

ECE1512 – Homework 1: Wednesday, September 23, 2015

Part A: Image Enhancement Using Intensity Transformations

The focus of this project is to experiment with intensity transformations to enhance an image.

Download Fig. 3.8(a) from the book web site and enhance it using

- (1) The log transformation of Eq. (3.2-2).
- (2) A power-law transformation of the form shown in Eq. (3.2-3).

In (1) the only free parameter is c , but in (2) there are two parameters, c and r for which values have to be selected. As in most enhancement tasks, experimentation is a must. The objective of this project is to obtain the best visual enhancement possible with the methods in (1) and (2). Once (according to your judgment) you have the best visual result for each transformation, explain the reasons for the major differences between them.

Image Database Link: http://www.imageprocessingplace.com/DIP-3E/dip3e_book_images_downloads.htm

Part B: Histogram Equalization

- (1) Write a computer program for computing the histogram of an image.
- (2) Implement the histogram equalization technique discussed in Section 3.3.1.
- (3) Download Fig. 3.8(a) from the book web site and perform histogram equalization on it.

As a minimum, your report should include the original image, a plot of its histogram, a plot of the histogram-equalization transformation function, the enhanced image, and a plot of its histogram. Use this information to explain why the resulting image was enhanced as it was.

Required Format for Submitting Homework Reports

Homework reports be kept short, and be organized in a uniform manner to simplify grading. The following format achieves these objectives.

Page 1. Cover Page. Typed:

- Homework title
- Course number
- Student's name
- Student ID
- Date due
- Date handed in

Page 2. Technical discussion. One to two pages (max). This section should include the techniques used and the principal equations (if any) implemented.

Page 3 (or 4). Discussion of results. One to two pages (max). A discussion of results should include major findings in terms of the project objectives, and make clear reference to any images generated.

- **Results.** Includes all the images generated in the project. Number images individually so they can be referenced in the preceding discussions.
- **Appendix.** Program listings. Includes listings of all programs written by the student. Standard routines and other material obtained from other sources should be acknowledged by name, but their listings should not be included.

Layout. The entire report must be in standard sheet size format (8.5 x 11 inches in the U.S.)

Alternatively, the report should be submitted as PDF email attachment, using the following subject line:

ECE1512_HOMEWORKTITLE-by-STUDENTNAME

A note on program implementation

As per your textbook recommendation, the objective of the computer programs used here is to teach the student how to manipulate images. There are numerous packages that perform some of the functions required to implement the projects. However, the use of "canned" routines as the only method to implement an entire project is discouraged. For example, if the students are using MATLAB and the Image Processing Toolbox, a balanced approach is to use MATLAB's programming environment to write M functions to implement the projects, using some of MATLAB's own functions in the process. A good example is the implementation of the 2-D Fourier Fast Transform. The student should use the MATLAB function that computes the 2-D FFT directly, but write functions for operations such as centering the transform, multiplying it by a filter function, and obtaining the spectrum.