UNIVERSITÄT BASEL

UNI BASEL

Lecturer
Prof. Dr. Thomas Vetter
Departement Informatik
Bernoullistrasse 16
CH – 4056 Basel

Assistants
Sandro Schönborn <sandro.schoenborn@unibas.ch>
Adam Kortylewski <adam.kortylewski@unibas.ch>

Homepage
http://www.cs.unibas.ch

Pattern Recognition (CS254) - Sheet 2 [10 Points]

Preliminary Discussion	03.10.2013
Deadline	17.10.2013

Skin detection using a Gaussian Likelihood

For the following experiments we provide two files `skin.mat` and `nonskin.mat` containing RGB color data (format: 3×#samples). This data represents the pixel values from several photographs which were manually labeled as belonging to skin resp. non-skin regions.

Exercise 1 - General Gaussian Likelihood [10 Points]

For this exercise you will write a skin detector, able to classify pixels in an image as skin or non-skin.

(a) **Training**
Train a General Gaussian likelihood for each dataset. By "general", we mean with a general covariance matrix.

(b) **Detection**
Write a function that takes as input an image, the two likelihood models, and a threshold parameter, Θ. As output it should produce a binary image indicating how each pixel has been classified according to the likelihood ratio:

$$\frac{p(\text{color}|\text{skin})}{p(\text{color}|\neg\text{skin})} > \Theta$$

(c) **Test**

(i) Test your function on the image `image.png` and compare your result with the ground truth stored in the image `mask.png`. Generate a ROC-curve of the number (percentage) of true positive as a function of false positive pixels. Find the value of Θ at the equal error rate and at the minimal total error rate.

(ii) Construct and test a Bayesian Maximum-A-Posteriori classifier. Modify the likelihood ratio from above to become the posterior ratio. Estimate the prior value using the given image.

(iii) Test your optimized classifiers (i and ii) on the image `test.png`. Give the true positive and false positive rates as well as the absolute error rate using the mask file `mask-test.png`.