

### Lab 3 - skin detection

- Detect the “skin-pixels” in a color image. Create a new binary image, the same size as the input color image, in which the skin pixels are white (255) and all non-skin pixels are black (0). Implement all the below described methods. ([test images](#))
- Evaluate the below described methods by using the [Pratheepan dataset](#). For the images in this dataset the “ground truth” information is provided. Compute and display the confusion matrix and the accuracy. The confusion matrix has the following form:

		Predicted by the proposed method	
		Skin pixels	Non-skin pixels
Ground truth	Skin pixels	True Positive	False Negative
	Non-skin pixels	False Positive	True Negative

The True Positive are the number of pixels that were labeled as skin in the ground truth image (the white pixels) and by the employed skin detection method. The False Negative are the number of pixels that were labeled as skin in the ground truth image and as non-skin by the employed skin detection method. The False Positive are the number of pixels that were labeled as non-skin in the ground truth image (the black pixels) and as skin pixels by the employed skin detection method. The True Negative are the number of pixels that were labeled as non-skin in the ground truth image and by the employed skin detection method.

$$Accuracy = \frac{True\ Positive + True\ Negative}{True\ Positive + False\ Negative + False\ Positive + True\ Negative}$$

- Use skin pixel classification to detect the face in a portrait image (find a minimal square that frames the human face). Do not use an already implemented face detection function.

Bibliography: [1](#), [2](#), [3](#), [4](#), [5](#)

A color pixel ( $R, G, B$ ) is classified as “skin” if:

1)

$$R > 95 \ \& \ G > 40 \ \& \ B > 20 \ \&$$

$$\max\{R, G, B\} - \min\{R, G, B\} > 15 \ \&$$

$$|R - G| > 15 \ \& \ R > G \ \& \ R > B$$

An  $(H,S,V)$  pixel is classified “skin” if:

2)

$$H \in [0,50] \ \& \ S \in [0.23,0.68] \ \& \ V \in [0.35,1]$$

$(R,G,B)$  to  $(Y,Cb,Cr)$  conversion:

$$Y=0.299R+0.587G+0.114B$$

$$Cb=-0.1687R-0.3313G+0.5B+128$$

$$Cr=0.5R-0.4187G-0.0813B+128$$

$$R,G,B \in [0,255] \rightarrow Y, Cb, Cr \in [0,255].$$

An  $(Y,Cb,Cr)$  pixel is classified “skin” if:

3)

$$Y > 80 \ \& \ 85 < Cb < 135 \ \& \ 135 < Cr < 180, \ Y, \ Cb, \ Cr \in [0, 255]$$