Module im Bereich: Fundamentals of Data Science

- ⚠ Hinweise zu Modulen im Bereich: Fundamentals of Data Science
- Data Mining I - Introduction to Data Mining
- Data and Knowledge Engineering
- Introduction to Simulation
- Logik 2
- Machine Learning
- Principles and Practices of Scientific Work and Soft Skills

⚠ Hinweise zu Modulen im Bereich: Fundamentals of Data Science

Im Folgenden werden Module für den Bereich *Fundamentals of Data Science* aus anderen Fakultäten aufgelistet. Wir verweisen auf die Modulbeschreibungen der jeweiligen anbietenden Fakultät; sie können in den Modulhandbüchern der entsprechenden Fakultäten gefunden werden.

Abweichende Module müssen vom Studiengangsleitenden genehmigt werden.

Mathematik

- Statistical Methods (Statistical Methods II) (Winter)

Data Mining I - Introduction to Data Mining

Summer

Introduction to Data Mining

(in German: Data Mining I - Introduction to Data Mining)

Module-ID: FIN-INF-120454

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
DM1_ENG	6	Summer	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	false
Responsibility:	Myra Spiliopoulou
Lecturer:	Myra Spiliopoulou
Classes:	• Vorlesung DM1_ENG • Übung DM1_ENG **COURTESY TRANSLATION:** • Lecture class DM1_ENG • Exercise class DM1_ENG
Applicability in curriculum:	- M.Sc. DKE: Fundamentals of Data Science - M.Sc. DE: Methoden der Informatik - M.Sc. VC: Computer Science

Intended learning outcomes:
When successfully completing this course, the students

- comprehend the purpose of model induction from data
- are familiar with the behaviour of simple learning algorithms on tabular static data and can apply them to derive models
- comprehend the purpose, challenges and basic instruments for model evaluation
- can evaluate models
- comprehend the purpose of data engineering in preparation of data mining
- are familiar with basic tasks of data engineering

and have thus acquired skills they need in order to design themselves learning algorithms, and to build workflows for model evaluation.

Content:

- Underpinnings: basic forms of learning
- BLOCK 1 - supervised: Classification algorithms and evaluation procedured
- BLOCK 2 - unsupervised: Clustering algorithms and evaluation procedures
- BLOCK Evaluation: more on model evaluation and model comparison
- BLOCK Data Engineering: basic steps on engineering the data before they are input to the model learner

Workload:

- 28 hours - in presence : lecture class (2 hours per week)
- 28 hourse in presence: exercise class (2 hours per week)
- 124 hours: independent work (for lectures, exerices and for the exam preparation)

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
A minimum number of points must be achieved during the course.	• Schriftliche Prüfung - Klausur (120 min) **COURTESY TRANSLATION:** • Written exam of the form 'Klausur' (120 min)	• Vorlesung (2 SWS) • Übung (2 SWS) **COURTESY TRANSLATION:** • Lecture (2 hours per week of the semester) • Exercise (2 hours per week of the semester)

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	• Databases • Data management • Basics in statistics

Media:	Literature:
	Book M: The book of the course is *Introduction to Data Mining* by Pan-Ning Tan, Michael Steinbach, Anuj Karpatne and Vipin Kumar. PEARSON, 2019 (2nd edition) • Chapters 2 and 3 • Parts of Chapters 4, 6, 7 • Parts of Chapters 8 and 10 Overview of the book under https://www-users.cs.umn.edu/~kumar001/dmbook/index.php including slide collections etc To read the full textbook (electronic version): Find the ebook from the library here, follow the direct link, and log in -> Shibboleth login -> Otto-von-Guericke University -> Log in -> read. *Note:* Some slides come from the 1st edition. They concern content that did not change between the two editions. **Book D:** *Data Preprocessing in Data Mining* by Salvador Garcia, Julian Luengo and Fransisco Herrera, SPRINGER International Publishing Switzerland, 2015**** This book is used in the Block 'Data Engineering' (Block 'Data' for short). This book is available as pdfs from our library. The chapters of relevance are mentioned in the description of the course block.****

Comments:

This module is intended for students in low semesters of 4-semester-long master degrees and assumes a limited background in data science. It is not appropriate for students with a bachelor degree in data science.

Data and Knowledge Engineering

Sommer

(in German: Data and Knowledge Engineering)

Module-ID: FIN-INF-120500

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
	6	Sommer	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	
Responsibility:	Andreas Nürnberger
Lecturer:	Andreas Nürnberger
Classes:	Seminar *Data and Knowledge Engineering*
Applicability in curriculum:	- M.Sc. INF: Schlüssel- und Methodenkompetenzen - M.Sc. INGINF: Schlüssel- und Methodenkompetenzen - M.Sc. WIF: Schlüssel- und Methodenkompetenzen - M.Sc. DKE: Fundamentals of Data Science - M.Sc. VC: Schlüssel- und Methodenkompetenzen

Intended learning outcomes:
Students who complete the course ...

- understand how to work in practice with DKE approaches
- can perform a literature review on the state-of-the-art on a given topic
- can describe a given DKE task in form of a scientific paper
- can present and defend a practical project by a presentation and discussion

Content:
The seminar focuses on applying machine learning techniques to a hands-on problem, resulting in a paper and short presentation in one of the following research areas: Information Retrieval:

- Document organization
- Information management
- Ranking & Explainability

Natural Language Processing
- Named Entity Recognition
- Tokenization & Filtering
- Latent Representations of Words / Sentences / Documents

Human Computer Interaction
- Usability
- User Experience (UX) Design
- Human-AI interaction

Workload:
180 h self study

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
	Written report and oral presentation (*Referat*). Requirements for exam participation will be announced in the first week of the course in class and online.	Seminar

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	

Media:	Literature:

Comments:

Introduction to Simulation

Winter

(in German: Introduction to Simulation)

Module-ID: FIN-INF-120345

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
ItS	6	Winter	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	
Responsibility:	Graham Horton
Lecturer:	Graham Horton
Classes:	• Lecture *Introduction to Simulation* • Exercise class *Introduction to Simulation*
Applicability in curriculum:	- M.Sc. DKE: Fundamentals of Data Science - M.Sc. DE: Grundlagen Informatik - M.Sc. DE: Informatik Grundlagen (SPO 2027)

Intended learning outcomes:
Students who complete the course ...

- can analyse discrete, continuous and hybrid systems using a professional simulation tool
- know how to obtain an accurate result efficiently when integrating initial value problems numerically
- can carry out input and output analysis to obtain statistically significant results for stochastic, discrete-event models
- can select an appropriate modelling paradigm for a given situation
- can perform a simulation study and interpret its results

Content:
Introduction to the fundamentals and steps in a simulation study:

- discrete-event simulation
- random variables and random number generation
- statistical data analysis
- ordinary differential equations and numerical integration
- stochastic Petri nets
- the AnyLogic simulation system
- discrete-time Markov chains
- agent-based simulation

Workload:
56 contact hours + 124 h self study

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
	2h written exam	• 2 SWS lecture • 2 SWS exercise class

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	Basic engineering mathematics

Media:	Literature:
	Banks, Carson, Nelson, Nicol: Discrete-Event System Simulation

Comments:

Logik 2

Winter

(engl. Logic 2)

Modulnummer: FIN-INF-0

Kürzel	CP	Semester	Fachsem.	Dauer	Sprache	Niveau
Logik2	10	Winter	ab 4.	1 Semester	deutsch	Bachelor,Master

Link zum LSF:	LSF
Zugang beschränkt:	true
Verantwortung:	Fabian Neuhaus
Dozent:in:	Fabian Neuhaus
Lehrveranstaltungen:	Vorlesung Logik 2 Übung Logik 2
Verwendbarkeit:	- B.Sc. INF: Informatik - Wahlpflicht - B.Sc. INF: Informatik Wahlpflicht (SPO 2027) - B.Sc. CV: Informatik - Wahlpflicht - B.Sc. CV: Computervisualistik Wahlpflicht (SPO 2027) - B.Sc. INGINF: Informatik - Wahlpflicht - B.Sc. INGINF: Informatik Wahlpflicht (SPO 2027) - B.Sc. WIF: Verstehen und Gestalten - Wahlpflicht - B.Sc. WIF: Informatik Wahlpflicht (SPO 2027) - B.Sc. INF (bilingual): Informatik - Wahlpflicht - B.Sc. INF (bilingual): Informatik Wahlpflicht (SPO 2027) - M.Sc. INF: Informatik - M.Sc. INF: Informatik Wahlpflicht (SPO 2027) - M.Sc. INGINF: Informatik - M.Sc. WIF: Informatik - M.Sc. WIF: Informatik Wahlpflicht (SPO 2027) - M.Sc. DKE: Fundamentals of Data Science - M.Sc. DE: Grundlagen Informatik - M.Sc. DE: Informatik Grundlagen (SPO 2027) - M.Sc. VC: Computer Science - M.Sc. VC: Computer Science (SPO 2027)

Angestrebte Lernergebnisse:

- Anwendungen von ausgewählten Erweiterungen der klassischen Logik zur Wissensrepräsentation
- Anwendungen von ausgewählten nicht-klassischen Logiken zur Wissensrepräsentation
- Anwendung von Beweiskalkülen für Logiken
- Verstehen von fortgeschrittenen semantischen Methoden für Logiken
- Verstehen von metalogischen Beweisen und die Fähigkeit einfache metalogische Beweise selbst zu führen

Inhalt:
Die Veranstaltung baut auf der Pflichtveranstaltung Logik auf, in der die klassische Aussagen- und Prädikatenlogik eingeführt wird. In Logik 2 werden einerseits weiterführende Themen der klassischen Logik behandelt (u.a. Korrektheits-, Vollständigkeits- und Kompaktheitsbeweise). Darüber hinaus werden Erweiterungen der klassischen Logik sowie nichtklassische Logiken behandelt, z.B. Modallogik, Temporallogik, epistemische Logik, Konditionallogik, mehrwertige Logiken und Logik höherer Stufe.

Arbeitsaufwand:

- Präsenzzeiten: 14 X 4h = 56h
- selbständige Arbeit = 244h
  (Vorbereiten der Vorlesung,
  Lösen Übungsaufgaben,
  Vorbereitung Präsentation)

Prüfungsvorleistungen:	Studien-/Prüfungsleistungen:	Lehrform / SWS:
• 2 Drittel der Übungsaufgaben votiert • BA: mindestens 1 Präsentation • MA: mindestens 2 Präsentationen	Mündliche Prüfung	Übung 2 SWS Vorlesung 2 SWS

Voraussetzungen nach Prüfungsordnung:	Empfohlene Voraussetzungen:
keine	Erfolgreicher Abschluss des Modul Logik bzw. fundiertes Wissen im Bereich der Themen des Moduls"Logik.

Medienformen:	Literatur:

Hinweise:

Anmeldung via E-Learning-Plattform

Machine Learning

Winter

(in German: Machine Learning)

Module-ID: FIN-INF-120517

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
ML	6	Winter	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	
Responsibility:	Andreas Nürnberger
Lecturer:	Andreas Nürnberger
Classes:	• Lecture *Machine Learning* • Exercise class *Machine Learning*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Informatik - M.Sc. DKE: Fundamentals of Data Science - M.Sc. DE: Methoden der Informatik - M.Sc. VC: Computer Science

Intended learning outcomes:
Students ...

- can create machine learning pipelines and individual algorithms
- program decision trees, multi-layer perceptrons, and KNN classifiers in Java, Python, C++
- can evaluate the predictive performance of various classifiers for practical scenarios

Content:

- Introduction to concept spaces and concept learning
- Algorithms for instance-based learning and cluster analysis
- Algorithms for generating decision trees
- Bayesian learning
- Neural networks
- Association learning
- Reinforcement learning
- Hypothesis evaluation

Workload:
56 contact hours + 124h self study

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
	Written exam (also for pass/fail grade). Requirements for exam participation will be announced in the first week of the course in class and online.	• Lecture (2 SWS) • Exercise class (2 SWS)

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	Algorithmen und Datenstrukturen

Media:	Literature:

Comments:
Can only be credited if the module "Grundlagen des Maschinellen Lernens" has not been credited already.

Principles and Practices of Scientific Work and Soft Skills

Summer

(in German: Principles and Practices of Scientific Work and Soft Skills)

Module-ID: FIN-INF-120502

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
PPSW	6	Summer	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	true
Responsibility:	PD Dr. Claudia Krull
Lecturer:	PD Dr. Claudia Krull
Classes:	• Lecture PPSW • Exercise PPSW
Applicability in curriculum:	- M.Sc. INF: Schlüssel- und Methodenkompetenz (SPO 2027) - M.Sc. WIF: Schlüssel- und Methodenkompetenz (SPO 2027) - M.Sc. DKE: Fundamentals of Data Science - M.Sc. DE: Human Factors - M.Sc. DE: Schlüssel- und Methodenkompetenz (SPO 2027) - M.Sc. VC: Schlüssel- und Methodenkompetenz (SPO 2027)

Intended learning outcomes:

- Students know how a Goal is defined and are able to formulate it properly. based on that students know methods for time management.
- Students understand important aspects of project management and teamwork, including phases and pitfalls.
- Students are able to conduct a systematic literature review in order to gain an overview of an area of interest.
- Students are able to identify and formulate research hypothesis
- Students understand how a scientific publication is structured, can read it and extract the important information.
- Students are able to write a research proposal on a selected topic in the form of a scientific publication.
- Students understand how to present a research topic proposal on a selected topic.

Content:
The course covers the following topics, among others:

- Introduction to Scientific Work
- Literature Research and Management Research Projects and Thesis Topics
- Scientific Writing - Thesis Structure and Writing Techniques
- Study Skills & Self Management
- Project Management & Team Work
- Presentation Skills

The project and term paper topic can be related to an ongoing research project or be used for Master’s thesis preparation.
Workload:
40 h in person teaching 140 h independent work

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
participation in all classes completion of assignments keeping all deadlines	Report	Lecture (2 SWS) Exercise (2 SWS)

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	

Media:	Literature:

Comments:
participation is limited to 40