BME 42-731 / ECE 18-795 Project Assignment #1

Essential characterization of a light microscope

Assigned on Jan-20-2010,
Due on Feb-17-2010 in class

A. Overview

The goal of this project is to demonstrate the 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 is 80 points. You may also get 10 points of extra credit if you complete question B.4.2.

B. Instructions

B.1 Download the image data using the following link

http://ccdl.compbio.cmu.edu/BME42_731/project1_images.zip

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)

Define 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.