Valid from 2025.HS

Module description: Data Science

Module Code	w.MA.XX.DS.24HS
ECTS Credits	6
Language of Instruction/Examination	German
Module Description	The "Data Science" module focuses on the application of selected concepts, methods, tools, and best practices in the field of data science. The module comprises a total of three blocks. In the first block, "Advanced Data Management," students learn advanced methods of data management. The second block, "Applied Data Analysis & Modeling," builds on the first block and covers methods for collecting, processing and analyzing data, including machine learning (ML). The third block, "Foundation Models," is dedicated to the topic of foundation models (FMs). It deals with multimodal interactions (generative AI, multimodal with a focus on FMs), the control of FMs by means of prompting, retrieval augmented generation (RAG) and the generation and extraction of images and films. Owing to the application-oriented character of the module, students acquire the necessary knowledge that allows them to apply data science in practice.
Organizational Unit	Institut für Wirtschaftsinformatik
Module Coordinator	Mario Gellrich
Program and Specialization	• Business Information Technology
Legal Framework	Academic Regulations MSc in Business Information Technology dated 22.08.2019, Appendix to the Academic Regulations for the degree program in Business Information Technology, first adopted on 10.07.2012
Module Category	**Module Type** Compulsory
Prerequisite Knowledge	• Statistics • Python programming (procedural) • Working with Visual Studio Code • Working with Git and GitHub • File formats (e.g., XML, JSON) & data management • Database queries with SQL
Contribution to Program Learning Objectives (by the concerned Module)	• Professional Competence • Methodological Competence • Social Competence • Self-Competence
Contribution to Program Learning Objectives	**Professional Competence** • Knowing and Understanding Content of Theoretical and Practical Relevance • Apply, Analyze, and Synthesize Content of Theoretical and Practical Relevance • Evaluate Content of Theoretical and Practical Relevance **Methodological Competence** • Problem-Solving & Critical Thinking • Scientific Methodology • Work Methods, Techniques, and Procedures • Information Literacy • Creativity & Innovation **Social Competence** • Written Communication • Oral Communication • Teamwork & Conflict Management **Self-Competence** • Self-Management & Self-Reflection • Ethical & Social Responsibility • Learning & Change

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Module Learning Objectives	Students... • can store, query, and analyze temporal data. • can implement and manage real-time data streams. • can apply concepts of graph theory and use graph databases. • can manage, analyze, and visualize spatial data. • can collect data using web scraping and web APIs. • can process data to make it usable for analysis. • can perform exploratory data analyses to identify patterns, trends, and anomalies in the data. • can apply machine learning (ML) models to create predictive models. • can assess and improve the predictive quality of ML models. • can communicate the results of data analyses clearly and effectively. • can apply generative AI and multimodal foundation models (FMs). • can control the behavior of FMs using fine tuning and prompting. • can control the behavior of FMs using retrieval augmented generation (RAG). • can use FMs to implement requirements for conversational behavior in a conversational interaction. • can generate multimodal data (image, sound) using FMs. • can extract information from multimodal data (image, sound).
Module Content	**Block (1): Advanced Data Management** • Managing and using temporal data • Managing and using real-time data • Managing and using graph data • Managing and using spatial data **Block (2): Applied Data Analysis and Modeling** • Advanced data collection methods • Data preparation • Explorative data analysis (EDA) • Machine learning (ML) • Model performance & optimization • Communication of analysis results **Block (3): Foundation Models (FMs)** • Multimodal interactions (generative AI, multimodal FMs) • Control of FMs by means of prompting • Retrieval augmented generation (RAG) • Generating and extracting pictures & motion pictures
Links to other modules	This module is linked to the following modules:
Digital Learning Resources	• Teaching Videos • Practice and Application Exercises (with Key) • Case Studies (with Key) • Multiple Choice Tests
Methods of Instruction	• Application Tasks Social Settings Used: • Literature Review • Group Work • Problem-Oriented Teaching • Individual Work • Exercises • Project Work • Lecture • Case Studies

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Type of Instruction

	Classroom Instruction	Guided Self-Study	Autonomous Self-Study
Lecture	22 h	-	
Excercise	22 h	56 h	
Project Work	12 h	-	
Seminar	-	-	
Total	**56 h**	**56 h**	**68 h**

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Performance Assessment	End-of-module exam		Form	Length (min.)	Weighting
	-				
	Permitted Resources				

	Others	Assessment	Format	Length (min.)	Weighting
	Performance assessment on the topic of "Applied Data Analysis & Modeling" *Students complete tasks set by lecturers in an individual performance assessment in the form of a practical programming exam. The procedure for the performance assessment is communicated by the lecturers on the Moodle learning platform.*	Grade	Einzelarbeit	180	33.00
	on Performance assessment the topic of "Applied Data Analysis & Modeling" *Students complete tasks set by lecturers in an individual performance assessment in the form of a practical programming exam. The procedure for the performance assessment is communicated by the lecturers on the Moodle learning platform.*	Grade	Einzelarbeit	180	33.00
	Performance assessment on the topic of "Foundation Models (FM)" *Students complete tasks set by lecturers in an individual performance assessment in the form of a practical programming exam. The procedure for the performance assessment is communicated by the lecturers on the Moodle learning platform.*	Grade	Einzelarbeit	180	34.00

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Classroom Attendance Requirement	Other The attendance requirements apply to individual days. Attendance requirements are communicated in good time in class and via the Moodle learning platform. Mandatory attendance is required for on-site examinations/project work as part of hackathons. Exact dates will be communicated at the beginning of the semester and the attendance requirements apply to individual days.
Compulsory Reading	• The compulsory literature (German or English) handed out in the courses or provided on the Moodle teaching platform applies.
Recommended Reading	
Comments	Although the language of instruction is German, the documents (e.g., presentations, exercises) are always issued in English. The reason for this is that most terms in "Data Science" are formulated in English, thus ensuring uniform and clear communication. It also facilitates access to further literature and current research results, which are predominantly written in English.