Computer Engineering Department
Faculty of Engineering, Mahidol University

**LAB03: Image Enhancement in the Spatial Domain (part2)**

**Objectives**

Upon completion of this lab, you will be able to:

1. Understand the gray-level transformations**.**
2. Write an user-defined function in MATLAB for the gray-level transformations, including histogram equalization and image averaging.

**Exercises**

Note that you should create your own function in MATLAB as MATLAB User-defined function. It means that you cannot call MATLAB built-in function, which generates output in the same manner as your own function. You can use the images provided in the folder \Google Drive\EGCO486_60-1\LABs\LAB03_Part2 for your exercises.

1) Image enhancement in spatial domain using contrast stretching

1.1 Write a user-defined function in MATLAB for increasing the dynamic range of the gray-levels in the original image, with the following function name: Myhisteq.m. When this program is used with two images "Dark256.tif" and **"**Low-contrast256.tif", the results as shown in Figure 1 and 2, respectively.

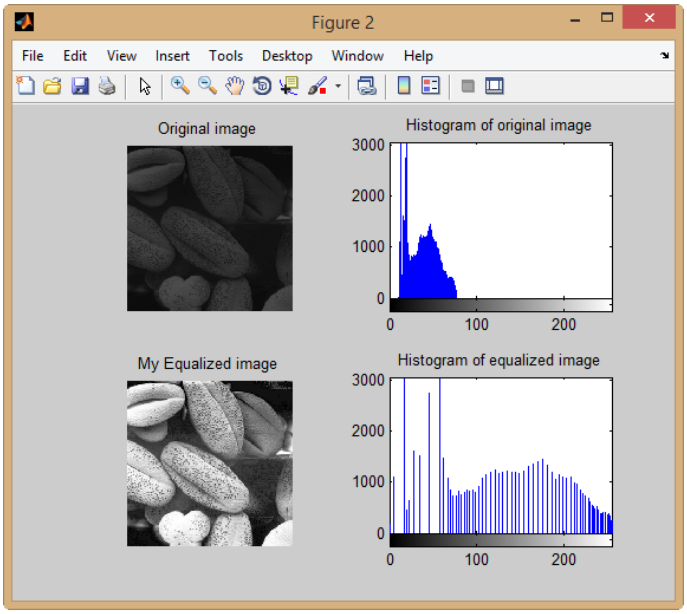


Figure 1: For case the dark image, the result image of applying the histogram equalization.

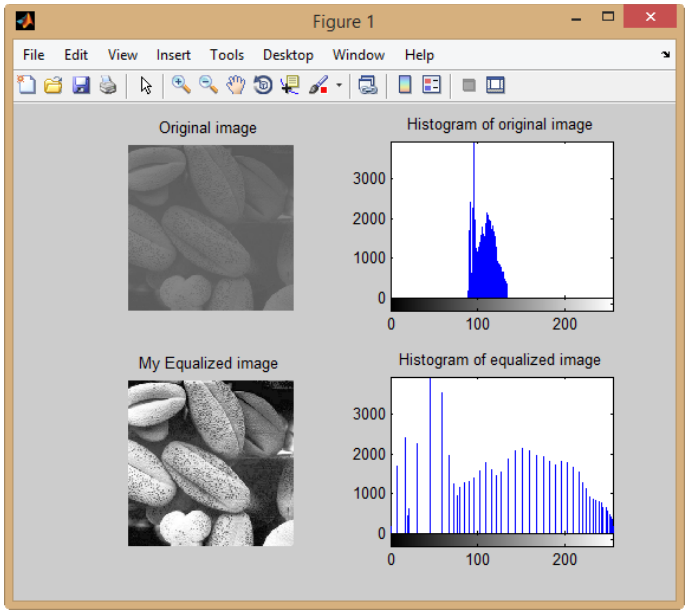


Figure 2: For case the low-contrast image, the result image of applying the histogram equalization.

2) Image enhancement in spatial domain using image averaging

2.1 Write a user-defined function in MATLAB for noise removal by averaging multiple images, with the following function name: Myimaver.m. For image averaging method, you should firstly compute the averaging of 16 noisy images to obtain the averaged image (The sum of noisy images and then dividing it with the number of noisy images). Next, you can be used the noise model equation to find the noised image (The difference of first image and the

averaged image). When this program is used with 16 noisy images “p1.bmp”, “p2.bmp”, …, and “p16.bmp” the results as shown in Figure 3.

- Noise model is defined as:

$$n(i, j) = p(i, j) - \bar{p}(i, j)$$

where $n$ is a noise model

$p$ is the first image

$p$ is the averaging of different noisy images

- Mean of noise is defined as :

$$\bar{n} = \frac{1}{MN}\left(\sum_{i=0}^{N-1}\sum_{j=0}^{M-1} n(i, j)\right)$$

where

$\bar{n}$ is a mean of noise value in the noised image

$MN$ is a size of image

- Standard deviation of noise is defined as :

$$\sigma = \sqrt{\frac{1}{MN}\left(\sum_{i=0}^{N-1}\sum_{j=0}^{M-1}\left(n(i, j) - \bar{n}\right)^2\right)}$$

where

$\sigma$ is the standard deviation of noise value in the noised image

For the first plot image on Figure 3, you can choose either one image from 16 noisy images to show as input image. Example for the first plot image, I have used the first image “p1.bmp”.

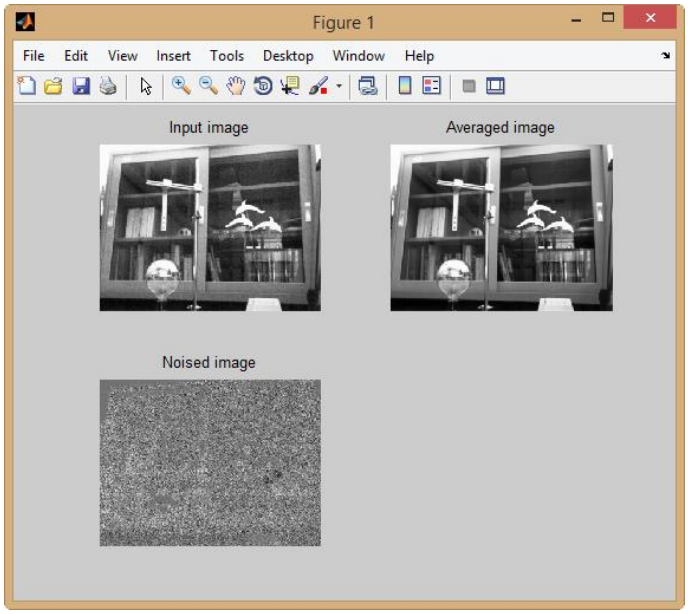


Figure 3: The result image of removing noise to obtain the smoothed image.

**What you need to submit:**

Prepare a zip file that contains all matlab files (m-file extension). Email the zip file to the account **send2narit@hotmail.com** with the following subject line: **EGCO486_LABxx_yyy**, which xx is a number of LAB and yyy is the last 3 digits of the student identification number. Your email should reach us before Tuesday 11:59 PM.