

Master of Science (M.Sc.)
„Mannheim Master in Data Science“

University of Mannheim

– Module catalog –

Appendix

Academic Year

HWS 22/23

Die folgenden Veranstaltungen wurden nach Veröffentlichung des Modulkatalogs dem Kursprogramm hinzugefügt.

Overview

B. Fundamentals

| Module No. | Name of Module | Offered | Language | ECTS | Page |
|------------|--------------------------------------|---------|----------|------|------|
| IS 557 | Scientific Programming with Python** | Fall | E | 6 | MMM* |

* For a detailed description, please see the module catalog of the respective following degree programs:

- MMM: M.Sc. Mannheim Master in Management, <https://www.bwl.uni-mannheim.de/studium/master/mmm/>

**Prerequisites: No completed exam in CS 470 Programming with Python

C. Data Management

| Module No. | Name of Module | Offered | Language | ECTS | Page |
|------------|---------------------|---------|----------|------|------|
| CS 664 | Blockchain Security | Fall | E | 6 | 3 |

D. Data Analytics Methods

| Module No. | Name of Module | Offered | Language | ECTS | Page |
|------------|-----------------|---------|----------|------|------|
| CS 667 | Computer Vision | Fall | E | 6 | 5 |

E. Responsible Data Science

| Module No. | Name of Module | Offered | Language | ECTS | Seite |
|------------|--|-------------|----------|--------|-------|
| AC 654 | Additional Course – Responsible Data Science | Fall/Spring | E | Max 18 | 7 |

F. Project and Seminars

| Module No. | Name of Module | Offered | Language | ECTS | Seite |
|------------|-------------------------------|---------|----------|------|-------|
| CS 722 | Seminar Ethical Aspects of AI | Spring | E | 4 | |

Detailed Descriptions

C. Data Management

| CS 664 | Blockchain Security |
|----------------|---|
| Form of module | Inverted classroom with exercises |
| Type of module | Specialization course |
| ECTS | 6 |
| Workload | Hours per semester present: 56h (4 SWS), Self-study: 112h |
| Prerequisites | There are no formal prerequisites but knowledge in cryptography and/or IT-security is recommended, e.g., by attending the lectures “Kryptographie I” or “Selected Topics in IT-Security” |
| Aim of module | Blockchains promise secure and reliable data storage and consensus in a trustless environment. In the light of their growing popularity, Blockchain security becomes increasingly important. The course will equip students with a solid understanding of blockchains, their design principles, underlying technologies and cryptographic |

| | |
|---|---|
| | primitives. Bitcoin, Monero and Ethereum will be discussed in greater detail and a substantial part of the course will be devoted to security issues and possible attacks. |
| Learning outcomes and qualification goals | <p>Expertise: Students will acquire profound knowledge of Blockchain technology as well as the skills to critically examine the security of Blockchain-based systems.</p> <p>Methodological competence: Successful participants will be able to understand and evaluate the different ways in which different Blockchain systems try to achieve security. They will also be able to identify where, why and how these security measures are broken for both, current and new systems.</p> <p>Personal competence: The analytic, concentrated, and precise thinking of the students is trained. As multiple different but related Blockchains are discussed, their abstraction capacity is further developed and the transfer of the learned concepts to related questions is trained.</p> |
| Media | Video recordings, annotated lecture slides |
| Literature | Will be announced in the lecture |
| Methods | Reworking the lecture and studying the relevant literature in self-study. During the lecture: discussing questions and ideas and working together on concrete examples. Solving exercises in self-study and in practice in cooperation with fellow students. |
| Form of assessment | Written exam |
| Admission requirements for assessment | - |
| Duration of assessment | 90 Minutes |
| Language | English |
| Offering | HWS |
| Lecturer | Prof. Dr. Frederik Armknecht |
| Person in charge | Prof. Dr. Frederik Armknecht |
| Duration of Module | 1 Semester |
| Further Modules | - |
| Range of application | M.Sc. Mannheim Master in Data Science, M.Sc. Wirtschaftsinformatik Lehramt Informatik M.Sc. Mathematik M.Sc. Wirtschaftsmathematik |
| Semester | 1st/2nd/3rd semester |

D. Data Analytics Methods

| CS 667 | Computer Vision |
|---|--|
| Form of module | Lecture with Exercise |
| Type of module | Specialization Course |
| Level | Master |
| ECTS | 6 |
| Workload | Hours per semester present: 56 (4SWS) |
| Prerequisites | Basis skills in linear algebra, basis knowledge in python, machine learning; no completed exam in Higher Level Computer Vision (CS 646) |
| Aim of module | <ul style="list-style-type: none"> - CNNs, generative models and RNNs for computer vision - Detection, segmentation etc. - Self-supervised learning - Recent trends, e.g. transformers |
| Learning outcomes and qualification goals | <p>Expertise:</p> <p>The students have a detailed understanding of modern computer vision techniques based on machine learning. They can understand and evaluate given computer vision algorithms.</p> |
| | <p>Methodological competence:</p> <p>Students understand the technical basis of computer vision algorithms; they can explain the discussed methods and implement them.</p> |
| | <p>Personal competence: Understanding complex Computer Vision problems; thorough judgment in the design and use of methods; can work efficiently in a team.</p> |
| Media | Exercise sheets and lecture slides available online |
| Literature | <ul style="list-style-type: none"> - Computer Vision: Algorithms and Applications by Richard Szeliski |

| | |
|---------------------------------------|--|
| | - Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Orville |
| Methods | Lecture, weekly exercise, book studies, implementation of algorithms, visualization of results |
| Form of assessment | Written or oral examination (TBA) |
| Admission requirements for assessment | - |
| Duration of assessment | 90 minutes (Written examination) or 15 minutes (Oral examination) |
| Language | English |
| Offering | Fall Semester |
| Lecturer | Juniorprofessor Dr. Paul Swoboda |
| Person in charge | Juniorprofessor Dr. Paul Swoboda |
| Duration of module | 1 semester |
| Further modules | - |
| Range of application | M. Sc. Wirtschaftsinformatik, M.Sc. Mannheim Master in Data Science, Lehramt Informatik |
| Semester | 1st / 2nd / 3rd semester |

E. Responsible Data Science

| AC 654 | Additional Course – Responsible Data Science |
|--|---|
| Form of module | Depends on course |
| Level | Master |
| ECTS | Max. 18 |
| Workload | Depends on course |
| Prerequisites | Depends on course |
| Aim of module | The course falls into the responsible data science area of the MMDS and covers topics related to responsible data science, but is not directly equivalent to any course in the MMDS module catalogue. The course level equals a regular course in MMDS study program. The module can be taken either at the University of Mannheim or at any other university in Germany or abroad. |
| Learning outcomes and qualification goals | Depends on course |
| Media / Literature / Methods / Form and duration of assessment | Depends on course |
| Language | English preferred, but any other language possible if Mannheim faculty member is able to identify content and level |
| Offering | Spring semester / Fall semester |
| Lecturer | Lecturer at the host university |
| Person in charge | Lecturer at the host university |
| Duration of module | 1 Semester |
| Further modules | - |
| Range of application | MMDS |
| Semester | 2 nd /3 rd /4 th semester |

F. Projects and Seminars

| CS 722 | Seminar Ethical Aspects of AI |
|---|--|
| Form of Module | Seminar |
| Type of Module | Seminar |
| Level | Master |
| ECTS | 4 |
| Workload | 120 h per semester |
| Prerequisites | IE 661 / IS 661 "Text Analytics" or IE 675b "Machine Learning" or IE 678 "Deep Learning" or IE 560 "Decision Support" |
| 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, and prepare a written report about the results. Topics of interest focus around a variety of problems and tasks from the fields of Data-Science, Network Science and Text Mining. |
| Learning Outcomes and Qualification Goals | <p>Expertise:</p> <p>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, as well as to judge the contribution of the research papers to ongoing research.</p> |
| | <p>Methodological competence:</p> <p>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.</p> |

| | |
|---------------------------------------|--|
| | <p>Personal qualification:</p> <p>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.</p> |
| Media | Scientific papers and books; presentation with PowerPoint or LaTeX. |
| Literature | Up-to-date literature will be assigned during the seminar. |
| Teaching and Learning Methods | Review scientific work independently under the guidance of a professor or a research staff member. Active discussions in a group of peers. |
| Form of Assessment | Written report with oral presentation |
| Admission requirements for assessment | - |
| Duration of Assessment | N/A |
| Language | English |
| Offering | Spring Semester |
| Lecturers | Markus Strohmaier, Simone Ponzetto |
| Person in charge | Markus Strohmaier, Simone Ponzetto |
| Duration of module | 1 semester |
| Further modules | - |
| Range of Application | M. Sc. Wirtschaftsinformatik, M.Sc. Mannheim Master in Data Science, M. Sc. Mannheim Master Management |
| Semester | 3 rd semester |