CS631T – Spring 2019
Assignment 5 – Color Image Processing
Due Thursday, 04/04/2019
Submit electronically before 11:59pm on Blackboard
Total Points: 25 points

General Assignment Instructions: Save all solutions in a **single** m-file. Be sure to place semicolons wherever appropriate, to suppress unnecessary console output, such as when loading images into memory, or operating on them. **You should submit only your m-file via the BB system. Please do not send any image**!

Please include comments at the top of each m-file. The comments should contain at least the following: **your name, your contact email, and assignment number**. **In your main function, place a message "-----Finish Solving Problem X-----" followed by a pause command (i.e., wait for a key to be pressed before continuing) at the end of each solution, where X is the question number (i.e., 1, 2, or 3).**

Problems:

1. Color Image Processing **[25 points]**

The task here is to help a robot to identify a bright orange ball in its surrounding. The *ball.bmp* is an image obtained from a camera mounted on the robot.

   a) Implement a **Myrgb2hsi** function to convert red-green-blue (RGB) colors to hue-saturation-intensity (HSI). The formula for such a conversion can be found on lecture 3 PPT slides. The function prototype should be:

   function [H, S, I] = Myrgb2hsi(Im)

   where Im is the original color image, and H, S, and I are the normalized hue value, saturation-value, and intensity value in the HSI color space, respectively. That is, H, S, and I should be in the range of [0, 1]. **[5 points]**

   Load and convert *ball.bmp* to HSI color space by calling the **Myrgb2hsi** function. Display the three images side-by-side on figure 1 with the appropriate title for each subplot. Call an appropriate Matlab function to do the similar conversion and display the three images (i.e., Hue, Saturation, and Intensity) side-by-side on figure 2 with the appropriate title for each subplot. Display the difference images between your results and the Matlab's results side-by-side on figure 3 with the appropriate title for each subplot. Use display command to explain the reason for these differences and the visual differences between your results and the Matlab's results. **[3 points]**

   b) Find the edges of the image *ball.bmp* using the Sobel, Prewitt, Roberts, Laplacian of Gaussian, and Canny (we have not explain the details of Canny yet but you do not need to know the detail for solving this problem) methods on the **Value (i.e., Intensity) image** obtained from calling the Matlab function, which converts the RGB color images to HSV images. Display the edges obtained from these four methods on figure 4 with the appropriate title for each subplot. Use display command to explain which methods give you good results. In general, how can you tell which edge detector will be appropriate for the specific application? **[5 points]**

c) In H-space, find a threshold for the ball (i.e., separate the ball from the background). Find the centroid of the ball and indicate its location by a cross on the original color image. **[12 points]**