Computer Exercise: Multivariate Analysis applied to Multispectral Microscopy Data

In this computer exercise you will work with a data set taken with a multispectral microscope of malaria infected blood smears. The purpose is to get an understanding of the combined spectral and spatial information contained in the images, how they were acquired and what sort of analysis can be done.

The files needed for the lab can be downloaded from:

https://www.dropbox.com/sh/dg0yjpwr5w24r94/t1JI5cqUk6

The lab will be conducted as a group where the instructor will give some explanation with slides before each segment so only work on the different parts when instructed to.

Part 1: True- & False-color representation

- Open CompEx.mat (containing normalized images for all modes of malaria sample)
- Practice showing the images with imshow.
  - Imshow with individual spectral bands
  - Imshow with combined spectral bands
    - True color
    - False color
  - Constructing images between angular modes

(commands: ‘imshow.m’, ‘plot.m’)

Part 2: Extracting Spectra from individual blood cells

- Use spectra1.m, spectra2.m
  - Spectra1.m finds the spectra from a single pixel wherever the user clicks
  - Spectra2.m compares two regions of pixels to eachother
- Play with program extracting spectra from pixel or region.
- Compare spectra between two pixels

(commands: ‘imshow.m’, ‘plot.m’)
Part 3: Singular Value Decomposition

- Run spectra3.m (prepares data for svd)
- Run SVD command with data (AllSpectra)
- Look and discuss U, S, and V
- Use semilogy.m and look at eigenvalues. Discuss truncation and noise level
- Use Spectra4.m, understand what is happening.
- Plot the data in the new coordinate system using plot3.m

(commands: ‘svd.m’, ‘semilogy.m’, ‘plot3.m’)

Part 4: Hierarchical Clustering

- Use Spectra5.m and understand the results
- Change truncation and see effects
- Plot clusters in original image.

(commands : ‘pdist.m’, ‘linkage.m’, ’dendrogram.m’)

The data you have worked with can be found in an open-source article at:

http://biomedicaloptics.spiedigitallibrary.org/article.aspx?doi=10.1117/1.JBO.18.3.036002

“Staining-free malaria diagnostics by multispectral and multimodality light-emitting-diode microscopy”

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