Computer and Biological Vision
ECSE-529

Assignment #1 **Due date: September 19, 2016**

SEGMENTATION OF COLOR IMAGES USING HISTOGRAM THRESHOLDING

1. Find a program on the Internet that implements the method of Otsu and use it to compute the segmentation threshold(s) for the 400x293 B/W image of Lena stasjon. Show the resulting binary-segmented image by coloring the foreground red and the background green.

Reference: N. Otsu, A Threshold Selection Method from Gray Level Histograms, IEEE Trans. on Systems, Man, and Cybernetics, vol. SMC-9, no. 1, Jan. 1979, pp. 62-66.

2. As an improvement to Otsu's method, the search range for the optimal threshold can be modified using the method of Rosen. In image segmentation, specific algorithms can be designed according to the prior knowledge of the background to enhance the quality of the segmentation.

First an optimal threshold is calculated using Otsu's Method. Suppose that we know that the difference of the variance of the object and background is significant, and that the object is darker and its variance is larger. Then, the Otsu threshold value will bias toward the object. Therefore, we can search within a limited range for the optimal threshold because it is actually larger than the Otsu threshold. Based on the above analysis, a novel range-constrained Otsu method can be proposed as follows:

Algorithm: Range-constrained Otsu's method
Step 1: Calculate the threshold T1 using Otsu's method in the whole image.
Step 2: Calculate the threshold T2 using Otsu's method in the range of pixels with gray levels in [T1, 255].
Step 3: Then the pixels whose gray levels are smaller than T2 are classified as object and the others as background.

Show the resulting binary-segmented image for the black and white photo of Lena stasjon by coloring the foreground red and the background green. Compare and discuss with the results in #1.

Reference: P.L. Rosin, Unimodal Thresholding, Pattern Recognition, 34 (2001), pp. 2083–2096

3. Compute and plot the three individual 1D histograms for each of R, G, and B in the whole RGB color image Lena stasjon. Comment on what information can be discerned from the images by an examination of the three histograms

NOTE

1. The submitted answer to the assignment should be a maximum of 2 pages plus the pertinent figures.

2. Attempt all parts of this assignment listed above. The total mark for this assignment will be based on your response to each part.