Exercise 7 - Machine Learning II - 2016

Please send your submissions (runnable code, plots and written answers) **via email to weis@ccc.cs.uni-frankfurt.de until Tuesday June 7th 2016**. One submission per student. Prepare to present your solutions in the exercise session. Students that are not able to explain their solutions may not be given credit on their submissions.

1 Skin color classification (6 Points)

- (Textual answer) What other possibilities would make sense to represent $P(c|skin)$?

- (Textual answer) What is the difference of using the ratio

$$\frac{P(c|skin)}{P(c|non - skin)} \tag{1}$$

compared to the full Bayesian formulation:

$$P(skin|c) = \frac{P(c|skin)P(skin)}{P(c|skin)P(skin) + P(c|non - skin)P(non - skin)} \tag{2}$$

What are their commonalities, what are the differences? Which information do we lose by using the above, what are the benefits?

- (Textual answer) Are the above computations a generative or a discriminative model? Why?

2 Skin color classification applied (4 Points)

Download the RGB skincolor dataset from https://archive.ics.uci.edu/ml/datasets/Skin+Segmentation

- Load the dataset, create a 3d plot of the pixels of the respective classes (skin, non-skin)

- Use a multivariate Guassian to represent $P(c|skin)$ and $P(c|non - skin)$ (hint: np.mean, np.cov, scipy.stats.multivariate_normal)

- Compute the ratio $\frac{P(c|skin)}{P(c|non-skin)}$ for all pixels of some image containing skin and use it to create a version of this image that only contains pixels classified as skin

- (Bonus) compute the full Bayesian version and use it for classification

Additional sources:

- A Survey on Pixel-Based Skin Color Detection Techniques (see 3.2.2)

- Computer vision: models, learning and inference (see 6.6.1)

- Slides: Region Based Skin Color Detection (see 12)

- Slides: Face Detection Using Skin Detection (see 17 and following)