EEL6562: Assignment #1 (Spring 2004)

(distributed 02/09/2004)

Note: This is an *individual* assignment, so please do your own work.

1 Overview

Goal: To apply basic image processing techniques for segmentation of simple images.

For this assignment, you are given images containing non-overlapping balls against various backgrounds. Figure 1(a) shows one example, while the course web site at:

    http://mil.ufl.edu/~nechyba/eel6562/assignments.html

contains several other test images. The program you develop should segment input images of this type, generating an output image that assigns the color *black* to background pixels, and a unique color (not equal to *black*) to each distinct foreground object (i.e. ball), as is illustrated in Figure 1(b).
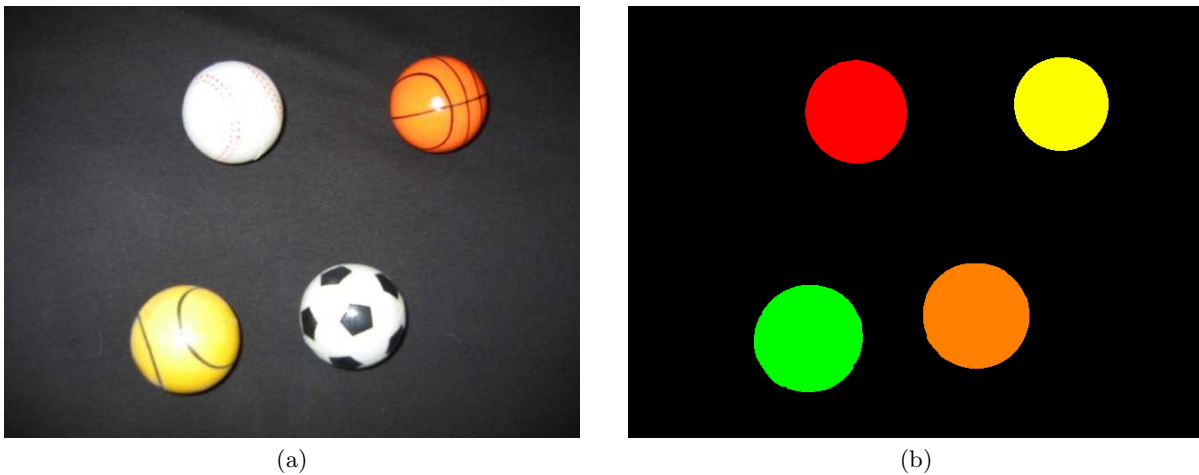

(a)   (b)

Figure 1: (a) Sample input image; (b) sample desired output image.

2 Grading

This assignment is worth **100 points**, with the possibility of an additional **20 bonus points**.

2.1 Report (20 points)

Turn in a short (1-2 pages) report describing your algorithm.

2.2 Demonstration (80 points)

Your work will be graded on a live demonstration of your program[1] where you will demonstrate your program on a test image, similar to those provided as part of this assignment. Demonstrations will take place either in the NEB computer lab during the following dates: **03/01 - 03/04**. After times and procedures for those dates are finalized (via e-mail), you will be able to sign up for a specific date/time.

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[1]Students on FEEDS will be notified about the procedure for evaluating their assignment separately via e-mail.

For those who cannot bring a laptop or demo on one of the NEB lab computers, the TA will have a computer (*PIII 846 MHz with 512 MB RAM running Windows XP Pro*) available with *Mathematica 4.2 for Students*. Computers in the NEB lab have *Matlab* and *Visual C++*, as well as Unix environments. If your program will not work on any of these and you cannot bring a laptop of your own, email the TA (`mcnese@ufl.edu`) as soon as possible, but at least 3 days prior to your demonstration. **Note:** *It is important that you test your program on the computer you will use for the demo prior to your demo.*

For the demonstration, you will be given one test image to segment, similar to images `blk1`, `gry1` and `blu1` available on the class web site. Your program must provide the following output:

1. Number of objects segmented.

2. Segmented output image in an uncompressed image format (e.g. BMP, PPM) named `yourname.ext` (e.g. `michaelnechyba.ppm`). This image must be made available to the TA through e-mail, floppy, CD, flashdisk, etc., at the time of the demo.

Your grade will be computed as follows:

1. **(40 points)** The first criterion c_1 will account for objects as a whole. Points will be assigned as follows:

$$c_1 = \begin{cases} 0 & TruePositives < FalsePositives \\ \frac{40(TruePositives - FalsePositives)}{CorrectNumberOfObjects} & otherwise \end{cases} \quad (1)$$

If a single ball is segmented into more than one blob, one blob will be counted as a *TruePositive* and the remaining blobs will be counted as *FalsePositives*.

2. **(40 points)** The second criterion c_2 will account for the number of correctly segmented pixels. Points will be computed as follows:

$$c_2 = \min[\frac{PercentCorrectlySegmentedPixels}{2}, 40] \quad (2)$$

Note: 80% correctly classified pixels yields the maximum number of points possible.

3. **(20 bonus points)** For bonus credit, your program will be tested on an image with a white background, similar to `wht1`. If your program correctly segments any ball in the image, you will be given an additional 20 points.

Please make sure that your program segments an image reasonably fast on the demonstration computer. *If your program takes longer than 5 minutes you will receive no credit for the demonstration part of the assignment.* If your algorithm is only partially complete (i.e. still requires manual input), partial credit may be awarded.

Due to the large class size, there will be no makeup demonstration times. If you miss your allotted time, you will be given zero points for the demonstration. If for some reason your program does not run during that allotted time, you will also receive a zero for the demonstration.