Contrast Enhancement Package

Submitted By
Amrata Ramchandani 183316001
Avichal Chandra 183310021
Mahesh Ji Pandey 183310003

PROBLEM STATEMENT

Develop a contrast enhancement package supporting linear / logarithmic / exponential / histogram equalization / standard deviation contrast stretch operations. The menu should allow the user to select a remotely sensed image from the hard disk, choose an enhancement operation, and display on the screen side by side the original and contrast enhanced images.

Introduction

Image enhancement is one of the most interesting and visually appealing areas of image processing.
Image data when received in its original form often has poor visible appearance like

1. Inadequate contrast,
2. Too dark image
3. Or too bright image.

Poor illumination, lack of dynamic range in the imaging sensor, or even an incorrect setting of a lens aperture during image acquisition can produce low-contrast images.

Due to the poor quality of an image it is not easy to extract the information that is existing in that image.
Such kind of images requires Image enhancement that improves the quality of images in terms of contrast and reduction of noise contents for better visual perception.

Image enhancement techniques have been widely used in many applications such as Enhancing Satellite Images, X- Ray Images, where the subjective quality of images is important for human interpretation.

A common problem with satellite images is that during acquisition of images through remote sensing the range of reflectance values collected by a sensor may not match the capabilities of display monitor.Which eventually generates an poor contrast image.

And the problem with X-Ray Images is that they too generates low contrast images. One of the reasons for low contrast of X-ray images is presence of bulk amount of liquid in human body. One can increase the power of X-Rays for capturing images but it may harm human body and that's why instead of increasing the power to improve the quality of images is improved using contrast enhancement techniques.

The contrast of an image is a range of brightness values present in it or put a simpler way, the maximum pixel value minus the minimum pixel value is referred to as contrast. An 8-bit image at full contrast has a range of brightness from 0 to 255, and range with anything less than that can be said as lower contrast image.

Contrast enhancement is a process that makes the image features stand out more clearly by making optimal use of the colors available on the display or output device.

In this project we are trying to improve the quality of Images in terms of contrast by using various contrast enhancement techniques like

1) Linear
2) Standard deviation
3) Histogram Equalisation
4) Logarithmic and
5) Exponential

Specifications of Contrast Enhancement Package

- ➔ **Platform** : Web based Application
- ➔ **Technology** : Python 2.7
- ➔ **Framework & Libraries** : Flask, Open CV2, Numpy, Matplotlib
- ➔ **Developed and Tested on :**
  - ◆ Laptop with screen size 15.6" (Front-end of this web application is not all screen- responsive, It works fine with any laptop screen size, Functionality is screen independent)
  - ◆ Ubuntu 16.04 OS

To setup this web application on your local server, above mentioned specifications should be fulfilled. Once that is done, Place the project folder as it is anywhere on your computer, Start the application by executing server.py file and open http://127.0.0.1:5000/ on your web browser.

The below given screenshots will explain the contrast enhancement interface

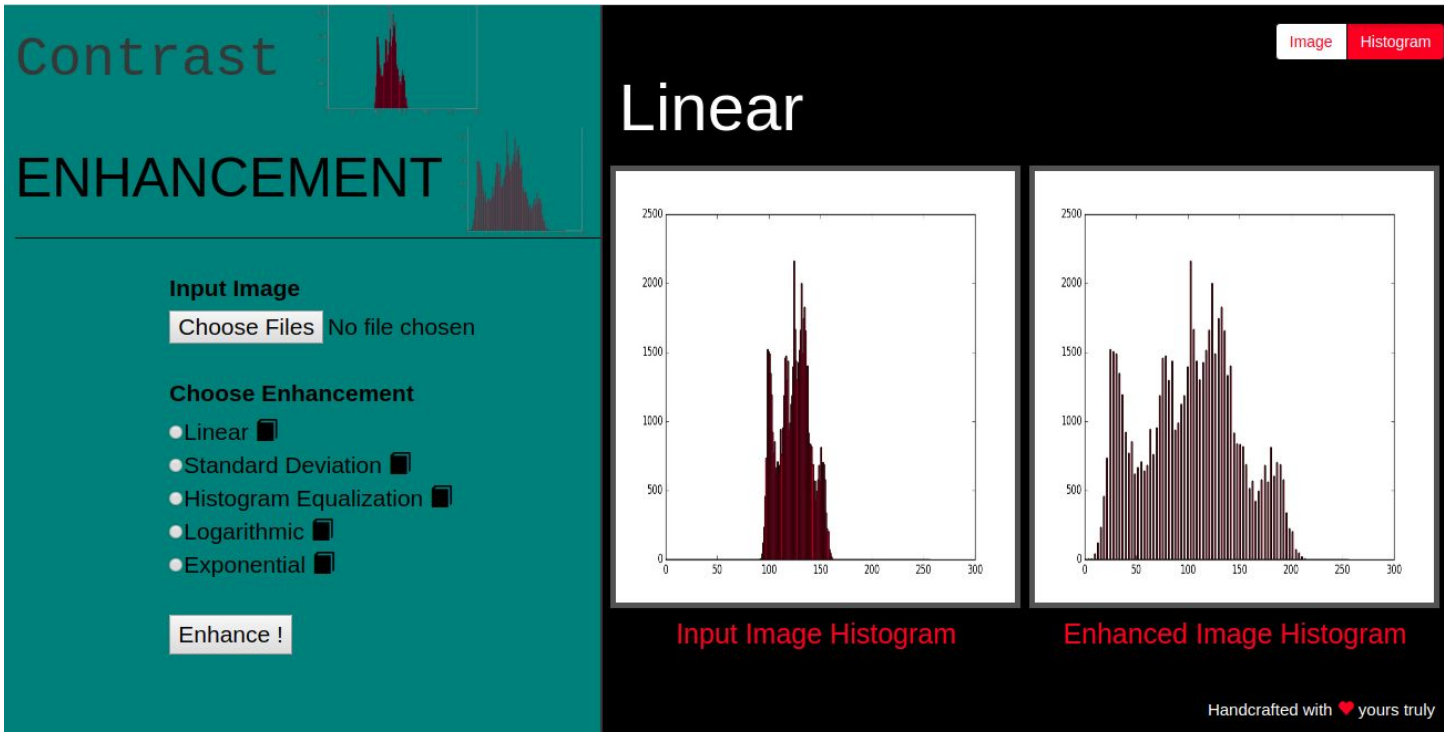
Index page : It has got the slider effect which converts RGB to GrayScale Image


Amrata
Mahesh
Avichal


Amrata
Mahesh
Avichal

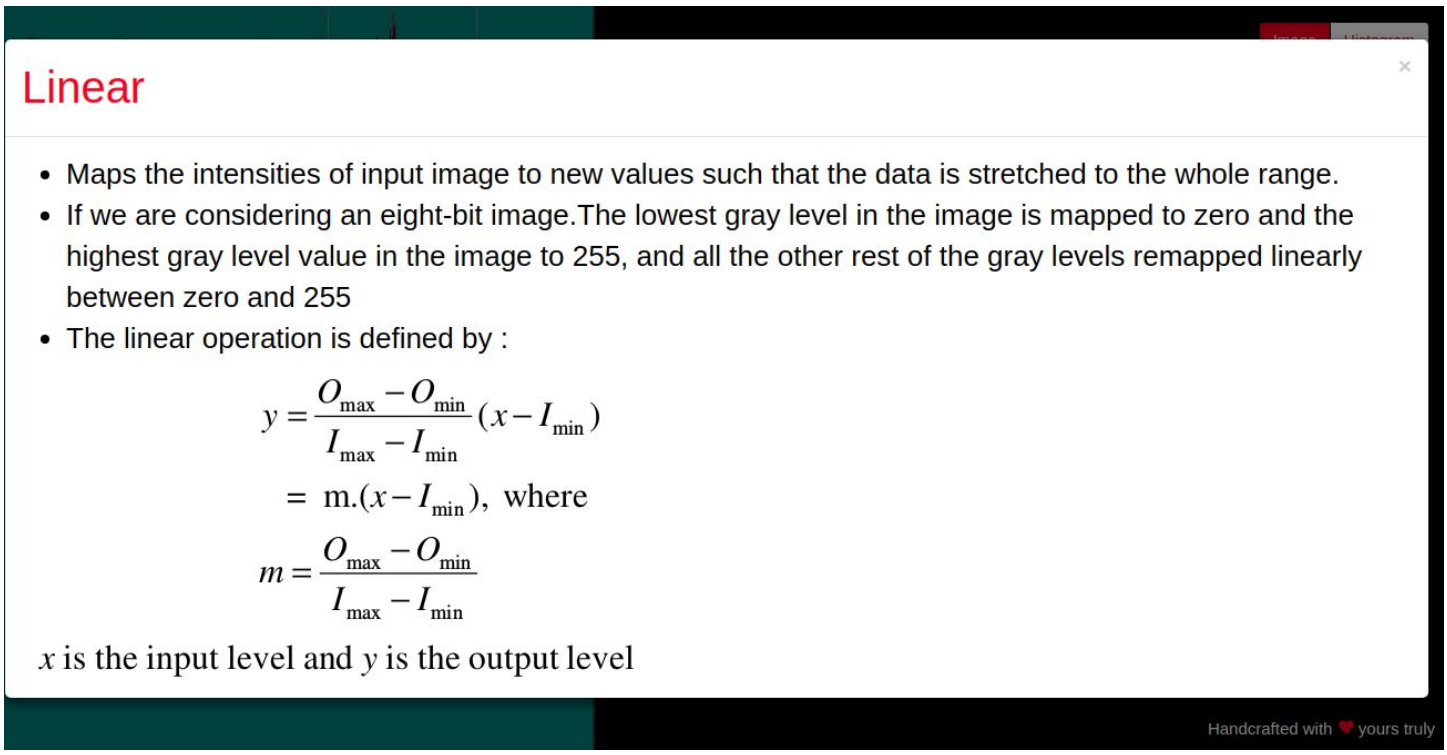
Introductory Page : Click on "Amrata" button on the Index page to reach this page. This page was developed to give introduction about this package while giving the demo.

Enhancement Page : Click on "Enhance" button on the Introductory page to reach this page. By default this page shows the Linear Contrast Enhancement. Top-Right Corner has the toggle button to switch between an image and its respective histogram.

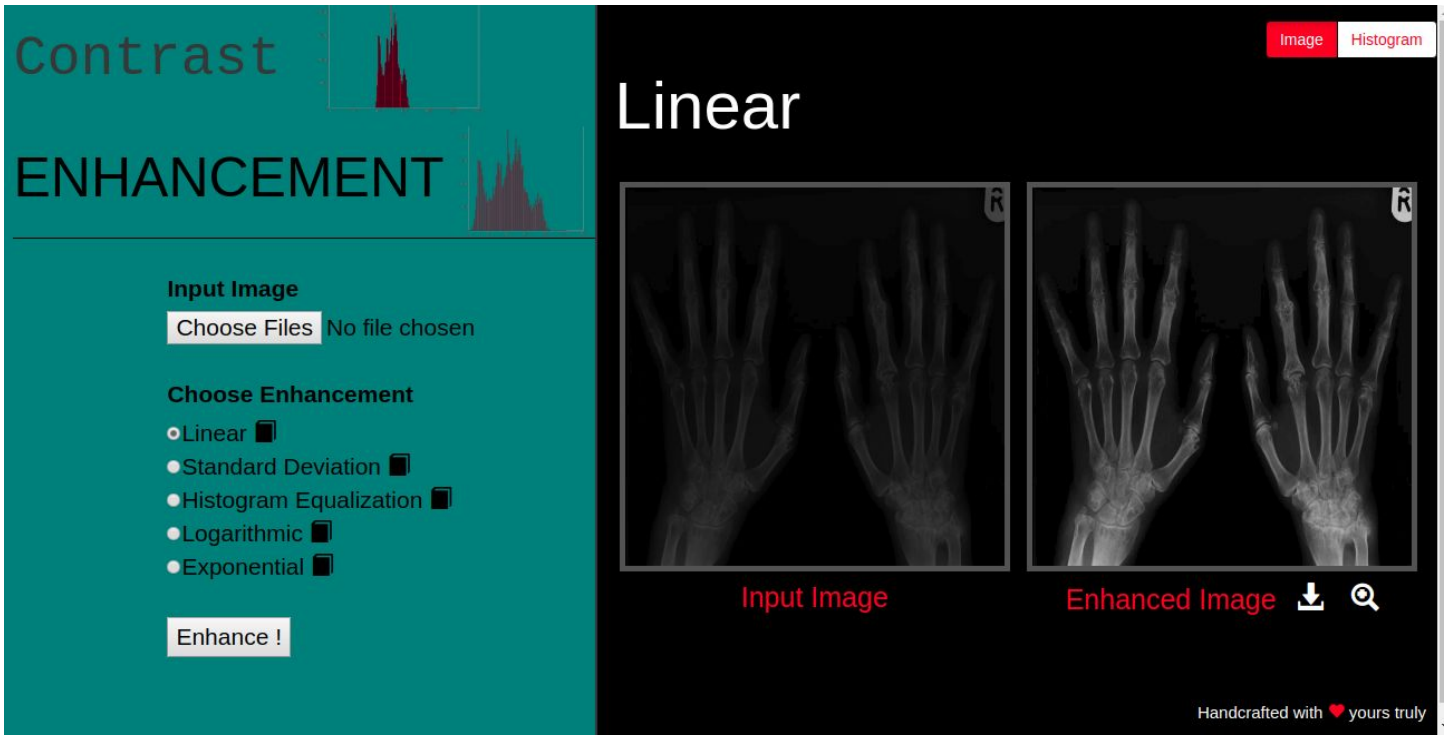


Brief Description about the specific contrast enhancement can be found by clicking on the book icon placed beside the enhancement name on the Left half of the screen.

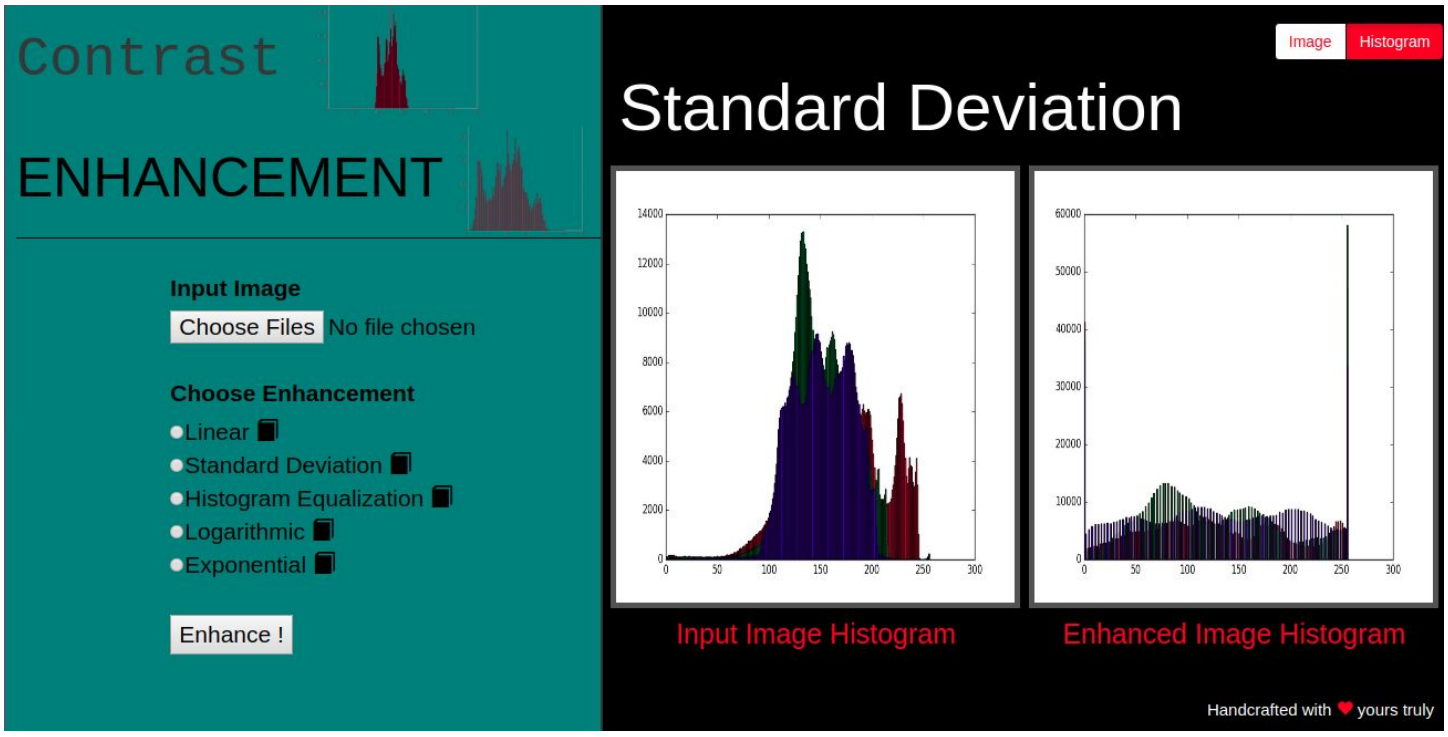
For e.g



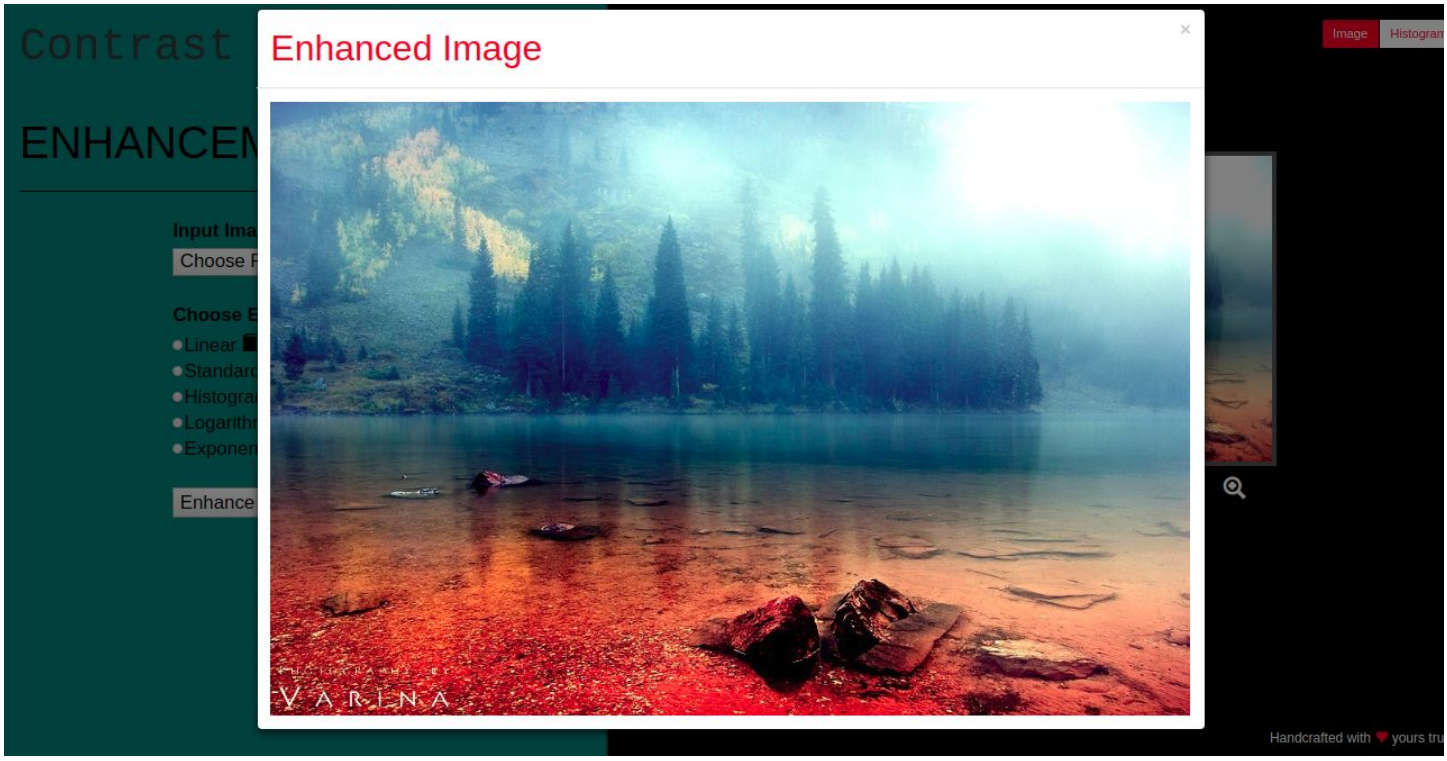
Linear enhancement done on an X-Ray Image



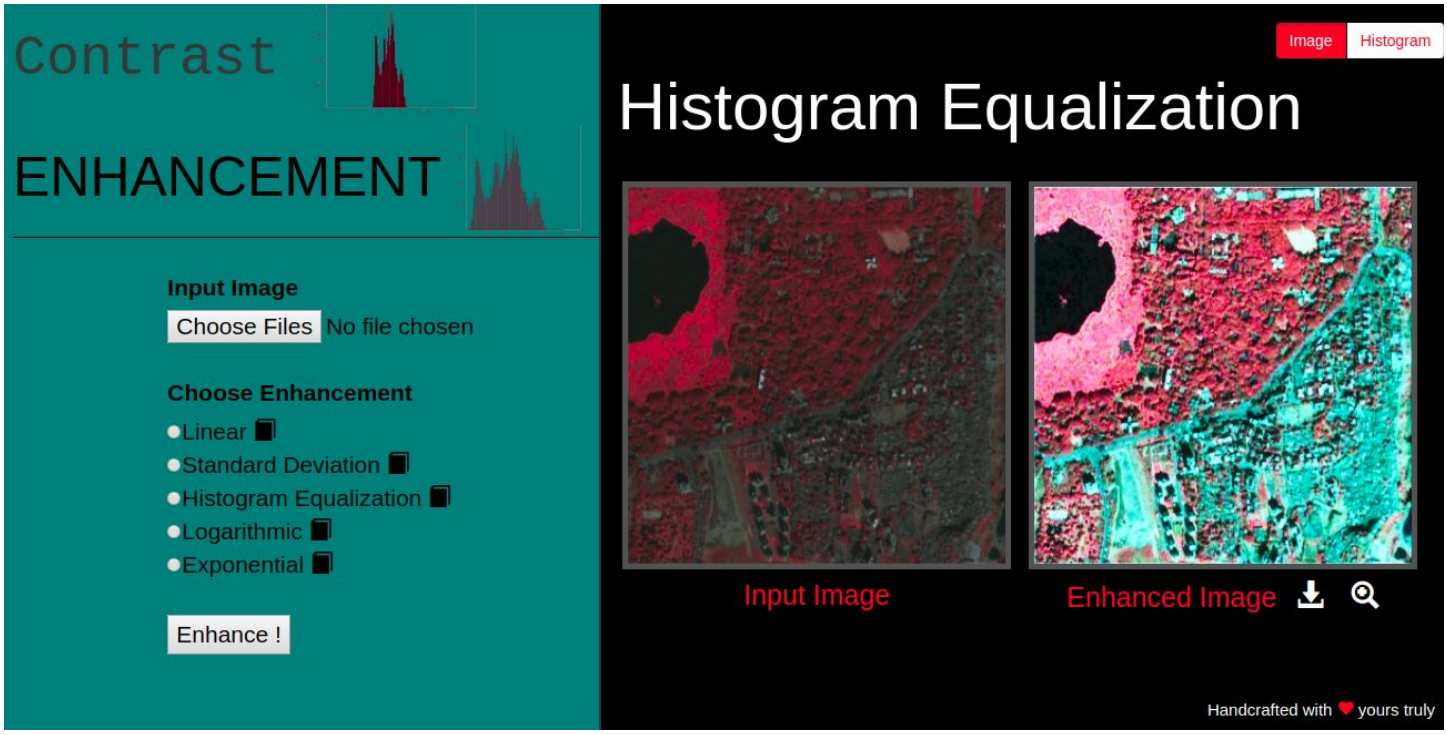
Standard Deviation : There is an option to input K-value

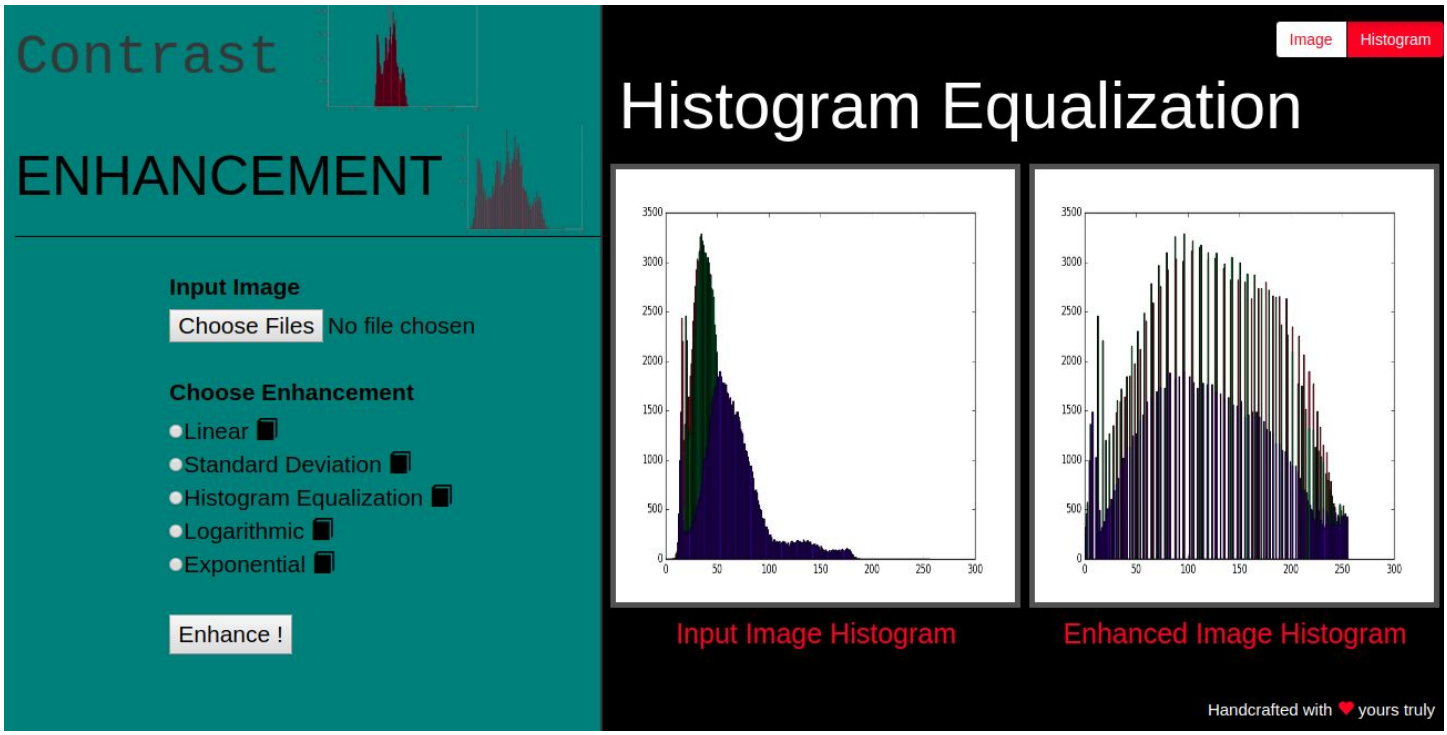


Enhanced Image can be seen in its full dimension, by clicking the zoom in icon placed below the enhanced image. And there is also an option to download the enhanced image, download icon is placed on the left side of zoom in icon.

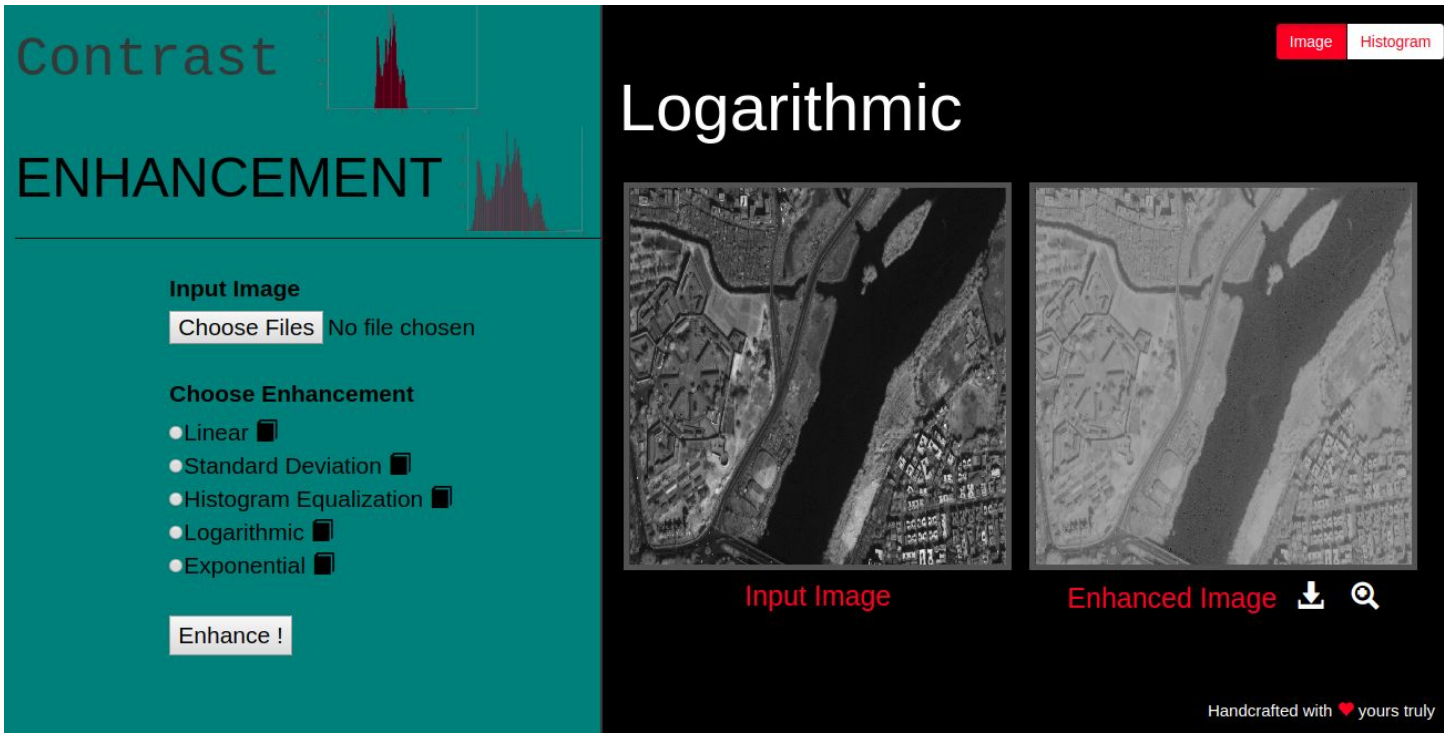


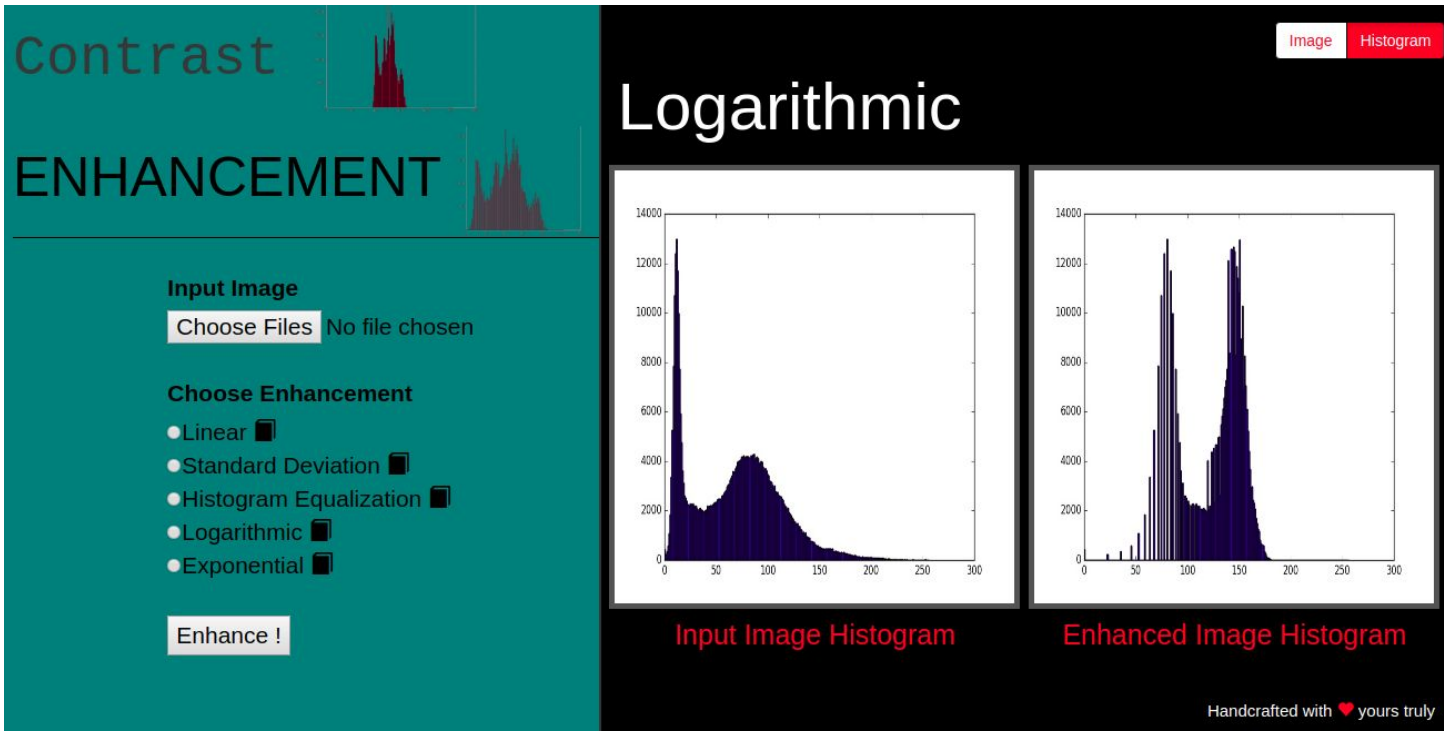
Histogram Equalization



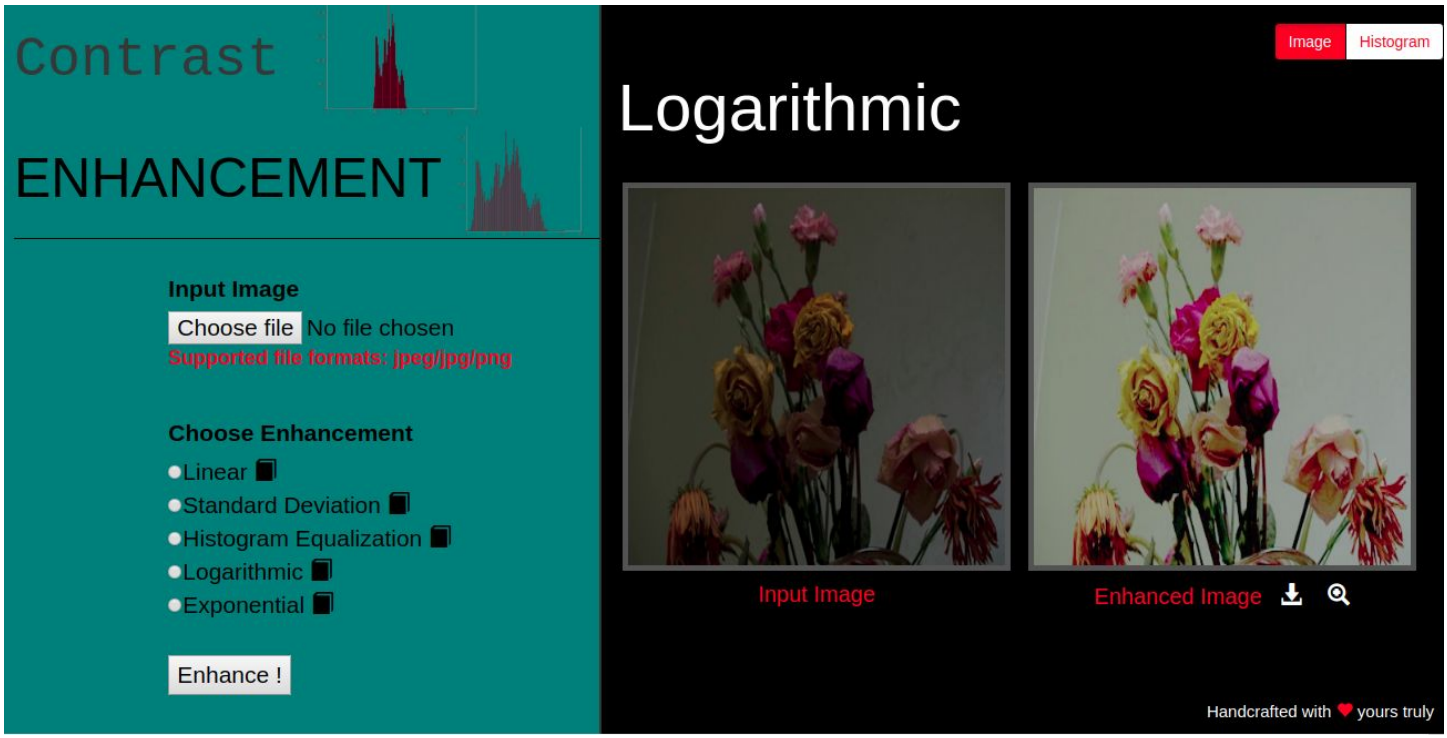


Logarithmic

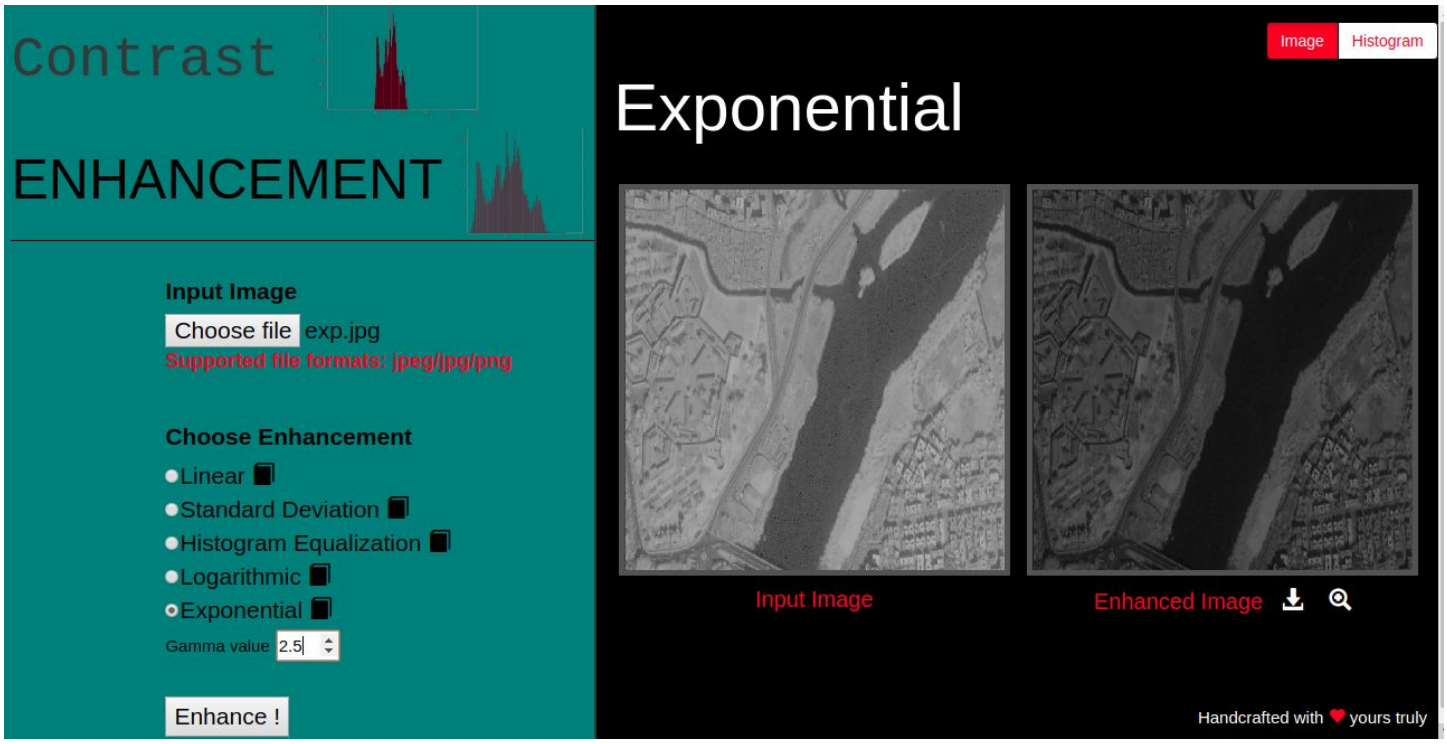


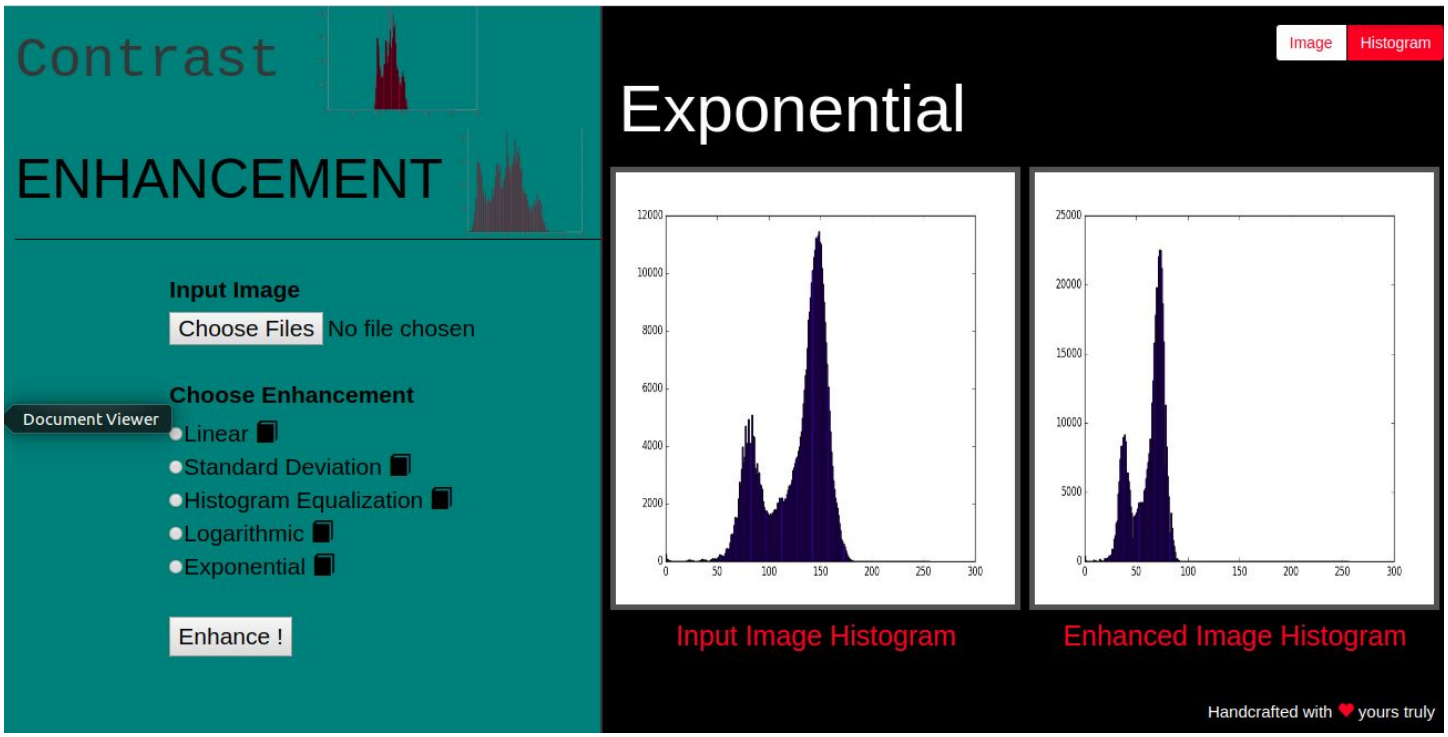


One more example of Logarithmic



Exponential





Summary

To summarize, in this project we have tried to show various linear and non-linear enhancement techniques on both RGB and Gray Scale images, Main focus was given on Commonly used images like satellite images,X-Ray images and normal images.

Future Scope:

As a future scope, we can add more features in this tool like

1) An optional feature to make comparative study of various enhancement techniques.

We made this project as a Web application with the vision of taking it online.As I found that not many Image processing tools are available online for Research Purpose or any other experimental usage. We can combine all the image processing techniques from the rest of the groups in this application and then we can host it on our CSRE server for people all over the internet.