ECE-GY 6123 Image and Video Processing, Spring 2023
Computer Assignment 1: Color and Contrast Manipulations
Due 2/09/2023 at <u>11:59 PM</u>

Please submit your solutions, including Python code and outputs (when relevant), as <u>a single PDF</u> file to GradeScope.

In this assignment, you will get familiar with Python, some basic image-processing libraries, and perform fundamental image-processing tasks. It is recommended that you use,

- **NumPy**: for manipulating images as arrays.

- **Matplotlib**: for displaying images and plotting graphs.

- **OpenCV**: for loading images and converting between colorspaces.

You are <u>not</u> allowed to use specialized libraries for histogram equalization.

Problem 1 (Working with Images).

(a) Load an RGB color image and display the RGB image as well as the R, G, and B channels separately. Describe what you observe in each component.

(b) Convert the RGB image to the HSV colorspace and display the H, S, and V channels separately. Describe your observations.

(c) Detect blue pixels, defined by having a hue in range $[110, 130]$. Your detected pixels should be in the form of a binary mask. Use this mask to display only the blue pixels of your original image, with the non-blue pixels displayed as black.

Problem 2 (Contrast Enhancement).

(a) Load and display a low-contrast grayscale image.

(b) Calculate and plot the image's histogram. Comment on the relation between the image's contrast and its histogram.

(c) Recall, we derived in lecture that the cumulative distribution function (CDF) of the histogram is the theoretic optimal histogram-equalization transformation function. Plot the CDF of your histogram. Is this an appropriate equalization function? Why or why not?

(d) Apply the CDF as a transformation function to your image[1]. Display your transformed image and its histogram. Has your image's histogram been equalized? Comment on the your original image and histogram vs. the transformed image and histogram.

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[1]Hint: think about using python array indexing in a smart way.