03-IMAP-AML	Advanced Machine Learning

Lehrform *(teaching format)* / **SWS** *(hours per week)*: 2VL + 2UE

Kreditpunkte *(credit points)*: 6

Turnus *(frequency)*: usually, each winter term

Inhaltliche Voraussetzungen *(content-related prior knowledge/skills)*: NONE

Sprache *(language)*: English

Lehrende *(teaching staff)*: AG Cognitive Systems Lab (Prof. Dr. Tanja Schultz, Dr. Felix Putze)

Studiengang *(degree program)*	Module	Semester
Informatik (Master)	IMAP, IMAP-AI, IMA-VMC	ab 1.Sem.
AI and Intelligent Systems (Master)	AI-F-AML	1. sem.
Systems Engineering I/II (Master)	M07-PB-AuR	ab 1./2.Sem.
Management Information Systems (Master)	(MIS-INF3)	ab 2.Sem.
Informatik (Bachelor)	(nur *Freie Wahl*)	

Lernergebnisse:

Die Studierenden sind in der Lage,

- verschiedene Methoden des maschinellen Lernens in komplexen Anwendungsfällen gegeneinander abzuwägen,
- sie in ihren Unterschieden zu beschreiben und Vor- und Nachteile, sowie Bedingungen einzelner Verfahren zu erklären (Transferleistung wird erwartet)
- entsprechenden Python-Code nachvollzuziehen und zu erläutern,
- Ressourcenverbrauch von maschinellen Lernverfahren abzuschätzen.

Learning Outcome:

- The students will be able to weigh different methods of machine learning against each other for complex use cases.
- They will be able to describe their differences, the advantages and drawbacks, as well as predconditions of different methods (including transfer).
- They are able to understand and explain the Python code for these methods.
- They are able to estimate the resource consumption of machine learning methods.

Inhalte:

- Generative/ Discriminative Modelle, Regression, Features, Evaluation
- Statistische und mathematische Grundlagen
- Grundlagen Neuronaler Netze
- Convolutional Neural Networks, Recurrent Neural Networks, Generative Models, Bayesian and Gaussian Networks
- Attention Modules, Distance Metric Learning, Gradient Boosting
- End-to-end Systems, Optimization, Explainable AI

- Verantwortungsvoller Umgang mit Berechnungsressourcen und Berechnungskomplexität machineller Lernverfahren und Tiefen Neuronalen
  Netzen,
- Konzepte zum Umgang mit Daten- und Modellsharing, sowie zur gemeinsamne Nutzung von Hardware, Software und Infrastruktur.

Contents:

- Generative/ discriminative models, regression, features, evaluation
- statistical und mathematical fundamentals
- fundamentals of neural networks
- Convolutional Neural Networks, Recurrent Neural Networks, Generative Models, Bayesian and Gaussian Networks
- Attention Modules, Distance Metric Learning, Gradient Boosting
- End-to-end Systems, Optimization, Explainable AI
- Responsible use of computational resources and computational complexity of machine learning and deep neural networks.
- Concepts for handling data and model sharing, as well as for sharing hardware, software and infrastructure.

Hinweise *(remarks)*: The table lists only the primary / most specific modules to which this course is assigned.