Master of Science (M.Sc.)

„Mannheim Master in Data Science“

University of Mannheim

– Module catalog –

Appendix

Academic Year

HWS 2021/ FSS 2022

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

Modulnr.	Name des Moduls	Bereich	Semester	Sprache	ECTS	Seite
CS 470	Python for Data Scientists	Fundamentals	FSS	E	6	3
CS 660	Compiler Construction	Data Management	HWS	E	6	BI**
CS 661	Parallel Programming	Data Management	FSS	E	6	5
DA 100	Automated Media Content Analyses	Data Analytics Methods	HWS/FSS	E	6	7
IE 678	Deep Learning	Data Analytics Methods	FSS	E	6	BI****
IE 694	Artificial Intelligence Applications in Industry	Data Analytics Methods	FSS	E	6	9
MAA 519	Stochastic Calculus	Data Analytics Methods	HWS	E	5	WM*****
MAC 527	Markov Processes	Data Analytics Methods	FSS	E	4	WM*****
IS 540	Management of Enterprise Systems	Data Management	HWS	E	6	MMM***
MKT 511	Marketing Analytics	Data Analytics Methods	FSS	E	6	MMM***
MKT 545	Customers, Markets and Firm Strategy	Data Analytics Methods	FSS	E	6	MMM***
CS 720	Uncertainty Estimation	Projects and Seminars	FSS	E	4	11

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

BI: M.Sc. Business Informatics

https://www.wim.uni-mannheim.de/studium/studienorganisation/m-sc-business-informatics

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

MMM: M.Sc. Mannheim Master in Management

https://www.bwl.uni-mannheim.de/studium/master/mmm/

**** For a detailed description, please see the appendix of the respective following degree program:

BI: M.Sc. Business Informatics

https://www.wim.uni-mannheim.de/studium/studienorganisation/m-sc-business-informatics

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

WM: M.Sc. Business Mathematics

https://www.wim.uni-mannheim.de/media/Fakultaeten/wim/MK_M.Sc._Wima___Mathe_2021_22_11012022.pdf

CS 470	**Python for Data Scientists**
Form of module	Lecture and accompanying tutorial/practical sessions
Type of module	MMDS Fundamental
Level	Master
ECTS	6
Workload	Hours per semester present: 56h (4 SWS)
	Self-study: 84h per semester • 28h: pre and post lecture studying and revision • 56h: preparation and presentation of tutorial exercises
Prerequisites	None
Aim of module	The course will provide data scientists with the knowledge they need to be able to apply Python3 in data science projects. It assumes that students are familiar with another object-programming language such as Java, C# or C++, but does not assume any prior Python knowledge. Topics covered include – • The Python interpreter & programming paradigms • Basic expressions & control flow statements • Functions & scoping • Data structures • Modules • Classes & object-oriented concepts • Errors and exceptions • Testing and debugging • Exploring & visualizing data with Python

	• Machine learning applied - clustering and classification • Project management & (third-party) software repositories
Learning outcomes and qualification goals	Expertise: After taking the course, students will be familiar with Python3 and will be able to use it in data science projects
	Methodological competence: Students will acquire the skills to develop high-quality Python software for data science and other applications
	Personal competence: • ability to work independently • ability to work in a team
Media	Projector, PC (Linux), printed lecture slides
Literature	• Introduction to Computation and Programming Using Python, Third Edition (John. V. Guttag), MIT Press • Think Python: How to Think Like a Computer Scientist, 2nd Edition, Allen B. Downey, O`Reilly • The (Official) Python Tutorial
Methods	lectures, tutorials/practical sessions, independent study
Form of assessment	written examination (possibly including a programming test)
Admission requirements for assessment	none
Duration of assessment	120 minutes
Language	English
Offering	Spring Semester
Lecturer	Marcus Kessel
Person in charge	Marcus Kessel
Duration of module	1 semester
Further modules	-
Range of application	MMDS
Semester	1st/2nd semester

CS 661	**Parallel Programming**
Form of module	Lecture with Exercise
Type of module	Specialization Course
Level	Master
ECTS	6
Workload	Hours per semester present: 56h (4 SWS)
	Self-study: 112h
Prerequisites	Good programming skills.
Aim of module	In this course we will talk about various forms of paralleilsm: • multi-threading • SIMD vectorization • GPUs • distributed systems In order to target these hardware architectures, we will also discuss several programming languages/systems such as: • Java • C/C++ • OpenCL/CUDA • assembly language • OpenMP • MPI
Learning outcomes and qualification goals	Expertise: • Know various forms of parallelism. (MK1, MK2, MF1, MF3)
	Methodological competence: • Students will be able to use various forms of parallelism in software projects. (MF1, MF2, MF3)
	Personal competence: • Learn how to read software documentation. • Teamwork skills. (MK01, MK02)
Media	Lecture slides, exercise sheets, project assignments, software, software documentation
Literature	Schmidt, Bertil; Gonzalez-Dominguez, Jorge; Hundt, Christian; Schlarb, Moritz (2017). Parallel Programming: Concepts and Practice. ISBN-13: 978-0128498903. ISBN-10: 0128498900.

Methods	• Lecture • Weekly Exercises/programming projects
Form of assessment	Written examination (90 minutes)
Admission requirements for assessment	>=50% points in homework assignments in groups of 2-3 students
Duration of assessment	90 minutes written exam
Language	English
Offering	FSS 22
Lecturer	Junior Professor Dr. Roland Leißa
Person in charge	Junior Professor Dr. Roland Leißa
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

DA 100	**Automated Media Content Analysis**
Form of module	Exercise
Type of module	Data Analytics Methods
Level	Master
ECTS	6
Workload	Hours per semester present: 28 (2 SWS)
	Self-study: 145h (70h lectures/exercises, 75h research report)
Prerequisites	Basic skills in descriptive and inferential statistics, basic knowledge of data structures and data wrangling procedures, machine learning, web-scraping/web-mining
Aim of module	The course provides students with an overview of and first practical experiences in the application of automated content analysis methods for media texts and images. Arguing from a communication research perspective, it puts special emphasis on questions of reliability and validity. The course will cover the following topics: • Distinction of manifest and latent messages in media content • Basics of manual media content analysis • Measurement reliability and validity in content analysis • Text-mining applications for media content analysis (e.g., word & text metrics, dictionary-based approaches, sentiment analysis, topic modelling) • Machine-learning applications for media content analysis (supervised and unsupervised approaches) • Applications of distributional semantics and word embeddings for media content analysis • Computer vision applications for media content analysis • Validation strategies for obtained results
Learning outcomes and qualification goals	Expertise: After the course the students are aware of the typical research topics and questions in automated media content analyses and the different methodological approaches for tackling them; they know the different methods' potentials, limitations, and typical fields of application; they are able to develop their own specific research questions and can make an informed decision about which method to apply for answering it
	Methodological competence: Students are able to independently develop a research question and design in the area of automated media content analysis and can

	conduct a respective analysis using one of the different methodological approaches introduced in the exercise; they are able to document the results of their analyses in a research report and reflect upon their findings' limitations with regards to reliability and validity
	Personal competence: The course supports students to develop problem-solving competences with regards to research-design oriented questions. By solving exercises independently, the transfer of the learned material to related questions is promoted and self-confidence with regards to research-oriented tasks is gathered.
Media	Exercise sheets and lecture slides are available online
Literature	van Atteveldt, W., Trilling, D., & Arcila, C. (2021). Computational Analysis of Communication: A practical introduction to the analysis of texts, networks, and images with code examples in Python and R. http://cssbook.net/
Methods	Lecture elements, student presentations, weekly exercises, literature studies
Form of assessment	Written research report
Admission requirements for assessment	-
Duration of assessment	-
Language	English
Offering	HWS
Lecturer	MKW
Person in charge	MKW
Duration of module	1 semester
Further modules	-
Range of application	M.Sc. Data Science
Semester	1st/ 2nd/3rdsemester

IE 694	**Artificial Intelligence Applications in Industry**
Form of module	Lectures and Accompanying Tutorials
Type of module	Data Analytics Methods
Level	Master
ECTS	*6*
Workload	*Hours per semester present: 56 h (2 + 2 SWS)*
	Self-study: 124 h per semester Including the creation of a learning portfolio
Prerequisites	Recommended Knowledge: • Machine Learning Concepts and Techniques • Programming in Python
Aim of module	Participants will learn about the use of Artificial Intelligence methods, mostly from the field of machine learning in different sectors and industries. They will learn about application areas in the primary, secondary and tertiary sector, get an introduction to examples of such applications that have been published on a scientific level and gather some experience in working with data from the respective fields using publically available datasets.
Learning outcomes and qualification goals	Expertise: Students will acquire knowledge about possible applications of machine learning in different branches of industry as well as the dominant methods used in these areas.
	Methodological competence: Successful participants will be able to: • Identify potential for applying AI methods in different areas of industry; • Decide on a suitable method for addressing typical problems in these industries
	Personal competence: • Participants will learn to reflect and document their own learning process
Media	Slides, Book, Software Tools.
Literature	• Various Scientific Publications – details in the lecture slides
Methods	Lectures, tutorials, independent study
Form of assessment	Learning Portfolio

Admission requirements for assessment	n/a
Duration of assessment	-
Language	English
Offering	FSS
Lecturer	*Prof. Dr. Heiner Stuckenschmidt*
Person in charge	*Prof. Dr. Heiner Stuckenschmidt*
Duration of module	1 Semester
Further modules	-
Range of application	M.Sc. Wirtschaftsinformatik, Mannheim Master in Data Science
Semester	2.-4.

CS 720	**Uncertainty Estimation**
Form of Module	Seminar
Type of Module	Seminar
Level	Master
ECTS	4
Workload	120 h per semester
Prerequisites	Bachelor degree, the fundamentals
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 Mining, Web Mining, or the Semantic Web.
Learning Outcomes and Qualification Goals	Expertise: 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.
	Methodological competence: 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.
	Personal qualification: 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.
Media	Scientific papers and books
Literature	Depends on the topic of the seminar
Teaching and Learning Methods	Do scientific work independently under the guidance of a professor or a research staff member
Form of Assessment	Grading of the seminar paper, Peer Review, Presentation
Admission requirements for assessment	-

Duration of Assessment	N/A
Language	English or German
Offering	Spring semester
Lecturers	Tobias Weller
Person in charge	Prof. Dr. Heiko Paulheim
Duration of module	1 semester
Further modules	-
Range of Application	M. Sc. Wirtschaftsinformatik, M.Sc. Mannheim Master in Data Science, Lehramt für Gymnasien
Semester	3rd semester