Name: _____

Face Segmentation using Color Information

The purpose of this exercise is to give you some practice segmenting a face in an image. Segmentation is based on color, using one or more of the various color planes.

1. Download a *color* mugshot from thesmokinggun.com. This picture should be one in which the face stands out well from the background.

2. Separate the image into its red, green and blue component planes of data. Create a 1x3 subplot with the red, green and blue planes of data in these three windows. Be sure to label each with which color plane is represented. Note: RGB values are either uint8, or doubles in the range 0.0 to 1.0.

3. Convert the image to the hue-saturation-value (HSV) color space using the *rgb2hsv* function. Separate the image into its hue, saturation and value components. Create another 1x3 subplot with the hue, saturation and value planes of data in these three windows. Be sure to label each with which color plane is represented. Note: the Y, C_b and C_r values are doubles, in the range 0.0 to 1.0.

4. The National Television System Committee (NTSC) was used to transmit color information in analog color TV. Convert the image to the NTSC color space using the *rgb2ntsc* function. This color space consists of luminance (Y) and two chrominance components (I and Q). Separate the image into its Y, I and Q components. Create another 1x3 subplot with the Y, I and Q planes of data in these three windows. Be sure to label each with which color plane is represented. Note: the Y, C_b and C_r values are doubles, in the range -1.0 to 1.0.

5. The YC_bC_r color space is used to code color information in MPEG video. Convert the image to the YC_bC_r color space using the *rgb2ycbcr* function. This color space consists of brightness (Y) and two color difference components (C_b and C_r). Separate the image into its Y, C_b and C_r components. Create another 1x3 subplot with the Y, C_b and C_r planes of data in these three windows. Be sure to label each with which color plane is represented. Note: the Y, C_b and C_r values are uint8.

6. You now have 12 planes of data to view for the mugshot you chose. In which plane of data does the face stand out most from the background? By stand out, that could mean that the face is noticeably darker than the rest of the image, or it could be noticeably lighter than the rest of the image.

7. Choose a suitable threshold for the color component you chose that will make a binary image with the face being the prominent object. Use your *stats* function to be aware of the range of values in your chosen color component so you can choose your threshold wisely.

8. Use morphology to get rid of noise (areas not on the face) and filling in the black areas that actually should be on the face. In order, use MATLAB's *bwfill*, *imerode* and *imdilate* functions as needed. To create a structuring element for morphology, you can use the *strel* function with a "disk" shape structuring element. You pick the radii of the disks, which may change in size. You'll need to experiment with: different sizes of structuring elements, the number of times you dilate/erode, and the order you dilate/erode.

9. Use *bwlabel* to create a label image, then use *regionprops* to determine the largest object (which should be the face region), and to compute a bounding box for this object.

10. Using this bounding box and your *extract* function from Project 01, attempt to extract the face only from the original color image. Note that your extract function needs a simple change to extract all planes of data. Display the original image and the segmented face in a 1x2 subplot, and show it to your professor.

Professor initials: _____