Fachbereich Maschinenbau und Verfahrenstechnik
Faculty of Mechanical and Process Engineering

Organisation

Lecturer	Prof. Dr.-Ing. André Stuhlsatz
Lecture (3 SWS) Practical lesson (2 SWS)	weekly weekly
Workload	150h | 75h (attendance) | 75h (self-study)
Credits	5 CP
Subject-related prerequisites	Understanding of Engineering Mathematics, Computer Science (in particular, Matlab or Python skills)
Type of exam	oral exam (30 min)
Language	English (optional German)
Online-Ressourcen	Moodle Link

Advanced Machine Learning

Summer Term

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Topic: Machine Learning (ML), as a subfield of Artificial Intelligence, primarily deals with learning algorithms and data analysis methods. Numerous ML techniques are now available to the public in various software packages, addressing practical challenges such as speech recognition or image recognition. The rapid advancement and success of Deep Learning, propelled by companies like Google and others, are significantly influencing ML as a cross-cutting technology that increasingly impacts various aspects of our daily lives.

The lecture conveys the theoretical fundamentals of machine learning and, building upon them, practical and relevant machine learning techniques. In addition to theoretical considerations, the learned methods are applied through application-oriented examples such as image recognition or learning game strategies. This application process enables the acquisition of competence to explain, classify, and transfer these methods to other application scenarios. The following topics are covered in detail:

- Stochastic Decision/Learning Theory: Bayesian decision theory, classification, and regression, un/supervised learning, maximum likelihood, and Bayesian parameter estimation, including LDA and PCA.
- Non-parametric methods: k-Nearest-Neighbor, Parzen Windows, Decision Trees, Ensemble Methods.
- Kernel-based methods: Support Vector Machines, Kernel-PCA, Kernel-FDA.
- Neural Networks: Deep NN, Convolutional NN, Recurrent NN, Autoencoders, GANs, Boltzmann Learning, Restricted Boltzmann Machines.
- Reinforcement Learning: (Deep) Q-Learning.

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Literatur