Module Catalogue

Master's Programme: Data Science

(Master of Science, M.Sc.)

(120 ECTS credits)

Based on the *Prüfungs- und Studienordnung* of 18 July 2017

88/533/---/M0/H/2016

Issued on 12 September 2022

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Abbreviations and annotations

CP   credit points, ECTS credits
ECTS   European Credit Transfer and Accumulation System
h   hours
SoSe   summer semester
SWS   contact hours
WiSe   winter semester
WP   compulsory elective course/module
P   mandatory course/module

1. The ECTS credits assigned in the module catalogue are designated as follows: credit points not listed in parentheses are awarded when the relevant examination of the module or module parts has/have been completed successfully. Credit points in parentheses are listed for calculation purposes only.

2. The semester, in which a module should be taken, can either be mandatory or considered a recommendation, depending on the information in Anlage 2 of the *Prüfungs- und Studienordnung* of your degree programme. In this module catalogue, the options are indicated as "scheduled semester" or "recommended semester".

3. Please note: The module catalogue is for orientation purposes only while the provisions of the *Prüfungs- und Studienordnung* of your degree programme in the current version (in German only) are legally binding. See www.lmu.de/studienangebot and select your degreeprogramme.

Module: P 1 Inference and Sampling (Core Module Statistics)

Programme	Master's Programme: Data Science (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	P 1.1 Statistical Reasoning and Inference (Lecture)	WiSe	45 h (3 SWS)	75 h	(4)
Tutorial	P 1.2 Statistical Reasoning and Inference (Tutorial)	WiSe	15 h (1 SWS)	45 h	(2)
Lecture	P 1.3 Sampling and Experimental Design (Lecture)	SoSe	45 h (3 SWS)	75 h	(4)
Tutorial	P 1.4 Sampling and Experimental Design (Tutorial)	SoSe	15 h (1 SWS)	45 h	(2)

For successful completion of the module, 12 ECTS credits have to be acquired. Class attendance averages about 8 contact hours. Including time for self-study, 360 hours have to be invested.

Module type	Mandatory module with mandatory courses
Usability of the module in other programmes	None
Elective guidelines	None
Entry requirements	None
Semester	Scheduled semesters: 1 and 2
Duration	The completion of the module takes 2 semesters.
Content	The module *Inference and Sampling (Core Module Statistics)* covers fundamental statistical concepts and methods and consists of two courses, which each comprise a lecture accompanied by a tutorial. The first course, *Statistical Reasoning and Inference*, comprises (i) traditional and modern methods of statistical inference (maximum likelihood, composite likelihood, multiple testing, false discovery rate, etc.) and (ii) Bayesian approaches including computer intensive Markov-Chain-Monte-Carlo (MCMC) methods. The lecture is accompanied by a tutorial, in which the content of the lecture will be consolidated and numerical tools such as R will be applied. In the second course, *Sampling and Experimental Design*, fundamental ideas of sampling, bootstrapping, model selection, missing data, multivariate models and experimental design are introduced. A second focus of the lecture is on the analysis of "observational data" and related problems of potential biases. Finally, fundamental concepts

	and ideas of experimental design will be introduced. The lecture is accompanied by a tutorial.
Learning outcomes	Students learn fundamental concepts of statistical inference. They are able to use these concepts with new data and draw samples from complex data, and they know how to design experiments in order to draw conclusions from the data.
Type of examination	Written examination (120-180 minutes) or oral examination (30-45 minutes). In the summer semester 2023 an oral exam is planned.
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of relevant mandatory and possibly compulsory elective module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Göran Kauermann
Language(s)	English
Additional information	The course follows the book Kauermann, Küchenhoff, Heumann (2021), *Statistical Reasoning and Inference – for Data Science,* Springer.

Module: P 2 Knowledge Discovery and Big Data Management (Core Module Informatics)

Programme	Master's Programme: Data Science (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	P 2.1 Knowledge Discovery and Data Mining (Lecture)	WiSe	45 h (3 SWS)	75 h	(4)
Tutorial	P 2.2 Knowledge Discovery and Data Mining (Tutorial)	WiSe	15 h (1 SWS)	45 h	(2)
Lecture	P 2.3 Big Data Management (Lecture)	SoSe	45 h (3 SWS)	75 h	(4)
Tutorial	P 2.4 Big Data Management (Tutorial)	SoSe	15 h (1 SWS)	45 h	(2)

For successful completion of the module, 12 ECTS credits have to be acquired. Class attendance averages about 8 contact hours. Including time for self-study, 360 hours have to be invested.

Module type	Mandatory module with mandatory courses
Usability of the module in other programmes	None
Elective guidelines	None
Entry requirements	None
Semester	Scheduled semesters: 1 and 2
Duration	The completion of the module takes 2 semesters.
Content	The module *Knowledge Discovery and Big Data Management (Core Module Informatics)* covers all tasks within each step of the knowledge discovery process and consists of two courses, which each comprise a lecture accompanied by a tutorial. The first course, *Knowledge Discovery and Data Mining*, introduces feature representations and similarity measures as core concepts of data analysis. Based on these concepts, the course covers various methods from the area of data mining and pattern extraction (e.g. lazy learning, density-based clustering, k-medoid clustering, local outlier factor, a-priori algorithm, FP-growth, frequent subsequence mining). The second course, *Big Data Management*, focuses on the implementation of analysis methods and information systems for large, complex, and volatile data sets. First, modern data processing frameworks are presented that are used for managing, processing, and distributing data in data science

applications. These systems include batch processing (e.g. Hadoop, Spark), streaming systems (e.g. Storm, Flink), and NoSQL database systems (e.g. MongoDB, Cassandra). In addition, the course introduces data mining and machine learning techniques for large, heterogeneous and volatile data sets.

Learning outcomes	Students get an overview of the data analysis process as a whole as well as the individual tasks within this process and the different methods available to handle these tasks. They learn central techniques of data mining and pattern extraction and will be able to manage analysis processes by using suitable data management systems. This includes not only being able to use specific methods in a given system, but also being able to choose suitable methods and systems.
Type of examination	Written examination (120-180 minutes) or oral examination (30-45 minutes). In the summer semester 2023 an oral exam is planned.
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of relevant mandatory and possibly compulsory elective module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Matthias Schubert
Language(s)	English
Additional information	None

Module: P 3 Advanced Statistical Modelling and Programming

Programme	Master's Programme: Data Science (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Colloquium	P 3.1 Advanced Statistical Modelling and Programming (Colloquium)	WiSe	15 h (1 SWS)	105 h	(4)
Tutorial	P 3.2 Advanced Statistical Modelling and Programming (Tutorial)	WiSe	15 h (1 SWS)	45 h	(2)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 2 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Mandatory module with mandatory courses
Usability of the module in other programmes	None
Elective guidelines	None
Entry requirements	None
Semester	Scheduled semester: 1
Duration	The completion of the module takes 1 semester.
Content	This module comprises a variety of courses in advanced methods of statistics and computer science: advanced statistical modelling, multivariate statistics, algorithm design, and system development.
Learning outcomes	At the end of this module, all students will be on a homogeneous level of expertise in advanced methods in both statistics and computer science.
Type of examination	Written examination (60-90 minutes) or oral examination (15-20 minutes) or written assignment (15-30 pp.)
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of relevant mandatory and possibly compulsory elective module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Göran Kauermann / Prof. Dr. Thomas Seidl

Language(s)	English
Additional information	None

Module: P 4 Multivariate Statistics and Database Management

Programme	Master's Programme: Data Science
	(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Colloquium	P 4.1 Multivariate Statistics and Database Management (Colloquium)	WiSe	15 h (1 SWS)	105 h	(4)
Tutorial	P 4.2 Multivariate Statistics and Database Management (Tutorial)	WiSe	15 h (1 SWS)	45 h	(2)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 2 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Mandatory module with mandatory courses
Usability of the module in other programmes	None
Elective guidelines	None
Entry requirements	None
Semester	Scheduled semester: 1
Duration	The completion of the module takes 1 semester.
Content	This module comprises a variety of courses in advanced methods of statistics and computer science: advanced statistical modelling, multivariate statistics, algorithm design, and system development.
Learning outcomes	At the end of the module students will be on a homogeneous level of expertise in advanced methods in both statistics and computer science.
Type of examination	Written examination (60-90 minutes) or oral examination (15-20 minutes) or written assignment (15-30 pp.)
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of relevant mandatory and possibly compulsory elective module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Göran Kauermann / Prof. Dr. Thomas Seidl

Language(s)	English
Additional information	None

Module: P 5 Human Computation and Visual Analytics

Programme	Master's Programme: Data Science
	(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	P 5.1 Human Computation and Visual Analytics (Lecture)	WiSe	30 h (2 SWS)	30 h	(2)
Tutorial	P 5.2 Human Computation and Visual Analytics (Tutorial)	WiSe	30 h (2 SWS)	90 h	(4)
Practical project	P 5.3 Project in Human Computation and Visual Analytics	SoSe	15 h (1 SWS)	75 h	(3)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 5 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Mandatory module with mandatory courses
Usability of the module in other programmes	None
Elective guidelines	None
Entry requirements	None
Semester	Recommended semesters: 1 and 2
Duration	The completion of the module takes 2 semester(s).
Content	The module *Human Computation and Visual Analytics* covers those aspects of data science, in which humans either produce data, and process and analyse it with the help of algorithms, or in which data are presented to humans by a computer system. In the area of Human-Computer Interaction (HCI), the basics of human perception and cognition are introduced as well as some approaches for the design of usable systems. The lecture part on Visual Analytics (VA) covers the visual analysis of data by the human user as well as some visualization techniques. The lecture part on Human Computation (HC) gives an introduction to distributed data collection by humans (crowdsourcing), and the processing of data by humans, for example in the form of online games (HC). The tutorial includes lab sessions, in which students develop their own concepts based on what they have learned in the lecture. In the practical part, students will implement their own concepts for HC/VA systems in the form of a working prototype.
Learning outcomes	Students will learn to understand that the human user is an

integral part of the chain of collecting data, processing data and evaluating data. At the same time students will develop a consciousness for the effects of data science on the individual person as well as on society as a whole. At a technical level, students will understand and practically explore how to design and develop systems that involve the user either as a source, processor or recipient of data.

Type of examination	Oral presentation (30-60 minutes) and written assignment (15-30 pp.)
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of relevant mandatory and possibly compulsory elective module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Andreas Butz
Language(s)	English
Additional information	None

Module: P 6 Predictive Modelling

Programme	Master's Programme: Data Science (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	P 6.1 Predictive Modelling (Lecture)	SoSe	45 h (3 SWS)	75 h	(4)
Tutorial	P 6.2 Predictive Modelling (Tutorial)	SoSe	15 h (1 SWS)	45 h	(2)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Mandatory module with mandatory courses
Usability of the module in other programmes	None
Elective guidelines	None
Entry requirements	It is recommended that students have successfully completed the mandatory modules P3 and P4 before taking this module.
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	Predictive Modelling, in particular by means of non-linear, non-parametric methods, has become a central part of modern data analysis both in computer science and statistics in order to uncover complex patterns and relationships in data. The module covers models such as decision trees, support vector machines, and ensembles (random forest, bagging, boosting) and concludes with advanced techniques regarding model selection, feature selection, and hyperparameter optimization.
Learning outcomes	Students acquire theoretical as well as practical competences regarding the most important models of learning from data. The students should be able to conduct a data analysis project themselves, including understanding and interpreting the data, in order to critically judge advantages and disadvantages of the different methods. The accompanying tutorial covers a mix of theoretical and practical assignments. The latter will be conducted in R and will cover all methods introduced during the lecture.
Type of examination	Written examination (60-90 minutes) or oral examination (15-20 minutes) or written assignment (15-30 pp.)

	In the summer semester 2023 a written exam is planned.
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of relevant mandatory and possibly compulsory elective module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Bernd Bischl
Language(s)	English
Additional information	None

Module: P 7 Data Ethics and Data Security

Programme	Master's Programme: Data Science (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	P 7.1 Data Security and Data Anonymization (Lecture)	SoSe	15 h (1 SWS)	15 h	(1)
Tutorial	P 7.2 Data Security and Data Anonymization (Tutorial)	SoSe	15 h (1 SWS)	45 h	(2)
Lecture	P 7.3 Data Ethics	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Mandatory module with mandatory courses
Usability of the module in other programmes	None
Elective guidelines	None
Entry requirements	None
Semester	Recommended semesters: 2 and 3
Duration	The completion of the module takes 2 semesters.
Content	The module *Data Ethics and Data Security* covers basic legal and ethical questions and challenges of data security and privacy. The module comprises two courses. The first course consists of a lecture and a tutorial. The lecture introduces the foundations of data security and privacy as well as methodological and technical solutions in cryptography and data anonymisation. In the following tutorial, students learn to apply the contents of the lecture in micro-project The second course is a seminar with introductory talks on technical, legal, and ethical aspects of data security and privacy – especially when dealing with personal data or when planning experiments in data science – and students' presentations of their research on individual topics that address these issues.
Learning outcomes	Students will reflect on standard procedures and problems of data protection and learn technical methods to handle data responsibly.
Type of examination	Written examination (60-90 minutes) or oral examination (15-20 minutes) or written assignment (15-30 pp.)

In the summer semester 2023 a written exam is planned.

Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of relevant mandatory and possibly compulsory elective module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Dieter Kranzlmüller
Language(s)	English
Additional information	None

Module: WP 1 Selected Topics in Statistics

Programme	Master's Programme: Data Science (Master of Science, M.Sc.)

Related module parts

Course type	Course (compulsory elective)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 1.1 Selected Topics in Statistics (Lecture)	WiSe and SoSe	45 h (3 SWS)	75 h	(4)
Tutorial	WP 1.2 Selected Topics in Statistics (Tutorial)	WiSe and SoSe	15 h (1 SWS)	45 h	(2)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with elective courses
Usability of the module in other programmes	None
Elective guidelines	This module can be chosen in compliance with the following rules: In the compulsory elective modules WP 1 – WP 5, students have to take elective courses with a total of 12 ECTS credits.
Entry requirements	Students can find information about admission requirements in the LSF/moodle. They may also approach the Data Science program coordinator before choosing courses.
Semester	Recommended semester: 2 or 3
Duration	The completion of the module takes 1 semester.
Content	In the compulsory elective module WP 1, students may choose courses in specialized fields in statistics from the regularly offered master level courses. This includes courses at the partner universities TU Munich and University of Augsburg.
Learning outcomes	Students acquire theoretical and practical knowledge and skills in selected topics in statistics.
Type of examination	Written examination (60-90 minutes) or oral examination (15-20 minutes) or written assignment (15-30 pp.)
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of relevant mandatory and possibly compulsory elective module parts) has/have been completed successfully.

Responsible contact	Prof. Dr. Göran Kauermann / Prof. Dr. Andreas Butz
Language(s)	English
Additional information	None

Module: WP 2 Selected Topics in Informatics

Programme	Master's Programme: Data Science (Master of Science, M.Sc.)

Related module parts

Course type	Course (compulsory elective)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 2.1 Selected Topics in Informatics (Lecture)	WiSe and SoSe	45 h (3 SWS)	75 h	(4)
Tutorial	WP 2.2 Selected Topics in Informatics (Tutorial)	WiSe and SoSe	15 h (1 SWS)	45 h	(2)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with elective courses
Usability of the module in other programmes	None
Elective guidelines	This module can be chosen in compliance with the following rules: In the compulsory elective modules WP 1 – WP 5, students have to take elective courses with a total of 12 ECTS credits.
Entry requirements	Students can find information about admission requirements in the LSF/moodle. They may also approach the Data Science program coordinator before choosing courses.
Semester	Recommended semester: 2 or 3
Duration	The completion of the module takes 1 semester.
Content	In the compulsory elective module WP 2, students may choose courses in specialized fields in informatics from the regularly offered master level courses. This includes courses at the partner universities TU Munich and University of Augsburg.
Learning outcomes	Students acquire theoretical and practical knowledge and skills in selected topics in informatics.
Type of examination	Written examination (60-90 minutes) or oral examination (15-20 minutes) or written assignment (15-30 pp.)
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of relevant mandatory and possibly

	compulsory elective module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Göran Kauermann / Prof. Dr. Andreas Butz
Language(s)	English
Additional information	None

Module: WP 3 Theory of Selected Methods in Data Science

Programme	Master's Programme: Data Science (Master of Science, M.Sc.)

Related module parts

Course type	Course (compulsory elective)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 3.1 Theory of Selected Methods in Data Science (Lecture)	WiSe and SoSe	15 h (1 SWS)	15 h	(1)
Tutorial	WP 3.2 Theory of Selected Methods in Data Science (Tutorial)	WiSe and SoSe	15 h (1 SWS)	45 h	(2)

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 2 contact hours. Including time for self-study, 90 hours have to be invested.

Module type	Compulsory elective module with elective courses
Usability of the module in other programmes	None
Elective guidelines	This module can be chosen in compliance with the following rules: In the compulsory elective modules WP 1 – WP 5, students have to take elective courses with a total of 12 ECTS credits.
Entry requirements	Students can find information about admission requirements in the LSF/moodle. They may also approach the Data Science program coordinator before choosing courses.
Semester	Recommended semester: 2 or 3
Duration	The completion of the module takes 1 semester.
Content	In the compulsory elective module WP 3, students may choose courses in the field of data science with a focus on the theory of selected methods in data science. This includes courses at the partner universities TU Munich and University of Augsburg.
Learning outcomes	Students acquire theoretical knowledge on selected methods in data science.
Type of examination	Written examination (60-90 minutes) or oral examination (15-20 minutes) or written assignment (15-30 pp.)
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of relevant mandatory

and possibly compulsory elective module parts) has/have been completed successfully.

Responsible contact	Prof. Dr. Göran Kauermann / Prof. Dr. Andreas Butz
Language(s)	English
Additional information	None

Module: P 8 Data Science Practical (Practical Module)

Programme	Master's Programme: Data Science (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	P 8.1 Presenting Analyses in Data Science (Lecture)	WiSe and SoSe	15 h (1 SWS)	15 h	(1)
Tutorial	P 8.2 Presenting Analyses in Data Science (Tutorial)	WiSe and SoSe	15 h (1 SWS)	45 h	(2)
Practical project	P 8.3 Applied Data Science	WiSe and SoSe	30 h (2 SWS)	240 h	(9)

For successful completion of the module, 12 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 360 hours have to be invested.

Module type	Mandatory module with mandatory courses
Usability of the module in other programmes	None
Elective guidelines	None
Entry requirements	It is recommended that students have successfully completed the mandatory modules P1 and P2 before taking this module.
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	The module *Data Science Practical (Practical Module)* plays a central role in the curriculum of the master program. Practical experience with data-analytic methods, which are taught in the core modules and the compulsory elective modules, is essential in order to generate knowledge from data. Students will work on practical problems in the field of data science. The problems are typically concrete projects provided by business and industry partners. The students will tackle methodological challenges in the analysis of massive data; they will also learn to communicate the results and findings to the client. In the accompanying lecture and tutorial, the data and the methodologies used for the projects are discussed.
Learning outcomes	Students learn to work in teams with large datasets.

Type of examination	Oral presentation of results (45-75 minutes) and written report (30-40 pp.)
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of relevant mandatory and possibly compulsory elective module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Göran Kauermann / Prof. Dr. Matthias Schubert
Language(s)	English
Additional information	None

Module: P 9 Current Research in Data Science

Programme	Master's Programme: Data Science (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Seminar	P 9.1 Current Research in Data Science (Seminar)	WiSe and SoSe	30 h (2 SWS)	150 h	(6)
Colloquium	P 9.2 Data Science Workshops	WiSe and SoSe	15 h (1 SWS)	75 h	(3)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 3 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Mandatory module with mandatory courses
Usability of the module in other programmes	None
Elective guidelines	None
Entry requirements	It is recommended that students have successfully completed the mandatory modules P1 and P2 before taking this module.
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	In the seminar, an overview of current publications and new methodologies will provide insights into the field of data science. New developments will also be presented and discussed in the Data Science Workshops, e.g. the summer schools (Colloquium).
Learning outcomes	Students will deepen their skills of working with scientific publications and will learn to present newly acquired scientific knowledge. The Data Science Workshops, e.g. summer schools (Colloquium) will provide students with the opportunity to meet international experts in various specialised areas within the field of data science both from the academic world and from business and industry.
Type of examination	Oral presentation (30-60 minutes) and written assignment (15-30 pp.)
Type of assessment	The successful completion of the module will be graded.

Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of relevant mandatory and possibly compulsory elective module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Volker Schmid
Language(s)	English
Additional information	None

Module: WP 4 Selected Topics in Data Science

Programme	Master's Programme: Data Science (Master of Science, M.Sc.)

Related module parts

Course type	Course (compulsory elective)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 4.1 Selected Topics in Data Science (Lecture)	WiSe and SoSe	45 h (3 SWS)	75 h	(4)
Tutorial	WP 4.2 Selected Topics in Data Science (Tutorial)	WiSe and SoSe	15 h (1 SWS)	45 h	(2)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with elective courses
Usability of the module in other programmes	None
Elective guidelines	This module can be chosen in compliance with the following rules: In the compulsory elective modules WP 1 – WP 5, students have to take elective courses with a total of 12 ECTS credits.
Entry requirements	Students can find information about admission requirements in the LSF/moodle. They may also approach the Data Science program coordinator before choosing courses.
Semester	Recommended semester: 2 or 3
Duration	The completion of the module takes 1 semester.
Content	In the compulsory elective module WP 4, students may choose courses in specialized fields in data science. This includes courses at the partner universities TU Munich and University of Augsburg.
Learning outcomes	Students acquire theoretical and practical knowledge and skills in selected topics in data science.
Type of examination	Written examination (60-90 minutes) or oral examination (15-20 minutes) or written assignment (15-30 pp.)
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of relevant mandatory and possibly compulsory elective module parts) has/have been completed successfully.

Responsible contact	Prof. Dr. Göran Kauermann / Prof. Dr. Andreas Butz
Language(s)	English
Additional information	None

Module: WP 5 Applications of Selected Methods in Data Science

Programme	Master's Programme: Data Science (Master of Science, M.Sc.)

Related module parts

Course type	Course (compulsory elective)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 5.1 Applications of Selected Methods in Data Science (Lecture)	WiSe and SoSe	15 h (1 SWS)	15 h	(1)
Practical project	WP 5.2 Applications of Selected Methods in Data Science (Practical project)	WiSe and SoSe	15 h (1 SWS)	45 h	(2)

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 2 contact hours. Including time for self-study, 90 hours have to be invested.

Module type	Compulsory elective module with elective courses
Usability of the module in other programmes	None
Elective guidelines	This module can be chosen in compliance with the following rules: In the compulsory elective modules WP 1 – WP 5, students have to take elective courses with a total of 12 ECTS credits.
Entry requirements	Students can find information about admission requirements in the LSF/moodle. They may also approach the Data Science program coordinator before choosing courses.
Semester	Recommended semester: 2 or 3
Duration	The completion of the module takes 1 semester.
Content	In the compulsory elective module WP 5, students may choose courses in the field of data science with a focus on the application of selected methods in data science. This includes courses at the partner universities TU Munich and University of Augsburg.
Learning outcomes	Students acquire practical knowledge and skills in applications of selected methods in data science.
Type of examination	Written examination (60-90 minutes) or oral examination (15-20 minutes) or written assignment (15-30 pp.)
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of relevant mandatory

and possibly compulsory elective module parts) has/have been completed successfully.

Responsible contact	Prof. Dr. Göran Kauermann / Prof. Dr. Andreas Butz
Language(s)	English
Additional information	None

Module: P 10 Finale Module

Programme	Master's Programme: Data Science (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Thesis	P 10.1 Master's thesis	WiSe and SoSe	-	750 h	(25)
Disputation	P 10.2 Disputation	WiSe and SoSe	-	150 h	(5)

For successful completion of the module, 30 ECTS credits have to be acquired. Including time for self-study, 900 hours have to be invested.

Module type	Mandatory module
Usability of the module in other programmes	None
Elective guidelines	None
Entry requirements	It is recommended that students have successfully completed all mandatory and compulsory elective modules before taking this module.
Semester	Recommended semester: 4
Duration	The completion of the module takes 1 semester.
Content	The master's thesis concludes the study program. The thesis may be either research-orientated or stimulated by a practical problem. The thesis will be defended in a disputation.
Learning outcomes	Consolidation of acquired knowledge; independent scientific study.
Type of examination	Master's thesis (50-100 pp.) and disputation (40 minutes)
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of relevant mandatory and possibly compulsory elective module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Göran Kauermann / Prof. Dr. Thomas Seidl
Language(s)	English

Additional information   None