# Master of Science (M.Sc.)

# „Business Informatics“

University of Mannheim

– Module catalog –

**Appendix**

Academic Year

HWS 2025/ FSS 2026

The following modules were added to the course program after the publication of the module catalogue.

## 1. Overview

## C. Specialization Courses

### ii. IE-Courses

| Module no. | Name of Module | Offered | Language | ECTS |
|---|---|---|---|---|
| IE 685 | Large language Models and Agents | FSS | E | 3 |
| IE 692 | Advanced Process Mining | FSS | E | 6 |

### iii. IS-Courses

| Module no. | Name of Module | Offered | Language | ECTS |
|---|---|---|---|---|
| IS 608 | Analytics for Digital Markets | HWS/ FSS | E | 6 |
| IS 609 | AI Strategy: Business Models, Competition, and Markets | HWS/ FSS | E | 6 |
| IS 617 | Large Language Models for the Economic and Social Sciences | HWS | E | 6 |
| IS 618 | Social Media Data Analysis | FSS | E | 6 |

### iv. International Courses & other Specialization Courses

| Module no. | Name of Module | Offered | Language | ECTS |
|---|---|---|---|---|
| | Unwrapping the mind: knowledge, cognition, and AI | HWS | E | 5 |

## D. Projects and Seminars

### iii. Seminars

| Module no. | Name of Module | Offered | Language | ECTS |
|---|---|---|---|---|
| IS 703 | Master Seminar „AI, Platforms, and the Digital Economy“* | Irregular | E | 4 |
| IS 704 | Data Science III: Social Data Science Not offered in FSS 26* | Irregular | E | 4 |
| CS 733 | Advanced Topics in Process Mining | FSS | E | 4 |
| CS 734 | Green Software Engineering | FSS | E | 4 |

*For a detailed description please use the module catalog of the „Mannheim Master in Management“: https://www.bwl.uni-mannheim.de/en/programs/master/mmm/module-catalogs-2011-2020/

## 2. Detailed descriptions

## C. Specialization Courses

**ii. IE-Courses**

| **IE 685** | **Large Language Models and Agents** |
|---|---|
| Form of module | Lecture |
| Type of module | Specialization course |
| Level | Master |
| ECTS | 3 |
| Workload | Hours per semester: 28 h (2 SWS)<br>Self-study: 56 h per semester<br>● 31 h: pre and post lecture studying and revision<br>● 25 h: examination preparation |
| Prerequisites | ● Machine learning concepts and techniques<br>● Knowledge about natural language processing |
| Aim of module | Large Language Models (LLMs) such as GPT, Llama, Gemini and Claude, have the potential to enable a wide range of new applications and to significantly improve the performance of existing systems. The course introduces students to LLMs as well as their application. The course covers the following topics:<br>● Introduction to LLMs<br>● Prompt engineering<br>● LLM-based agents<br>● Tool use and environment interaction<br>● Retrieval augmented generation<br>● Context engineering for LLM agents<br>● Safety and security of LLM agents<br>● Evaluation of LLM agents<br><br>It is highly recommended to attend the course IE 686 Large Language Models and Agents Project in the same semester as this course as the schedules of both courses are aligned to each other. |
| | Expertise: |

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| Learning outcomes and qualification goals | Students will be able to identify opportunities for employing Large Language Models in business applications and will learn to select and apply appropriate prompt/context engineering techniques for solving complex tasks. (MK1, MF1) |
| | Methodological competence:<br>Participants will acquire knowledge on the application of Large Language Models and LLM agents for solving real-world problems. (MK2, MF3, MF4, MKO3) |
| | Personal competence: - |
| Media | Slide sets |
| Literature | ● Zhao, et al.: A Survey of Large Language Models. arXiv:2303.18223v16, 2025.<br>● Wang, et al.: A Survey on Large Language Model based Autonomous Agents. Frontiers of Computer Science, 2024.<br>● Mohammadi, et al. Evaluation and benchmarking of LLM agents: A survey. SIGKDD Conference on Knowledge Discovery and Data Mining, 2025. |
| Methods | The course consists of a lecture that introduces students to Large Language Models and state of the art prompt/context engineering techniques. |
| Form of assessment | Written examination |
| Admission requirements for assessment | - |
| Duration of assessment | 60 minutes |
| Language | English |
| Offering | Spring semester |
| Lecturer | Prof. Dr. Christian Bizer<br>Dr. Ralph Peeters |
| Person in charge | Prof. Dr. Christian Bizer<br>Dr. Ralph Peeters |
| Duration of module | 1 semester |
| Further modules | - |
| Range of application | M.Sc. Mannheim Master in Data Science, Mannheim Master in Social Data Science, M.Sc. Wirtschaftsinformatik, Lehramt Informatik |

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| Semester | 2nd/3rd semester |

| **IE 692** | **Advanced Process Mining** |
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| Form of Module | Lecture with exercise |
| Type of Module | Specialization course |
| Level | Master |
| ECTS | 6 |
| Workload | 150 h per semester |
| Prerequisites | Familiarity with Petri nets and BPMN for process modeling, along with basic Python programming skills, is expected. Prior experience in process mining is not a prerequisite. |
| Aim of module | Process mining is a data-driven discipline that extracts qualitative and quantitative insights into the execution of organizational processes through the analysis of event data. It combines formal process models with data science and machine-learning techniques. The course covers the foundations, algorithms, and state-of-the-art methods of process mining, including:<br>• Process discovery<br>• Conformance checking<br>• Process enhancement<br>• Predictive monitoring<br>• Non-traditional event data, including object-centric and partially ordered event data<br>• Event data preprocessing, abstraction, and clustering<br>Lectures are complemented by hands-on exercises that primarily focus on pen-and-paper problem solving, supported by selected implementations and evaluations using open-source process mining tools. A group project allows students to apply and evaluate process mining and ML-based methods in a practical setting. |
| Learning Outcomes and Qualification Goals | Knowledge:<br>After completing the course, students will be familiar with both fundamental and state-of-the-art process mining techniques and algorithms for the data-driven analysis of business processes. (MK1, MK2) |

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| | Capabilities:<br>• After completing the course, students will be able to analyze business processes using process mining techniques and (open-source) process mining tools.<br>(MF1, MF2, MF3) |
| | Competencies:<br>• During the course, students will learn to apply, compare, and evaluate process mining techniques on synthetic and real-world data, both individually and in teams.<br>(MKO1, MKO3) |
| Media | Electronic slides and exercise sheets |
| Literature | • van der Aalst: Process Mining: Data Science in Action, 2nd edition, Springer (2016)<br>DOI: 10.1007/978-3-662-49851-4<br>• van der Aalst & Carmona (Editors): Process Mining Handbook, Springer (2022)<br>DOI: 10.1007/978-3-031-08848-3<br>• Carmona et al.: Conformance Checking: Relating Processes and Models, Springer (2018)<br>DOI: 10.1007/978-3-319-99414-7<br>• Additional academic papers will be recommended on a per-lecture basis. |
| Teaching and Learning Methods | • Lectures<br>• Homework exercises to practice with joint discussion in exercise sessions |
| Form of assessment | 80% written exam<br>20% group assignment |
| Admission requirements for assessment | - |
| Duration of assessment | The exam will take 90 minutes; the assignment will be spread over various weeks with a single deadline towards the end of the semester. |
| Language | English |
| Offering | Spring semester |
| Lecturers | Prof. Dr. Daniel Schuster |
| Person in charge | Prof. Dr. Daniel Schuster |

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| Duration of module | 1 semester |
| Further modules | - |
| Range of Application | M. Sc. Wirtschaftsinformatik,<br>M.Sc. Mannheim Master in Data Science<br>M.Sc. Mannheim Master in Social Data Science |
| Semester | 2nd semester |

### iii. IS-Courses

*For a detailed description please use the module catalog of the „Mannheim Master in Management“: https://www.bwl.uni-mannheim.de/en/programs/master/mmm/module-catalogs-2011-2020/

### iv. International Courses & other Specialization Courses

| | **Unwrapping the mind: knowledge, cognition, and AI** |
|---|---|
| Form of module | Lecture |
| Type of module | Elective |
| Level | Master |
| ECTS | 5 |
| Workload | Hours per semester present: 28 h (2 SWS) |
| | Self-study: 112 h per semester |
| Prerequisites | None |
| Aim of module | With the rise of AI models like GPT-4, machines seem capable of mimicking human cognitive processes—thinking, perceiving, learning, and even making decisions. Hence, the question what the core of “human cognition” actually is, has become a focus of interest. In this lecture series, experts in cognitive science will explore different questions, for example what makes human cognition exceptional (if at all), how AI challenges our understanding of intelligence, and what we might gain from integrating AI into cognitive research. We will also address how |

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| | insights from human cognition can help develop more efficient, interpretable AI models and examine the ethical considerations that come with their use.<br>The perspective of psychology will approach human cognition using both experiments and formal modeling. Lectures will tackle human judgment and decision making, memory processes and memory strategies developing across the life-span, categorization and estimation as well as metacognition - the knowledge about one's own cognitive processes. .<br>From the linguistic perspective, we will focus on language acquisition and processing, as well as on the question how language relates to other domains of cognition. We will present both experimental results and historical corpus data to showcase how language is represented and processed in the mind and how learners acquire language along the dimension of time.<br>From a computational and AI-driven standpoint, the series will cover the modeling of cognitive processes, investigating how human judgment and decision-making are represented in computational frameworks. We will also explore the inner workings of AI language models, discussing how they process and generate language and how they can be extended through multimodal learning and interaction with users.<br>The philosophy lectures will explore what it means to say that something or someone "thinks" or "feels". We examine whether attributing mental states to artificial machines differs fundamentally from doing so to humans or non-human animals. We hope that this will also shed light on the broader implications of AI for our general understanding of mind and agency.<br>Bringing together research from psychology, linguistics, computational science, and philosophy, this series offers a rich and interdisciplinary exploration of intelligence, learning, and perception—both human and artificial. |
| Learning outcomes and qualification goals | Expertise:<br>Students will acquire knowledge of current research on language and the mind at the crossroads of linguistics, natural language processing, psychology and philosophy.<br>(MK1, MK2, MK3) |
| | Methodological competence:<br>Students learn to understand and summarize the state of the art in a certain area and discuss achievements and open problems.<br>(MF2, MKO2) |

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| | Personal competence: - |
| Media | Slides, Research Papers |
| Literature | Recommended Papers from invited speakers |
| Methods | Lectures, independent study |
| Form of assessment | Written examination |
| Admission requirements for assessment | - |
| Duration of assessment | 90 Minutes |
| Language | English |
| Offering | Fall semester |
| Lecturer | Prof. Dr. Arndt Bröder, Prof. Dr. Beatrice Kuhlmann, Prof. Dr. Carola Trips, Prof. Dr. Nicole Altvater-Mackensen, Prof. Dr. Simone Paolo Ponzetto, Prof. Dr. Wolfgang Freitag, Invited Speakers |
| Person in charge | Prof. Dr. Arndt Bröder, Prof. Dr. Beatrice Kuhlmann, Prof. Dr. Carola Trips, Prof. Dr. Nicole Altvater-Mackensen, Prof. Dr. Simone Paolo Ponzetto, Prof. Dr. Wolfgang Freitag |
| Duration of module | 1 Semester |
| Further modules | - |
| Range of application | M.Sc. Wirtschaftsinformatik, MMDS, MMSDS |
| Semester | 2.-4. |

## D. Projects and Seminars

### iii. Seminars

*For a detailed description for IS 703 and IS 704 please use the module catalog of the „Mannheim Master in Management“:
https://www.bwl.uni-mannheim.de/en/programs/master/mmm/module-catalogs-2011-2020/

| **CS 733** | **Advanced Topics in Process Mining** |
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| Form of Module | Seminar |
| Type of Module | Seminar |
| Level | Master |
| ECTS | 4 |
| Workload | 120 h per semester |
| Prerequisites | Participants are expected to have fundamental knowledge of process mining, including basic concepts, techniques, and tools, to actively engage with the seminar content. |
| Aim of module | In this seminar, each student conducts scientific research on advanced topics in process mining, either as a literature review, a small experimental study, or a combination of both. Each student prepares a written report and delivers a presentation to the class, sharing their findings and insights with peers.<br>Topics of interest include classical process mining tasks, such as process discovery, conformance checking, and predictive process monitoring, explored through current research trends and novel approaches, including generative AI, machine learning applications, and the analysis of non-traditional event data types. The seminar encourages students to investigate innovative methods, emerging challenges, and practical implications in the field. |
| Learning Outcomes and Qualification Goals | Expertise:<br>Students will develop a deep understanding of the research topic. They are expected to critically analyze and comprehensively summarize the topic in their own words, as well as evaluate the contribution of the research papers to ongoing research in the field. |
| | Methodological competence:<br>Students will develop the methods and skills needed to identify relevant literature for their topic, design methodologically sound scientific experiments, write a well-structured scientific paper, and effectively present their results. They will also gain awareness of the importance of academic integrity and the need to avoid plagiarism. |

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| | Personal Qualification:<br>Students will acquire the skills required to identify relevant literature for a research topic, organize and conduct a small-scale research project, write a well-structured and concise academic paper, and effectively present their results. They will be well prepared to write and present a Master's thesis. |
| Media | Scientific papers and books |
| Literature | • Depends on the specific topic<br>• For a general overview of the field, the following book is recommended: Wil van der Aalst: *Process Mining: Data Science in Action*, 2nd edition |
| Teaching and Learning Methods | Perform scientific work independently under the guidance of a professor or a research staff member |
| Form of Assessment | • Seminar paper (50%)<br>• Mid-term presentation (10%)<br>• Final presentation (40%) |
| Admission requirements for assessment | – |
| Duration of Assessment | • Seminar paper:<br>18 pages (excluding appendix and references)<br>• Mid-term presentation:<br>10 minutes presentation + 10 minutes discussion<br>• Final presentation:<br>20 minutes presentation + 10 minutes discussion |
| Language | English |
| Offering | Irregular |
| Lecturers | Prof. Dr. Daniel Schuster |
| Person in charge | Prof. Dr. Daniel Schuster |
| Duration of module | 1 semester |
| Further modules | – |
| Range of Application | M. Sc. Wirtschaftsinformatik, M.Sc. Mannheim Master in Data Science |
| Semester | 3rd semester |

| **CS 734** | **Green Software Engineering** |
|---|---|
| Form of Module | Seminar |
| Type of Module | Seminar |
| Level | Master |
| ECTS | 4 |
| Workload | 120 h per semester |
| Prerequisites | CS Fundamentals; Previous participation in the courses “Web Search and Information Retrieval” and “Text Analytics” are recommended. |
| Aim of module | In this seminar, students perform scientific research, either in the form of a literature review or by conducting a small experiment, or a mixture of both, prepare a written report about the results, peer review reports and present their own results. Topics of interest focus around a variety of problems and tasks from the fields of Green Software Engineering combined with Data-Science, and Text Mining. |
| Learning Outcomes and Qualification Goals | Expertise:<br>Students will acquire a deep understanding of the research topic. He/she is expected to describe in-depth and summarize the topic in detail in his/her own words, judge the contribution of the research papers and present them<br>(MK1); (MK1, MK2, MK3) |
| | Methodological competence:<br>Students will develop methods and skills to find relevant literature for his/her topic, to prepare methodologically sound scientific experiments, and to write a well-structured scientific paper and to present his/her results. He/she will be also aware of the need to avoid plagiarism. The key qualification Scientific Research is highly recommended as a prerequisite for the seminar.<br>(MF1, MF2, MF3) |
| | Personal qualification:<br>Students will acquire skills on how to find relevant literature for a research topic, organize a small research task, write a well-structured, concise paper about it and present the results of their work. He/she is well prepared to write and present a Master’s Thesis.<br>(MKO1) MF2 |

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| Media | Slides, scientific papers, books, software and datasets |
| Literature | Depends on the sub-topic. |
| Teaching and Learning Methods | • Self-study of assigned material, presentation of scientific articles, joint discussion of work, collaboration with peers<br>• Preparation of a seminar report (12 pages, plus bibliography<br>• Presentation of the seminar paper and answering questions (15 minutes)<br>• Participation in the presentation discussions<br>• Reflection on a seminar report written by someone else |
| Form of Assessment | • Presentation and discussion (40%),<br>• Report (50%),<br>• Peer Review Report (10%) |
| Admission requirements for assessment | Presentation (10-15 min), 10-20 min discussion, Report (12-14 pages;6-8 weeks), Peer Review Report (1-5 Page) |
| Duration of Assessment | N/A |
| Language | English |
| Offering | Spring Semester |
| Lecturers | Pooja Rani, Research Staff |
| Person in charge | Pooja Rani, Research Staff |
| Duration of module | 1 semester |
| Further modules | - |
| Range of Application | M. Sc. Wirtschaftsinformatik, Mannheim Master in Data Science |
| Semester | 3rd semester |