BME42-731/ECE18-795 Project Assignment #1

Essential characterization of a light microscope

Assigned on Jan-31-2011,
Due on Feb-28-2011 in class or by 5PM at instructor's office

A. Overview

This project is intended to demonstrate steps required for characterizing several essential aspects of the performance of a light microscope, including background noise, illumination uniformity, and pixel-size.

The total score for this project is 80 points. You will also get 10 extra credit points if you successfully complete question B.4.2.

B. Instructions

B.1 Download the image data

Image files for this project are stored under the CMU Blackboard webpage for this course. After logging into the blackboard page for this course, click on "Assignments". You should see a folder named "Project Assignment 01". The files (as a compressed package) are stored under this folder.

B.2 Characterizing fluorescence image background noise (30 points)

- Write a program that first crops a rectangular region from the background of the image series and saved the cropped region into a series of images that are named sequentially (such as background001.tif, background002.tif, …). Be sure to turn off compression when saving the images. (10 points).

- Based on the cropped background noise data, apply signal processing and statistical analysis tools to address the following three questions (20 points)

> B.2.1 What distribution does the noise signal follow? Is it a normal distribution? Is the noise white? Why? (10 points)
> B.2.2 Does the noise distribution change over time?
> B.2.3 Does the noise distribution change over space?

B.3 Characterizing illumination uniformity (20 points)

Invent and implement you own quantitative descriptors to characterize the uniformity of illumination.

B.4 Microscope pixel calibration (30 points)

We are using a micrometer slide purchased from TedPella for calibration. Detailed specifications can be found at

http://www.tedpella.com/histo_html/2280-10.htm

The slide that we are using is No. 2280-16.

B.4.1 Design and implement a manual/interactive approach to calibrate pixel size (30 points).

B.4.2 Design and implement a semi-automated or an automated method to calibrate pixel size **(extra credit: 10 points)**.

C. Report format

There is no page limit to the report.

Page size: letter
Line space: single
Page margins: no less than 1 inch
Font size: 12 points for the main text; 10 points for listed references

D. Submission of MATLAB codes

This course has its registry in CMU Blackboard (http://www.cmu.edu/blackboard/). We will use the "Digital Dropbox" tool for submission of MATLAB codes.