

## Lab 1 - Image Processing EEE412

Report is due to 29<sup>th</sup> Sep

### 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.
- 4- How to fold an image?
- 5- How to crop an image?
- 6- Down-sampling of images
- 7- Up-sampling of images
- 8- Image quantization

### Matlab functions:

Check the following *Matlab* functions :

*help, imread, size, whos, uint8, image, colormap, truesize, imwrite, datacursormode, 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: (30')

Download from ICE the monochrome image *Lenna* and save it as a file on your PC as *lenna512.bmp*.

Use the functions *imread* to load the image *Lenna512.bmp* into Matlab. Display the image with the function *image*, set the color-map with the function *colormap*, and set the image display size with *truesize*. Explain what happens to the displayed image if the color-map is changed to *cool(256)*, *hot(255)*, *gray (128)*, and *gray(64)*. (20')

Write a program to modify the color-map to display the image as a negative (i.e., invert the grayscale assignment). Explain your program and include it in your report. (10')

## 2. Task: (70')

In this task use the monochrome image *Lenna* to do the following:

- (1) Crop the face of the image *Lenna* (roughly as the one shown in the following) and display it (hint: you may use the command *datacursormode on* to get some useful information). (10')



- (2) Let's call the original image Lenna as  $I_0$ , please do the following sub-tasks of down-sampling and up-sampling:
  - (a)  $I_0 \rightarrow$  down-sampling to  $I_1$  with 1/2 size of  $I_0$  (both horizontally and vertically) using nearest neighbor interpolation. Display it and explain your founding in the report; (10')
  - (b)  $I_1 \rightarrow$  up-sampling to  $I_1'$  with the same size of  $I_0$  using nearest neighbor interpolation. Display it and compare to the original image. Explain your founding in the report. (10')
  - (c) Repeat the (a) and (b) with bilinear interpolation (optional: bicubic interpolation instead of nearest neighbor interpolation). (10')
  - (d) Calculate the psnr between the original image  $I_0$  and the up-sampling images, respectively, and compare the results of different interpolation methods. Explain your founding in the report. (10')
- (3) The original image of Lenna 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. (20')

## 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).

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