COMP2005 Laboratory Sheet 2: Histograms

We will be using the Matplotlib library to create and display the histograms of the images. Matplotlib is a data visualisation and plotting library for Python which contains functions similar to the ones in MATLAB. Install the Matplotlib library and import it using *from matplotlib import pyplot as plt* as only the pyplot module is needed. This is the official documentation for the pyplot module https://matplotlib.org/stable/api/pyplot_summary.html.

1. Creating Histograms

Histograms are often used in image processing to visualise and provide valuable information on the pixel distributions and act as a tool to assist in performing various image processing techniques. Read an RGB image (You may use the Tulip.jpeg image from the Moodle page).

- Create and display a histogram for each colour channel in the image using *hist* (Hint: Use *ravel* from Matplotlib).
- Convert the image to HSV and display the histograms of the hue and saturation channels. What should the number of bins be?
- Convert the image to greyscale and view the effects of changing the number of bins in the histogram.

2. Histogram Equalisation

Histogram equalisation is a technique in image processing used to improve the contrast of an image. It is done by redistributing the pixels to achieve a uniform distribution of pixel values. Using the greyscale image:

- Create and display the histogram.
- Use *equalizeHist* to perform histogram equalisation and display the histogram of the result.
- Vary the gain, bias and gamma of the image and look at its effect on the image, histogram and the output of histogram equalisation.

3. Contrast Stretching

Contrast stretching is also a technique to improve the contrast of an image by linearly stretching the range of pixel intensity values to a specified range of values, which is usually [0, 255]. Using the greyscale image:

- Perform contrast stretching on the image and display the resulting image and histogram (Hint: Use *normalize* from OpenCV).
- Display and compare the three images and histograms (original, histogram equalisation, contrast stretching). What is the difference between histogram equalisation and contrast stretching?

4. Expected Results

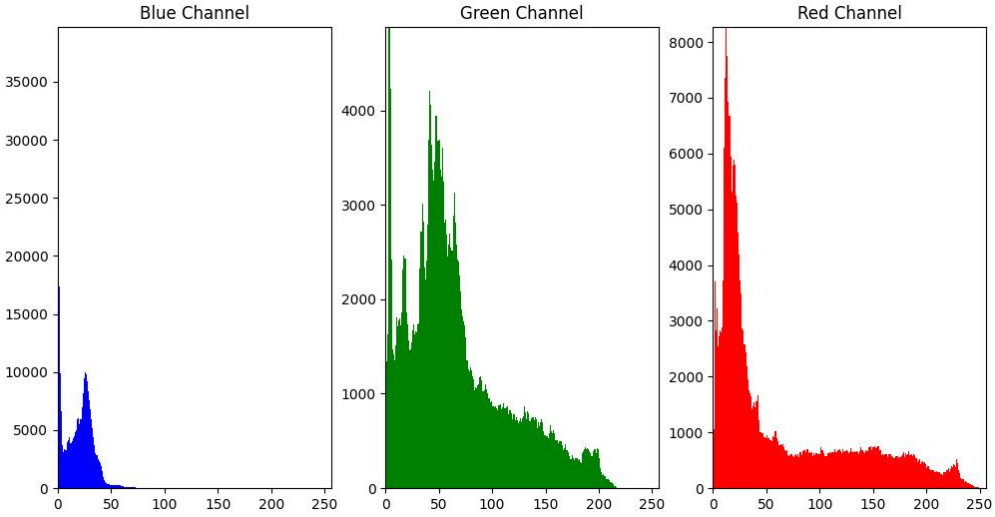

Figure 1: Histograms of RGB Image

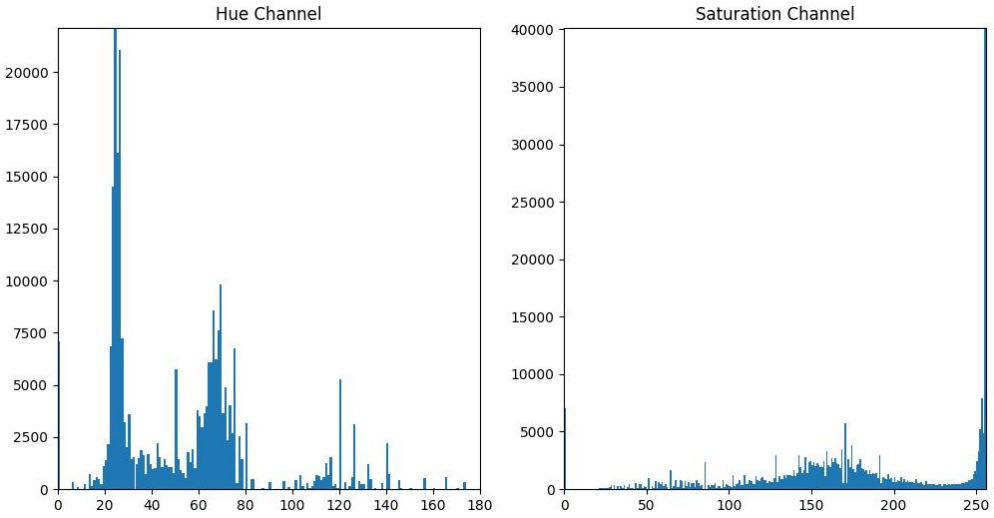

Figure 2: Histograms of HSV Image

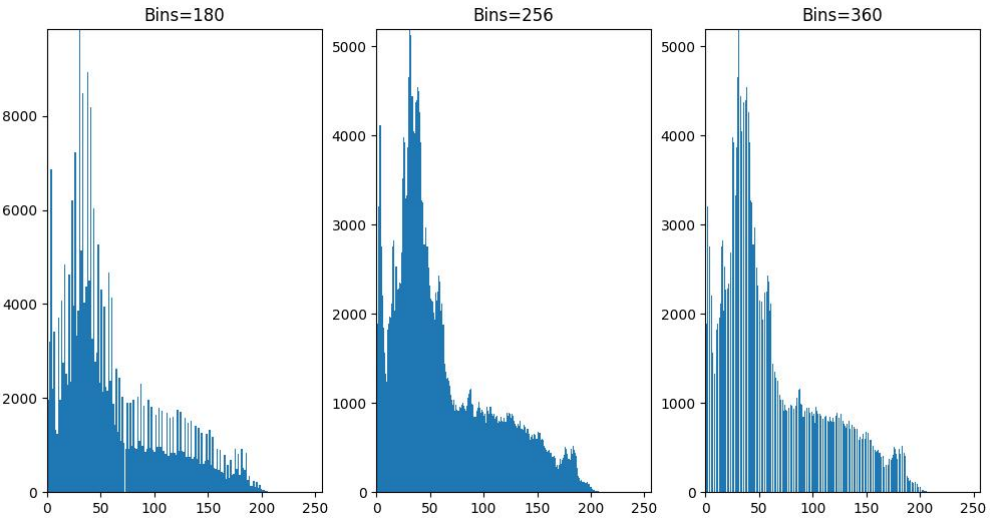

Figure 3: Changing the Number of Bins

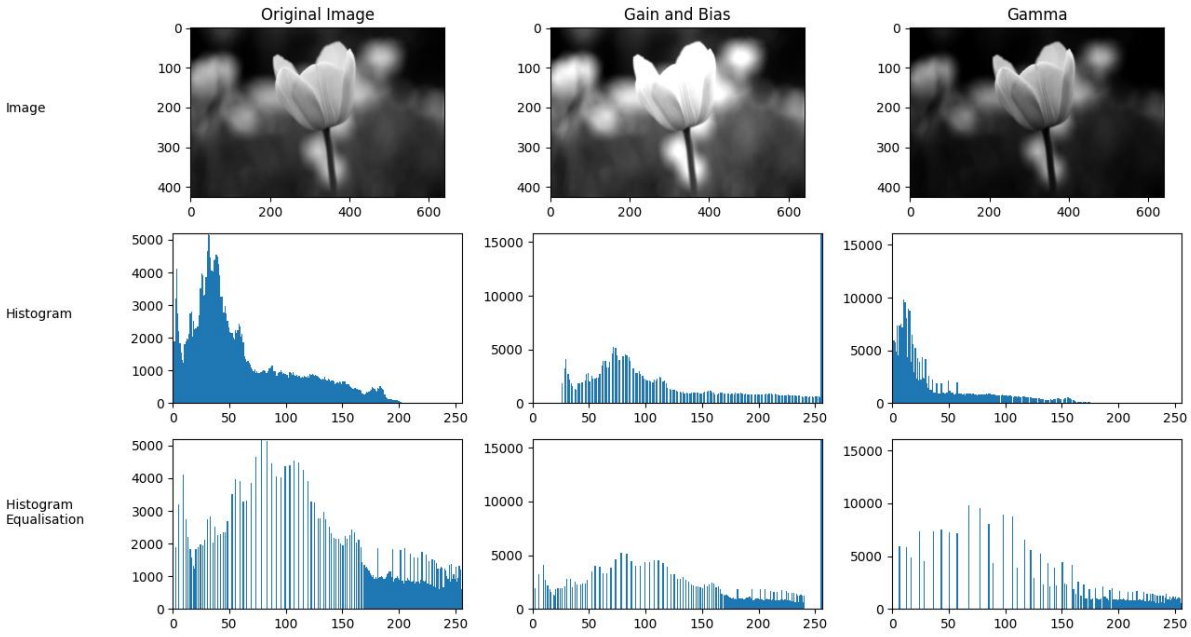

Figure 4: Varying Gain, Bias and Gamma

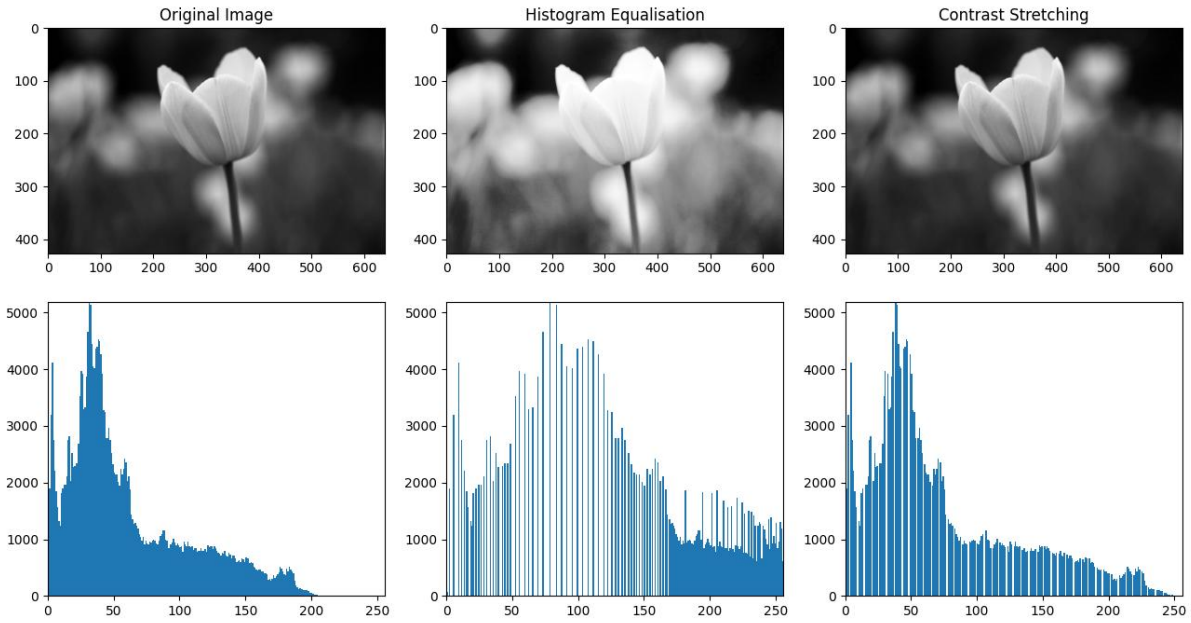

Figure 5: Histogram Equalisation vs Contrast Stretching