Lab 1 - Image Processing EEE412

Objectives:

1- Introducing the image processing capabilities of Matlab and its Image Processing Toolbox.
2- Learn to read and display different images.
3- Learn basic image processing steps.

Matlab functions:

Check the following *Matlab* functions :

help, imread, size, whos, uint8, image, colormap, truesize, imwrite, ginput, imwrite, imnoise, imresize

Hint: read the help about each of the previous functions and any other function you might use. Some Matlab functions have a section describing the *Algorithm(s)* they use, it is worth reading this section.

Tasks:

1. Task: (**20'**)

   Download from ICE the image *lenna512color.bmp* and save it as a file on your PC as lenna512Color.bmp. Use the functions *imread* to load the image Lenna512Color.bmp into Matlab.

   (1) Display the image with the function *image*, and shows three images of RGB components.
   (2) Change the color space into HSI, and show three images of HSI components.
   (3) Change this image into gray level, and show the gray image.
   (4) Change this image into binary level, and show the binary image.
   (5) Describing your founding from the above tasks by comparing different shown images?

2. Task (**10')**
   Write a function to measure the Peak Signal to Noise Ratio (*PSNR*) between two gray images in *dB*. For the peak value use 255.

$$PSNR(dB) = 10log_{10}(\frac{255\text{^}2}{mse})$$

   Where *mse* is the mean square error, and it is evaluated as:

$$mse = \frac{1}{N}\sum_{\forall ri}\sum_{\forall ci}\big(im(ri,ci) - im_2(ri,ci)\big)^2$$

3. Task: (**50'**)

In this task, we use the monochrome image *Lenna* (i.e., lenna512.bmp in ICE) to do the following sub tasks, and let's call the original image Lenna as I_0.

(a) I_0 -> down-sampling to I_1 with 1/2 size of I_0 (both horizontally and vertically) using mean value (**programing it by yourself**). Display it and explain your founding in the report; (**10**')
(b) I_1-> up-sampling to I_1' with the same size of I_0 using nearest neighbor interpolation (**programing it by yourself**). Display it and compare to the original image. Explain your founding in the report. (**10'**)
(c) Repeat the (b) with bilinear interpolation and bicubic interpolation (you can use Matlab function directly), respectively. (**10'**)
(d) Calculate the psnr between the original image I_0 and the up-sampled images, i.e., nearest, bilinear, and bicubic, respectively. Compare the results of different interpolation methods. Explain your founding in the report. (**20'**)

4. Task (**20**')
   The original image of Lenna (i.e., lenna512.bmp) uses 8 bits to represent the intensity levels, so it has 256 gray levels. Write a script to reduce it to 16 values by quantization. Display the quantized image, and describe the effect of severe quantization on images.

Lab Report

Write a **short** report which should contain a **concise description** of your results and observations. **Include** listings of the **Matlab scripts** that you have written. **Describe each of the images** that you were asked to display.

Submit the report electronically and a hardcopy version into the white collecting box beside the office EB310 (Hand written reports are not accepted) **before 2019-10-11**.

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