TU München
Fakultät für Informatik
PD Dr. Rudolph Triebel
John Chiotellis

Machine Learning for Robotics and Computer Vision
Winter term 2015

Homework Assignment 4
Topic: Boosting and Kernels
Tutorial December 18th, 2015

Exercise 1: Adaboost (Programming)

Download the file 'banknote_auth.zip' available at the course's website. The data are features of banknotes and the labels indicate whether a banknote is forged or not. The dataset is taken from `https://archive.ics.uci.edu/ml/datasets/banknote+authentication` with some duplicate entries removed. Implement the AdaBoost algorithm with decision stumps as weak classifiers.

a) To begin train on 50% of the data with 20 weak classifiers.

b) Generate a plot of the classification error with respect to the number of weak classifiers. What do you observe?

c) Add more weak classifiers. Does the error decrease? What's the optimal number of weak classifiers to use?

d) Now keep the number of weak classifiers fixed and try different training/testing set sizes. How does it affect the classification accuracy?

Exercise 2: Kernels

There exist a number of rules to construct new kernels from simpler ones. Using these rules, show that the Polynomial and the Gaussian kernel are valid. Try to also show the validity of the rules that you use in the process.

Hint: For the Gaussian kernel use the Taylor expansion of the exponential function to prove that the exponential of a kernel is also a kernel.

The next exercise class will take place on **December 18th, 2015**.

For downloads of slides and of homework assignments and for further information on the course see

`http://vision.in.tum.de/teaching/ws2015/mlcv15`