

Modulprofil

Prüfungsnummer

5173020

Dauer

1 Semester

Häufigkeit des Angebots

Jedes Sommersemester

SWS

4

ECTS-Credits (CP)

5.0

Workload

Angeleitete Studienzeit:

Präsenzzeit: 60 Std.

Selbststudienzeit: 90 Std.

Gesamt: 150 Std.

Lehrveranstaltungsart(en)

Seminaristischer Unterricht

Lehrsprache

Englisch

Organisation

Modulverantwortung

Prof. Dr. Andreas Lehrmann

Dozierende

Prof. Dr. Andreas Lehrmann

Verwendbarkeit

MAI

Studiensemester

1. Semester

Art des Moduls

Pflichtmodul

Verpflichtende Voraussetzungen gemäß SPO

None

Empfohlene Voraussetzungen

Knowledge in programming (Python) and mathematics (linear algebra, probability theory, multi-variable calculus).

Inhalte

This course provides a comprehensive introduction to the field of machine learning. Starting from basic principles, we are going to develop a data-driven framework that allows us to express representation and prediction tasks as learning problems, either supervised or unsupervised.

In both cases, our discussion of the relationship between data and model will lead to a broad spectrum of approaches with different properties: linear vs. non-linear, parametric vs. non-parametric, deterministic vs. non-deterministic, and classification vs. regression. We are going to explore how these models are formulated, how they can be optimized, and how they can be applied to new data.

In a parallel track, we are going to explore theoretical properties of machine learning models, including their robustness, complexity, and meta-level behaviour.

In particular, the course covers the following topics:

- Data: collection & representation
- Data: statistical & visual exploration
- (Linear/Probabilistic/Non-parametric) classification
- (Linear/Non-Linear/Robust) regression
- Meta learning: ensembling & boosting
- Clustering
- Outlier Detection
- (Stochastic) gradient descent
- (Feature/Model) selection
- Regularization
- Convolutions
- Kernel Trick
- Maximum likelihood & maximum a-posteriori
- Principal component analysis
- Gaussian processes
- Multi-dimensional scaling
- Neural networks & deep learning

Prüfung

Verpflichtende Voraussetzung gemäß SPO für die Teilnahme an der Prüfung

Keine

Art der Prüfung

Schriftliche Prüfung (sP) gemäß
§ 23 APO

Dauer/Form der Prüfung

90 Minuten

Die konkrete Festlegung der
abzuleistenden Prüfung erfolgt
im Studienplan

Prüfungssprache

Englisch

Voraussetzung für die Vergabe von Leistungspunkten

Keine

Lernergebnisse

Upon completion of this module the students have a broad understanding of machine learning and its subfields, including the following:

- They can independently collect/analyze data and take the necessary steps to prepare them for learning and inference tasks.
- They are familiar with a variety of supervised/unsupervised models and understand their principles and properties.
- They can select an appropriate model for a given task and design, implement, optimize, run, and analyze the corresponding machine learning pipeline.
- They understand the balance between expressiveness and generalization. They are able to employ selection, regularization, and meta-learning techniques to maximize model performance.

Literatur

1. Bishop, Christopher M.: Pattern Recognition and Machine Learning. Springer, 2006.
2. Murphy, Kevin P.: Probabilistic Machine Learning: An Introduction. The MIT Press, 2022.
3. Hastie, Trevor and Tibshirani, Robert and Friedman, Jerome: The Elements of Statistical Learning: Data Mining, Inference, and Prediction. Springer, 2009.