Project 1

You are asked to write three programs related to the manipulation of color in digital images.

These programs change the color of the image based on a histogram computed from a window in the image. The window is specified in terms of the normalized coordinates w_1, h_1, w_2, h_2, where the window upper left point is (w_1, h_1), and its lower right point is (w_2, h_2). For example, $w_1 = 0$, $h_1 = 0$, $w_2 = 1$, $h_2 = 1$ is the entire image, and $w_1 = 0.3$, $h_1 = 0.3$, $w_2 = 0.7$, $h_2 = 0.7$ is is window in the center of the image. The provided example program **proj1b.py** shows how to go over the pixels of this window.

First program

Write a program that gets as input a color image, performs linear scaling in the Luv domain, and writes the scaled image as output.

Pixel values outside the window should not be changed. Only pixels within the window should be changed.

The scaling in Luv should stretch only the luminance values. You are asked to apply linear scaling that would map the smallest L value **in the specified window** to 0, and the largest L value **in the specified window** to 100.

Second program

Write a program that gets as input a color image, performs histogram equalization in the Luv domain, and writes the scaled image as output. Histogram equalization in Luv is applied to the luminance values, as computed **in the specified window**. It requires a discretization step, where the real-valued L is discretized into 101 values.

As in the first program pixel values outside the window should not be changed. Only pixels within the window should be changed.

Third program

This is the same as the first program, except that the scaling is to be performed in the xyY domain. The scaling should stretch only the luminance (Y) values. In the specified window perform linear scaling that would map the smallest Y value to 0 and the largest Y value to 1.

Evaluation

We will test your programs on several images. These will include color image that should be "improved" by the scaling, and artificial image with very few pixels. The results of running your program on the artificial image will be printed and compared to the correct values.

1 What you need to submit

Submit a report and source code/files in machine readable form. Make sure that you are supplying all the files that your program uses.
Please notice that it is your responsibility to provide us with all the above information.
You must be present when your project is being evaluated.

1.1 Submitted material

- Source code for your program.

- Explanation of any decision that you have made, which is not a simple application of a formula. (For example, how do you handle division by 0 in your program, and other out of range values.)

- Describe the results that you obtain in applying your program. Can you find situations in which your program makes a picture look "bad"? Give an example of a such a picture.

1.1.1   Description of the files

- A description of the relevant files.

Testing your programs

We are going to run your programs and evaluate how they work. You must be present when your program is being evaluated.

Due Date: TBA