

SIMG-782 Introduction to Digital Image Processing

Homework 4 – Due October 14, 2005

Instructions: Your programs can be implemented in IDL or Matlab. In either case, provide a program that can be tested. All images can be found in the Images area of the course web page. Submit your results in a .zip file to the dropbox in MyCourses.

1. Write pseudocode algorithm whose input is a pair of vectors h and g of length 256 representing the brightness count at 256 brightness levels and whose output is a point transform $s = T(r)$ that will convert an image A with histogram h into an image $B = T[A]$ with histogram approximately g . You should provide a way to do this even if h and g do not come from the same size images.
2. Implement and test your algorithm.
 - (a) Equalize the image EightAM.png so that histogram g is approximately uniform. You can compare the results you get to those produced by the HIST_EQUAL function in IDL .
 - (b) Match the brightness histogram for EightAM.png to the histogram for LENA.png. Your program should also create plots of the histograms of *EightAM* before the transformation, *EightAM* after the transformation, and the histogram of *Lena*.
3. It is difficult to see detail in the ctscan.png image. It is also difficult to equalize because of the large area of black background. You can equalize the foreground image by separating it from the background, calculating the equalization transformation on the foreground pixels, and applying the transformation to the whole image. Construct an equalization of the foreground image.
4. The image boy.png is an underexposed true color image. Construct a program to equalize the image brightness without creating serious changes in the colors.
5. The images blobz1.png and blobz2.png are shown in figure 1. The difference is that blobz1 has nearly uniform illumination while blobz2 has very nonuniform illumination. The goal of this problem is to construct an algorithm based on global greyscale thresholding for the segmentation of each image.

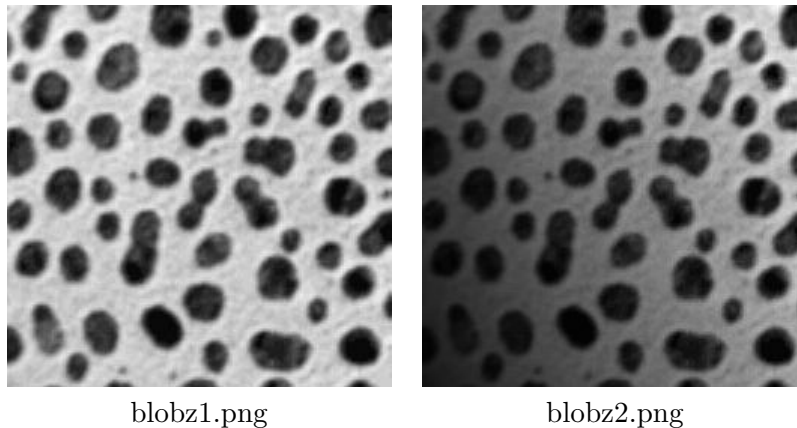


Figure 1: Microscope images with uniform and nonuniform illumination.

- (a) Construct an algorithm that will segment the blobz1.png image. This algorithm can use a global threshold that can be chosen by examination of the image histogram.
- (b) Construct an algorithm that will segment the blobz2.png image. This algorithm will require the determination of an illumination function followed by separation of a log-reflectance image from the illumination. The log-reflectance should then be suitable for global thresholding. [Note: you are not supposed to use the blobz1 image in the blobz2 algorithm, even though that would be very convenient. :-) The IDL routine SFIT may be useful to check your solution.]