

## Machine Learning for Computer Vision Winter term 2017

November 28, 2017  
Topic: Bagging and Boosting

### Exercise 1: Bootstrap Aggregation

- a) What is the core idea in bagging? How does it differ from boosting?
- b) Does bagging reduce the bias of the predictions, the bias or both? Why?
- c) What is the out-of-bag error and why is it useful?

### Exercise 2: 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 still change? 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?