CSE 803: Homework Set #3 Fall 2009

due Friday, 16 Oct. (5 PM paper; 11:59 electronic)

This work is to be done individually. This is Homecoming Weekend.

Carefully report answers to the following questions. Also, include your program code as well. You do not have to do everything with a single program. However, it is encouraged that all of your results are included in a single report. (Some students are submitting reports with too little analysis or thinking being reported.)

1. Enhance your HW2 programming work by writing a program to input a color image and output a 64 or 128-bin histogram of its color content. (This histogram can be as simple as a list of 64 (128) integer counts or can be an image.) To compute the bin number of pixel [R,G,B] use the 2 high order bits of R and B and the 2 (3) higher order bits of G. (a) Show the histograms for two of the face test images. (b) For each histogram output, identify in the histogram the presence or absence of evidence for the existence of human face pixels in the image.

Grabbing bits from different data items and putting them together to form a number might be a challenge for a non-CS major, so here is a tiny tutorial. Assume your R, G, B values are in the interval [0, 255]. Dividing each of these by 64 will give a value in [0, 3]; let’s say that these results are r, g, b. We can now get a number in [0, 63] by the combination bin = 16r + 4g + b. (Note that when each value of r,g,b is 3, the total is 63.) Those using MATLAB might add a final 1 to get into the interval [1, 64]. Even if you don’t use it, you should sketch out the formula for producing a 128 bin histogram or a 256 bin histogram.

2. Enhance your programming work from HW2 to address the problem of detecting human faces in a color image. The program[s] should input a color image that may contain human faces and output a color image with bounding boxes enclosing the detected faces. (The objective is for the student to gain experience in working with color pixels, NOT to produce a high peformance face detector.)

The items below are important goals/requirements in the experiment.

(a) The student should study the face colors in example images using an image tool and determine some characterization of human face color. The model may be just a set of example pixels, parameters of a distribution, a color model, etc. The model may then be given as input data to the face detection program[s] or as internal data for a function, etc. A model for nonface colors is also permissible, if needed.

(b) The program should output the input image enhanced by bounding boxes around the regions detected as faces. Inside the bounding boxes should be the ORIGINAL pixels from the input color image.

(c) Other program output should report on whatever region features were used in making the face detection decision.

(d) Students should show results on two images from their own collection or from the Internet, etc. in addition to two required instructor provided images.
(e) The instructor plans to add one or two test images a week prior to the due date so that students can test on images not used for training. **Report your program performance on images hw3test1 and hw3test2.**

(f) Students should submit their program sources files[s] as well as their output images. Separate images may be submitted in case the results do not look good when included in the report document; however, it is preferred if the images are included in the report. **If more than two files are submitted, please zip them up into one. Remember to include your name on the report and on your submitted file[s].**

**Resources**

Test images containing faces will be provided. As noted above, students are responsible for using 2 images of their own choosing.