Date: 05-11-2021   Assignment # 01

Subject: Digital Image Processing

Total Marks: 100

Note: Submit your assignment (**Python code**) online on Slate. A zero grade will be given if your assignment is found copied. Oral interview is mandatory; I will randomly call you all for an **oral interview** to validate your effort. **Deadline** for submission is **16:00 PKT, Monday 15th November 2021**.

Question # 01:

Develop a **Python** program that lets its user to input a **grayscale/color image** and displays the input image as well as its size. In case of color image convert it to grayscale for performing operations. The developed program should provide functions to perform each of the following basic operations:

1. A function to display the input image size, its dimensions, signal to noise ratio, and bit depth.

2. A function to calculate the **entropy** of the input image.

3. The program should provide a function to flip the image vertically. Using this function on an example image i.e., image Moon.bmp should give you results as shown below:

4. A function to multiple two images assuming one of the image is a shading pattern. Normalize the output after multiplication.

5. The program should also provide a function to generate the negative of an image. This means that a new image is created in which the pixel values are all equal to 1.0 minus the pixel value in the original image.

6. A function with parameter image and plane number to view the bit planes (depending on bit depth) of the input image. You must implement step function to extract the relevant bit planes.

7. A function to display the **contrast value (use average pixel difference definition)** of the image. Use appropriate formula to calculate contrast value.

8. A function to **calculate and display** the average intensity value of the pixels (**having shades between 50-200**; don't average all the shades) in the image e.g., Moon.bmp and then **thresholds this image** using the average intensity value. Thresholding means that a new image is generated in which each pixel has intensity 1.0 if the corresponding pixel in the original image has a value above the threshold and 0 otherwise.

   Hint: To calculate the average intensity of the pixels in an image simply iterate through every pixel in the image, summing all of their values and finally divide this sum by the total number of pixels. This program should have the following effect on Moon.bmp:
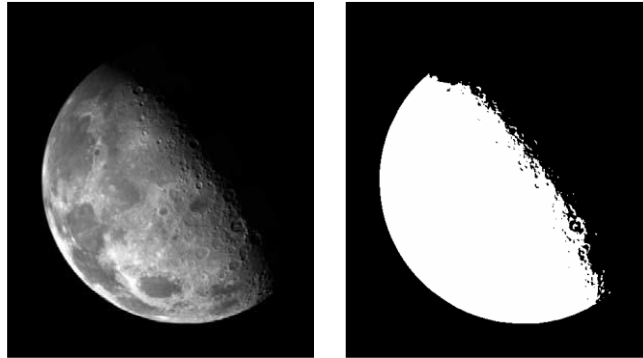
9. A function to perform the Log transformation on **odd column pixels (only)** of the input image.

10. A function to perform the **power law transformation (for value of gamma given as input).**

11. A function to perform the **contrast stretching** (given the stretching points from the range of input image's intensity values) transformation.

12. The program should also provide a **save function** to save the changed image after each operation.

Note:

You may use the opencv library but for thorough understanding, you are encouraged not to use the library functions.

For testing your program use Chapter 03 images of your textbook. Images are freely available online and can be downloaded from the following link:

Link: http://www.imageprocessingplace.com/root_files_V3/students/students.htm

<center>**xxx------- Good Luck! -------xxx**</center>