

Kursnummer: DLMBDSA01	Kursname: Data Science	Gesamtstunden: 150 h
		ECTS Punkte: 5 ECTS
Kurstyp: Wahlpflicht Kursangebot: WS, SS Course Duration: Minimum 1 Semester	Zugangsvoraussetzungen: None	
Kurskoordinator(en) / Dozenten / Lektoren: Siehe aktuelle Liste der Tutoren im Learning Management System	Bezüge zu anderen Modulen: Siehe Modulbeschreibung	
<p>Beschreibung des Kurses:</p> <p>The course Data Science provides the theoretical framework for the scientific treatment of data. It covers techniques for the storage of data and its pre-processing to achieve a processible data foundation. Subsequently, the course introduces advanced mathematical techniques and selected methods from artificial intelligence that are used to analyse data and to make predictions.</p> <p>Course Objectives and Outcome:</p> <p>Upon successful completion of the course, students are able</p> <ul style="list-style-type: none"> • to understand the techniques to store data. • to understand how data are pre-processed to prepare them for analysis. • to develop typologies for data and ontologies for knowledge representation. • to decide for appropriate mathematical algorithms to utilize data analysis for a given task. • to understand the value, applicability, and limitations of artificial intelligence for data analysis. <p>Teaching Methods:</p> <p>The learning materials include printed and online course books, vodcasts, online knowledge tests, podcasts, online tutorials, and case studies. This range of learning materials is offered to students so they can study at a time, place, and pace that best suits their circumstances and individual learning style.</p> <p>Course Content:</p> <ol style="list-style-type: none"> 1. Introduction to Data Science <ol style="list-style-type: none"> 1. Terms and Definitions 2. Sources of Data 2. Data Storage <ol style="list-style-type: none"> 1. Data Clustering 2. Data Replication 3. Data Indexing 4. Data Warehousing 3. Pre-processing of Data <ol style="list-style-type: none"> 1. Transmission of Data 2. Cleansing of Data (inaccuracy, incompleteness, inconsistency, de-replication) 3. Transformation of Data (normalization, aggregation) 4. Reduction of Data Dimensionality 4. Processing of Data <ol style="list-style-type: none"> 1. Data Typology and Taxonomy 		

2. Ontologies in Information Science
3. Identity vs. Similarity Search
4. Establishing Mathematical Data Descriptors
5. **Selected Mathematical Techniques**
 1. Geometric Transforms (translation, rotation, reflection)
 2. Radial Transforms (RDF)
 3. Integral Transforms (Hadamard, cosine, Fourier, Wavelet)
 4. The K-Means Algorithm
 5. Composite Tree Algorithm
 6. Minimum Covariance Determinant
 7. Support Vector Machines
 8. Artificial Bee Colony (ABC) Optimization
6. **Selected Artificial Intelligence Techniques**
 1. Machine Learning
 2. Self-Organizing Maps (Kohonen Network)
 3. Feedforward vs. Backpropagation Neural Networks
 4. Counterpropagation Neural Networks
 5. Evolutionary Algorithms
 6. Fuzzy Logic

Literatur:

Recommended Literature:

- Agrawal, A. (2018). Prediction Machines: The Simple Economics of Artificial Intelligence. Brighton, MA: Harvard Business Review.
- Hu, F. (2016). Big Data: Storage, Sharing, and Security. Boca Raton, FL: Auerbach Publications.
- Ciaburro, G., & Venkateswaran, B. (2017). Neural Networks with R: Smart models using CNN, RNN, deep learning, and artificial intelligence principles. Birmingham: Packt Publishing.
- Kepner, J., & Jananathan, H. (2018). Mathematics of Big Data: Spreadsheets, Databases, Matrices, and Graphs. Cambridge, MA: MIT Press.
- Russell, S. J., & Norvig, P. (2015). Artificial Intelligence: A Modern Approach. New York: Pearson Education.

An actual list with course-specific mandatory reading as well as references to further literature is available in the Learning Management System.

Prüfungszugangsvoraussetzung:

- Depending on the course: Completion of online knowledge tests (approx. 15 minutes per unit, pass / not pass)
- Course evaluation

Prüfungsleistung:

- Exam, 90 min.

Student Workload (in hours): 150

Self-study: 90 h
 Self-testing: 30 h
 Tutorials: 30 h

