Homework #1

CSCI 381/780 Image Processing

Queens College

Department of Computer Science

Due Date: March 31st

1. Write a program in Python to compute the histogram of a color image. Plot the histograms of each band (Read, Green, and Blue) as well as the gray level intensity image resulting of averaging the color bands. Use OpenCV, numpy, and Matplot to load, process, and visualize the information (**Note: do not use any predefined function like cv2.calcHist() or np.histogram()**) . Capture two images (one underexposed, and one overexposed) using your cell phone or digital camera from the same scene. Use the developed program to plot the histograms from the captured images. Describe briefly the differences in the histograms.
2. Capture an image with a uniform background, then put an object on the scene and capture a second image of the scene. Create a program to generate a binary image that identifies the object from the background--the pixels belonging to the object will take values of one and the pixels from background will take values of zero respectively. To do this, use the subtraction operator and a threshold to identify the differences between the first image and the second image that contains the object of interest. Test different values for the threshold until obtaining the best results. Quantify the number of pixels that belong to the object of interest. Visualize histograms and the binary image. Describe briefly the obtained results.
3. Develop a script in Python to generate an image in false color using the hyperspectral image "TIPJUL1.LAN"—which is composed of 12 bands; the 4th band corresponds to the infrared region, and the 3th and 2nd bands represent the visible red and green regions respectively. For the false color image, use the following combination of bands:
   Red color: band 4
   Green color: band 3
   Blue color: band 2
   (Note: the resulting image should show vegetation in red color).
   Finally, generate the NDVI image from the hyperspectral image (Normalize first each of the bands to have values from 0 to 1), and a binary image to show the location of vegetation. The binary image takes values of one where NDVI>0. Report all generated images.
4. Create from the Lidar point cloud "17258975.las" its corresponding raster. The resolution of the Lidar data is 2ppm, and the units of Longitude, Latitude, and altitude are in meters. Use 8 m for the length of each cell in the raster. The data is composed of a set of buildings. Applying logical operators, use a binary image to select one building from the raster (masking). Finally, develop an algorithm to calculate the area and altitude of the selected building.

Submit a document with all your results, comments, and code.