Workshop: Statistical and Machine Learning
Stefan Richter, Heidelberg University
Preliminary Schedule

Monday, 11.10.2021

(a) Introduction and Motivation to Supervised and Unsupervised Learning

(b) Statistical decision theory: Risk, Algorithms and Excess Bayes risk

Wednesday, 13.10.2021

(a) Classification: Decision boundaries, Discriminant functions, Risk transfer formula and calibration condition

(b) Logistic Regression (low- and high-dimensional)

Friday, 15.10.2021

(a) Support Vector Machines: Motivation, Optimal separating hyperplanes, Dual formulation

Monday, 18.10.2021

(a) Trees: Binary trees, Classification and Regression trees, Greedy algorithms

(b) Improving tree algorithms: Bagging

Wednesday, 20.10.2021

(a) Improving tree (and other) algorithms: Boosting

(b) Random Forest algorithm, intelligence of crowds approach

Friday, 22.10.2021

(a) Neural networks: Motivation, graphical representation, inference based on stochastic gradient descent

(b) Outlook: Convolutional neural networks and other network types

Monday, 25.10.2021

(a) Reinforcement Learning: Optimal strategy, Q-Learning, Deep-Q-Learning with neural networks

Wednesday, 27.10.2021

(a) Unsupervised Learning: Identification of representatives with Clustering

(b) k-means Clustering, clustering based on mixture distributions, EM algorithm

Friday, 29.10.2021

(a) Unsupervised Learning: Dimensionality reduction

(b) Principal component analysis and kernel-based principal component analysis

Monday, 01.11.2021

(a) Unsupervised Learning: Dimensionality reduction, reconstruction error

(b) Spectral clustering, optimal graph cuts, connection to principal component analysis