http://people.sc.fsu.edu/~jburkardt/presentations/asa_2011_images_homework2.pdf

Homework #11

Algorithms for Science Applications II
Assigned: Friday, 8 April 2011
Due: Friday, 15 April 2011

The JPEG image **visitor.jpg** is available on the class Blackboard site, and also at http://people.sc.fsu.edu/~jburkardt/latex/asa_2011_images_homework.html.

Problem 1:

Get a copy of the color image *visitor.jpg*. Read the file using the command **A=imread('visitor.jpg')**. **A** is an (M,N,3)-dimensional array, whose third component indexes the red, green and blue colors. Make a copy of **A** called **B**, set the green and blue components of **B** to 0, and use **imshow()** to display **B**. Use the **find()** command to index those entries of **B** which are less than 250. Set those entries of **B** to 0. Now the image should show just three substantial areas of red. In particular, one area is the face of the "visitor". This suggests that some skin tones have a very strong red signal and that color alone might help us spot some faces in an image. In this homework, we will try to improve this approach.

Redisplay the original image using **imtool(A)**. Notice that when you place the cursor on the image, the lower left corner of the viewer displays the location and the (R, G, B) values of the pixel. Sample 10 different "skin" pixels from the face and neck and record the (R, G, B) values.

It is roughly true that if an object is not fully illuminated, it stays the same color, but at a reduced intensity. If we take I, the intensity of a color, to be the sum $R + G + B$, we can define normalized values $(\bar{R}, \bar{G}, \bar{B})$ of color by dividing by I. Over a range of illuminations, the (R, G, B) values may change, but the normalized values should stay more nearly constant. Create a table in which you list the (R, G, B) and $(\bar{R}, \bar{G}, \bar{B})$ values for each of your ten sample pixels of skin.

Although your (R, G, B) values may vary greatly, the $(\bar{R}, \bar{G}, \bar{B})$ values should be relatively close to each other, which suggests that they describe a property of skin tone. Average these 10 values to get (R^*, G^*, B^*). Make a second table in which you list the (Euclidean) distance between each $(\bar{R}, \bar{G}, \bar{B})$ and the average (R^*, G^*, B^*). Define **dmax** as the maximum of these 10 distances.

Now we are ready to try to create an image that is mainly just the visitor's face. Make a copy of image **A** by zeroing out every pixel whose $(\bar{R}, \bar{G}, \bar{B})$ value is greater than **dmax** from the average (R^*, G^*, B^*). If you don't like the result, you can adjust the value of **dmax** and try again. (In my experiments, I ended up with mostly face, but lost some of the shiny forehead)

Turn in:

1. your table of 10 (R, G, B) and $(\bar{R}, \bar{G}, \bar{B})$ values at "skin" pixels.
2. the averaged skin tone value (R^*, G^*, B^*);
3. your table of the 10 distances of $(\bar{R}, \bar{G}, \bar{B})$ from (R^*, G^*, B^*);
4. the averaged distance **dmax**;
5. your final image which shows the attempt to display just the skin tone pixels.
