ECE-GY 6123 Image and Video Processing, Spring 2021
Programming Assignment 1: Color and Contrast Manipulations
Due: 2/11/2021

In this assignment, you will learn or refresh your skills to use Python to perform some basic image processing operations.

You could use either Python or Jupyter Notebook to complete the assignment. You should refer to the Jupyter TEMPLATE provided for more specific tasks assigned.

If you use Jupyter Notebook, a template is provided for you and you need to complete the TO DO part. You should add your comment/observations within the Notebook. You should submit the following as two separate attachments:

1. A pdf version of the notebbok (that includes the results/figures and comments you have for any results)
2. A zip file including all following files named **your-last-name-CA01**
    - The python notebook as a *.ipynb* file with the name as **your-last-name-CA01**
    - The pdf version of the notebbok
    - Add all the saved images in a folder named *output-images*

If you use Python, save all the figures/plots needed to be displayed, and you should submit the following

1. A report in .pdf that includes the results/figures and comments you have for any results. Also, please add instructions on how to run your python code.
2. A zip file including all following files named **your-last-name-CA01**
    - The python scripts as *.py* files.
    - Anything else needed to run your python code
    - Add all the saved images in a folder named *output-images*

Part 1: Basic operations for image loading, color manipulation, and color detection

1. Load a color RGB image, Display the color image as well as individual color components, Red, Green, and Blue. Describe your observations of what each component characterizes.
2. Convert the RGB image to the HSV image. Display the individual components, hue, saturation and value. Describe your observations of what each component characterizes.
3. Detect pixels whose color is blue, which is defined as having a hue value in the range of [110, 130]. Your detection result should be represented by a binary mask image. You should also produce a color image that only keeps the detected blue pixels. You should display the mask image and the image containing blue pixels.

Part 2: Contrast enhancement

1. Find a low contrast gray scale image. An example image is provided for you. Load the image.
2. Calculate and display its histogram. Make observations of the relation of the histogram and its contrast.
3. Determine the transformation function that will equalize the histogram. Recall that this is the cumulative probability density function, which you can calculate from the original histogram. Plot the function and comment on whether this function is appropriate for enhancing the contrast of the image.

4. Apply the transformation function to the image and compute the histogram of the transformed image. Display the transformed image and its histogram. Compare the original image and histogram and the transformed image and its histogram.