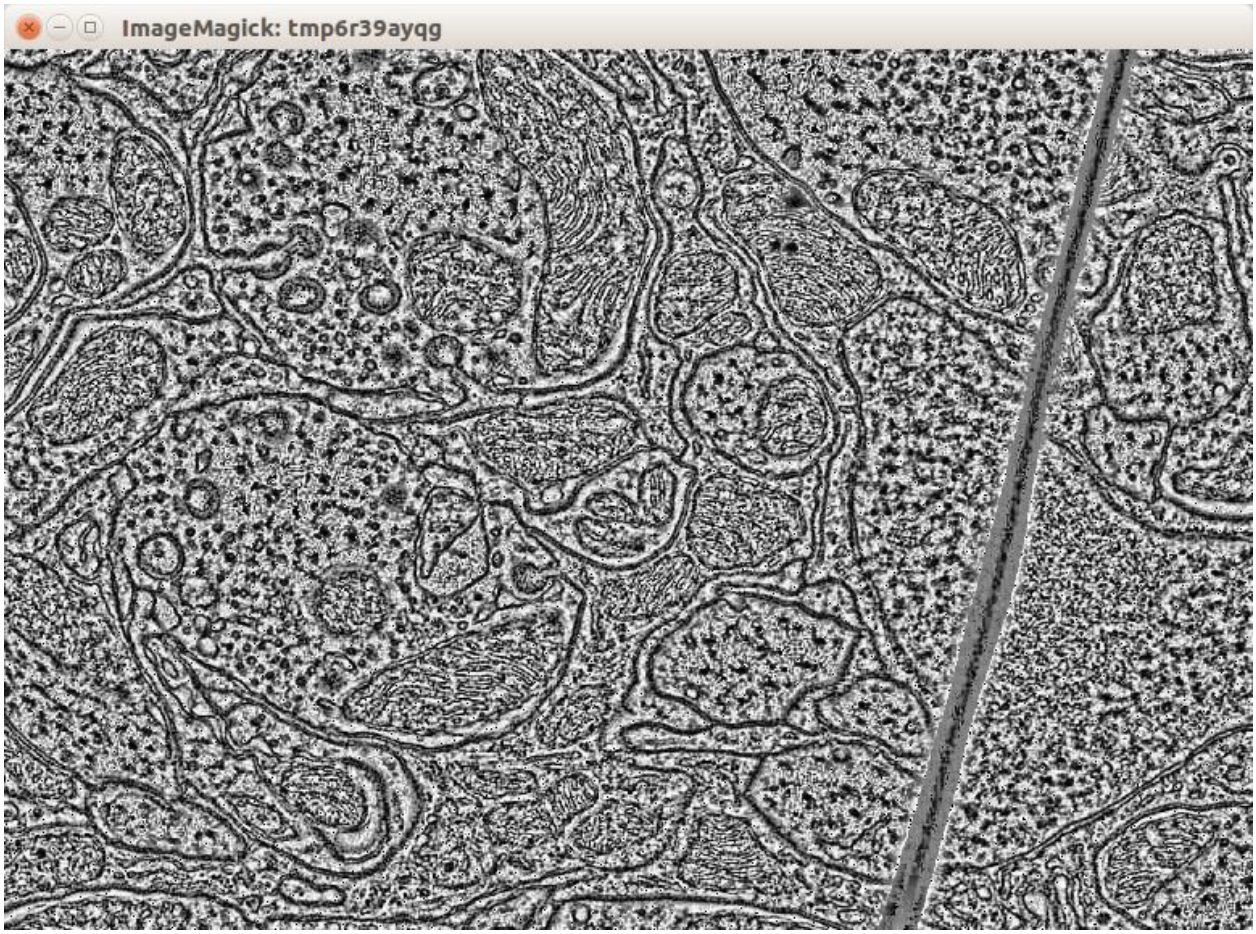


When window size is (15,15)

When Window size is (51,51)



When window size is (101,101)

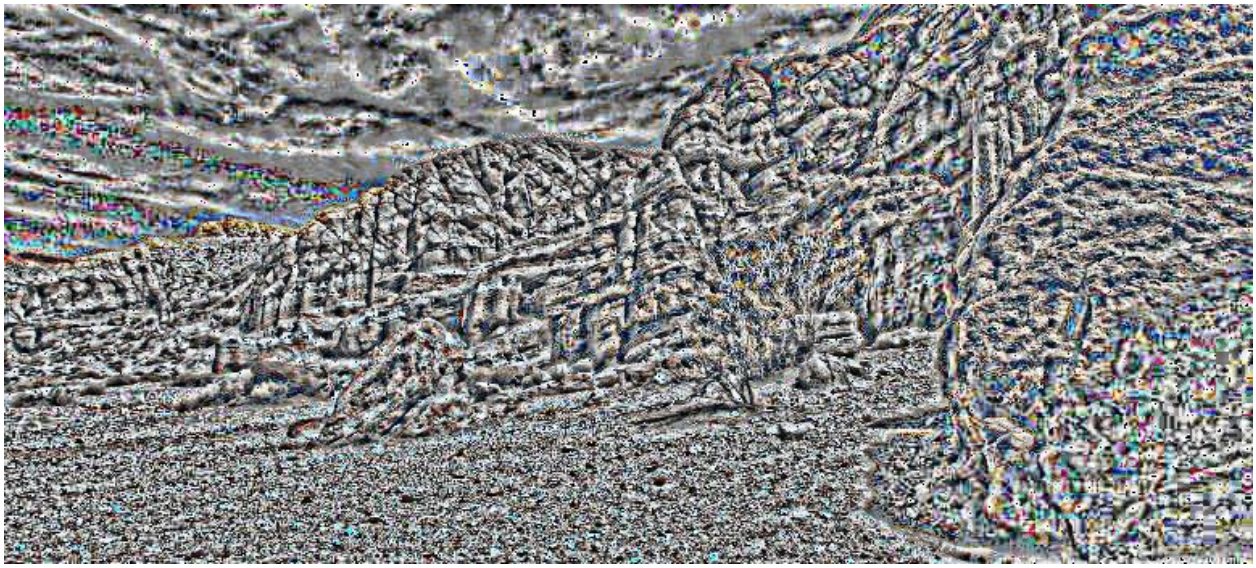


Window size (15,15)

Window Size (51,51)

Window size (101,101)

Window Size (51,51)



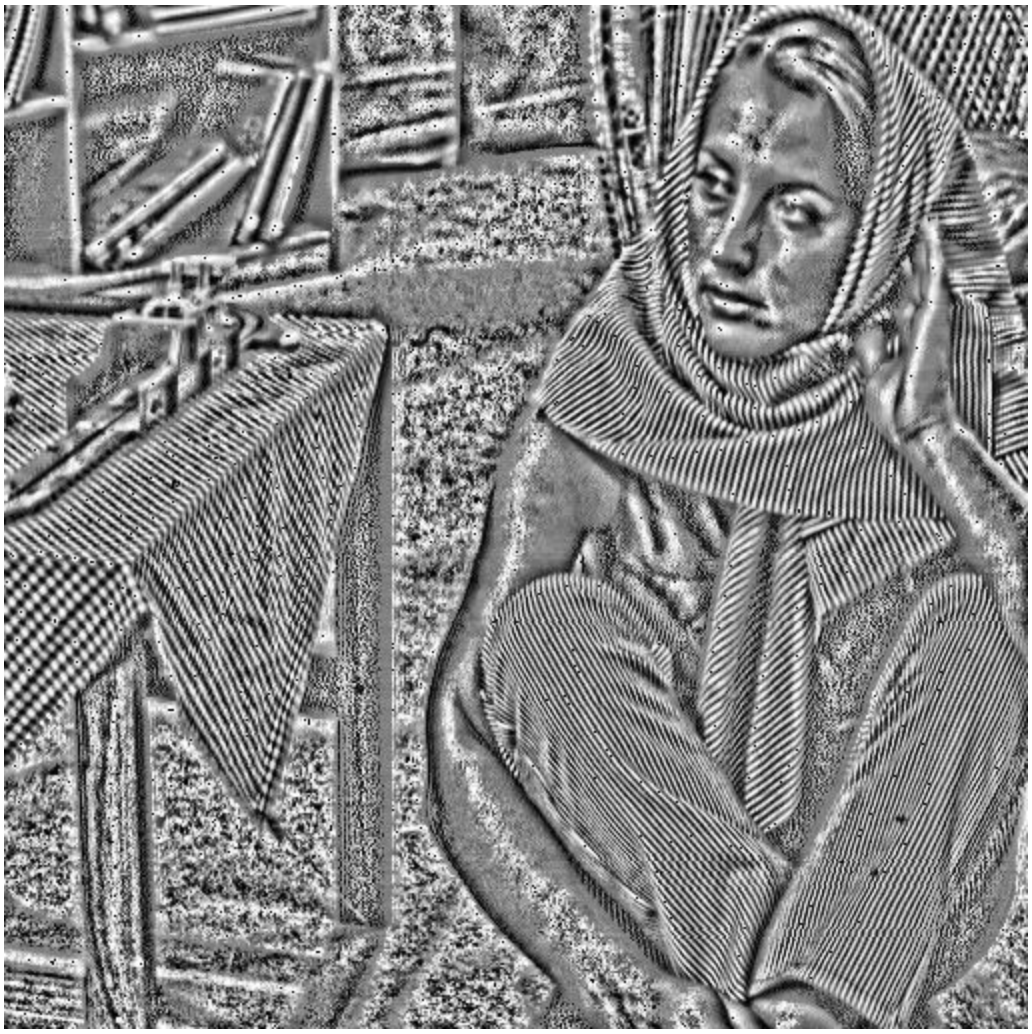
Window size (15,15)

Window Size (101,101)

e) Contrast-Limited Adaptive Histogram Equalization (CLAHE)

File Name:-- myCLAHE.py

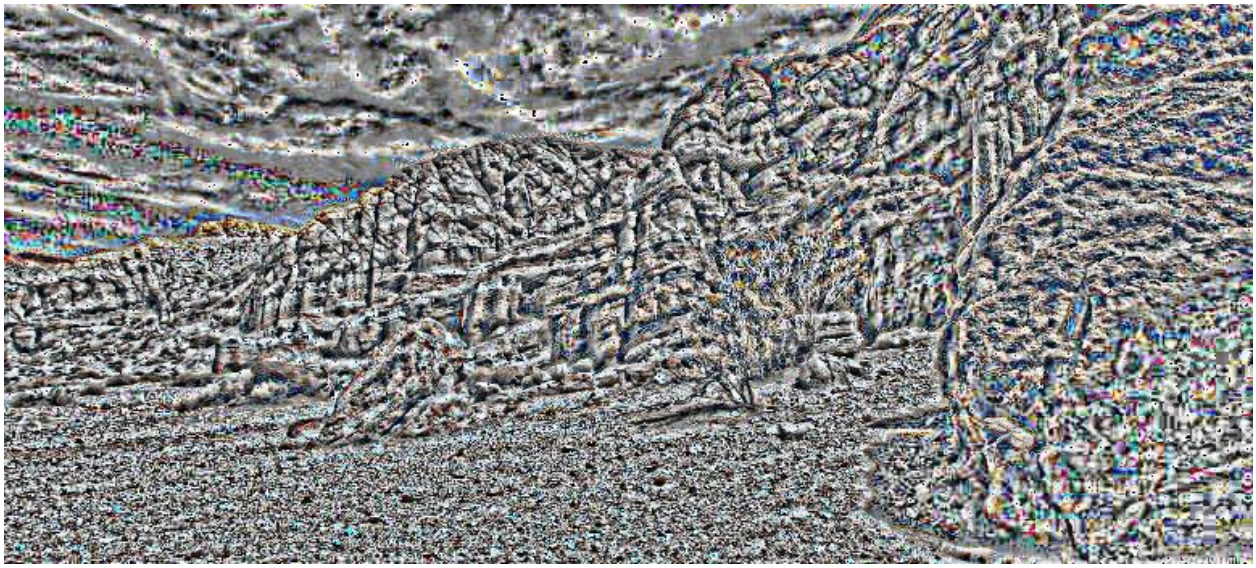
Functions are same as myAHE.py with only one modification where histogram is calculated we clip the amplitude of histogram of intensity values.



Window Size (15,15) clipping=0.6

Window size (51,51) and clipping=0.6

Window size (101,101) clipping=0.6



Window Size=(15,15) clipping=0.6

Window size=(51,51) clipping=0.6

Window Size (101,101) , clipping 0.6