

Workshop on Data Science and Artificial Intelligence (W3M50022)

Workshop on Data Science and Artificial Intelligence

FORMALE ANGABEN ZUM MODUL

MODULNUMMER	VERORTUNG IM STUDIENVERLAUF	MODULDAUER (SEMESTER)	MODULVERANTWORTUNG	SPRACHE
W3M50022	-	1	Prof. Dr. Bernhard Drabant	Deutsch/Englisch

EINGESETZTE LEHRFORMEN

LEHRFORMEN	LEHRMETHODEN
Vorlesung, Übung, Labor	Lehrvortrag, Diskussion, Gruppenarbeit

EINGESETZTE PRÜFUNGSFORMEN

PRÜFUNGSLEISTUNG	PRÜFUNGSUMFANG (IN MINUTEN)	BENOTUNG
Portfolio	Siehe Prüfungsordnung	ja

WORKLOAD UND ECTS-LEISTUNGSPUNKTE

WORKLOAD INSGESAMT (IN H)	DAVON PRÄSENZZEIT (IN H)	DAVON SELBSTSTUDIUM (IN H)	ECTS-LEISTUNGSPUNKTE
235	40	195	5

QUALIFIKATIONSZIELE UND KOMPETENZEN

FACHKOMPETENZ

Students acquire an in-depth understanding of the challenges and trends in the field of data science and artificial intelligence. They know the fundamental and advanced concepts and problems in this area and are able to implement them methodically and in practice.

METHODENKOMPETENZ

In this module, students learn about methods and concepts of data science and artificial intelligence as well as their application scenarios and are able to carry out and evaluate analyses independently. They have acquired the skills to evaluate the concepts and methods as well as assess their significance. They are able to weigh up the advantages and disadvantages of the methods and procedures. They select suitable procedures from a practical point of view.

PERSONALE UND SOZIALE KOMPETENZ

Students work in teams on hands-on projects on current topics in the field of data science and artificial intelligence and can responsibly evaluate and classify the applications and methods in an ethical, social and normative context.

ÜBERGREIFENDE HANDLUNGSKOMPETENZ

Students are familiar with the challenges of developing and applying technologies in the field of data science and artificial intelligence, particularly with regard to the transparency and traceability of results and model predictions, and can integrate this knowledge into their everyday work. They have acquired the competence to evaluate the concepts and methods and assess their significance. They are able to weigh up the advantages and disadvantages of the methods and procedures and select suitable procedures from a practical point of view.

LERNEINHEITEN UND INHALTE

LEHR- UND LERNEINHEITEN	PRÄSENZZEIT	SELBSTSTUDIUM
Workshop on Data Science and Artificial Intelligence	40	195

LERNEINHEITEN UND INHALTE

LEHR- UND LERNEINHEITEN

PRÄSENZZEIT

SELBSTSTUDIUM

Preamble: This module is a work shop module for summer schools in the framework of the university alliance EU4Dual. It offers workshops in current research topics in the area data science and artificial intelligence. In the initial set-up the following topics will be offered explicitly. The content may be subject to current developments and trends and may be adapted accordingly.

Transformers

In the workshop the theory and concepts of transformers will be presented. In the hands-on sessions appropriate software packages will be used to train, evaluate, fine-tune and use transformer models in various use cases and scenarios.

Machine Learning on Unstructured Data

In the workshop machine learning on unstructured will be discussed. In particular statistical and probabilistic methods based on Bayesian and statistical methods will be introduced and utilized to analyse unstructured data like texts, videos, etc. One focus is on the inference of uncertain model parameters and validation of hypotheses. Besides the conceptional and theoretical aspects there is a focus on computation and resources - hardware, software, computability. In the hands-on sessions the concept and ideas will be applied and implemented in various use cases.

Multimodal Machine Learning

Multimodal machine learning enhances machine learning in that it uses multiple interrelated data sources such as videos, images, audio sequences, texts etc. simultaneously to solve tasks in complex environments.

In this workshop basic concepts and methods for data analytics of multimodal data are presented. In particular it will be discussed how multimodal data will be joined and represented in order to build and apply appropriate machine learning algorithms which simultaneously learn from these multiple and interrelated modalities.

Note: In all workshops coding will be in Python and Jupyter Notebooks if not mentioned otherwise. Students are asked to bring their own notebooks (Windows, Linux or Mac Books) with the according programming tools (Python, IDE, ...) installed and with appropriate hardware endowment communicated by the lecturers.

BESONDERHEITEN

This module is conducted in English only.

Module appropriate for summer school in the context of the EU4Dual university alliance. Proposal for initial set-up: 1-d lecture & workshop on Transformers, 2-d lecture & workshop on machine learning on unstructured data, 2-d lecture & workshop on multimodal machine learning. Last day presentation of team projects.

VORAUSSETZUNGEN

Basic understanding of machine learning and neural networks. Elementary knowledge in working with Python (and/or R).

LITERATUR

(Excerpt)

- Baltrušaitis, T., Chaitanya, A., Morency, L.-P. "Multimodal machine learning: A survey and taxonomy." IEEE Transactions on Pattern Analysis and Machine Intelligence 41, 423-443 (2018):
- Bengio, Y., Courville, A., Vincent, P. "Representation learning: A review and new perspectives." IEEE Transactions on Pattern Analysis and Machine Intelligence 35, 1798-1828 (2013)
- Bishop, C. M. Pattern recognition and machine learning. Springer (2006)
- Goodfellow, I., Bengio, Y., Courville, A. Deep Learning, MIT Press (2016)
- Hastie T., Tibshirani, R., Friedman, J. The Elements of Statistical Learning. Springer Series in Statistics (2001)
- James, G., Witten, D., Hastie, T., Tibshirani, R. An Introduction to Statistical Learning. Springer Series in Statistics (2021)
- Sangeetha, M. Unstructured Data Analytics Using Machine Learning. Notion Press (2022)
- Škrlj, B. From Unimodal to Multimodal Machine Learning. Springer (2024).