Assignment #2 [15tpts]

Segmentation of individual cells or nuclei is an important and challenging job for biomedical image analysis. Analysis of cell morphology (shape, structure, color, texture), cell distribution, cell motility and behavior, or cell-to-cell interactions, *ALL* heavily rely on identification of individual cells. For this assignment we will explore different steps involved in segmentation of individual cells, nuclei, or particles.

The goals of this assignment are to understand:
   (i)   **A basic cell/nuclei/particle segmentation pipeline;**
   (ii)   **Clustering-based segmentation (K-means method);**
   (iii) Active contours based segmentation (Level sets method);
   LATER: Segmentation of overlapping/touching cells.

Assignment: Implement the following tasks and report the results for each of the given test images.

Task-I Preprocessing (5pts): Use Linear (i.e. Gaussian) or non-linear (i.e. median, morphological) filtering to smooth the input images and to remove noise.

Task-2a Cell/nuclei segmentation using K-means (10pts):

   a) Segment the nuclei from the background using k-means clustering method (use Matlab function kmeans).

   b) Use two different feature sets, show and discuss your results.

   Note 1: As feature vector (input to kmeans) you can use: intensity, color, or any other feature you think is useful.

   Note 2: Matlab kmeans(X,k) function partitions an [n-by-p] input data into k clusters. Here n is the number of data points and p is the length of the feature vector. In order to use Matlab kmeans function on image data you will have to reshape your [rows-by-cols-by-channels] image matrix into [n-by-p] input format, and you will also have to reshape the [n-by-1] output into [rows-by-cols] image format. For this purpose you can use Matlab reshape function.

Required Output:
For each of the test images listed above, show
   1. **Original image**,

2. **Pre-processed image** (Task-1),
3. Output of **K-means clustering**: This will be a multi-class output (Task-2)

Submission instructions:
1. You should submit an electronic version from Canvas.
2. You should show results for all the test images.
3. Your submission should include a report (including output images & your <u>interpretation</u> of the outputs) and associated programs.

References:
[1] Slides for Lectures 7 and 8 : Clustering-based segmentation.