Final Exam

CS 4499, Topics in Applied Image Processing

Due: December 19, 2013 (5 p.m.)

Problem 1 (35 points)

Objective: Understanding the techniques and basic properties of histogram equalization.

Show, by hand derivation or using software, e.g. MATLAB, that a second, third or fourth consecutive application of histogram equalization to an image will NOT produce any significant change in the output histogram (and therefore, the output image).
Problem 2 (35 points)

Objective: Comparison between spatial-domain and frequency-domain filtering for an input image.

Perform and answer the following 3 items:

(a) Design a spatial-domain median filter whose output is the median of the eight neighbors of the center pixel, using a 3x3 neighborhood.

(b) Now, use the MATLAB function `freqz2`, or an equivalent method, to obtain the frequency-domain equivalent of the median filter designed in (a). Plot the resulting filter by hand or using MATLAB.

(c) Apply the two filters, one at a time, to an input image that contains the famous “salt and pepper” noise. Compare the results (i.e. the output images) from these two filters by explaining differences or similarities between the results.
Problem 3 (30 points)

Objective: Packaging the portfolio of your software code developed for this course.

Throughout this course, including this Final Exam, you have developed several scripts and programs for applied image processing. As a good practice in software engineering, this Problem requests that you:

(a) Develop a menu driven user interface, either text-based or GUI, that lets a user select a specific program that you developed for a specific processing method. This interface should be as user-friendly as possible.

(b) Document, e.g. by comments and stubs, places in your software where future extensions or new features can be added. This is intended not just for users but also for future developers maintaining your software.

The entry point for your packaged software portfolio should be simple. For instance, a user may enter “CS4499Menu” within MATLAB, or at the command line to invoke your user menu and interface. The user should also have the flexibility of inputting the image(s) for his choice of processing method(s).