Note: The English translation is a service. If any doubts occur, the German proclamation No. 1601 is binding.

Revised version to the Regulations of the Programme-specific Part of the Examination Regulations for the Master's Degree Program "Data Science" at Technische Universität Braunschweig

The Faculty Council of TU Braunschweig's Carl-Friedrich-Gauß Faculty has adopted on 28.08.2024 the following Programme-specific Part of the Examination Regulations Pertaining to the Data Science Master's Degree Programme at Technische Universität Braunschweig (*Besonderer Teil der Prüfungsordnung für den Masterstudiengang Data Science an der Technischen Universität Braunschweig*, Data Science BPO):

1
Standard period of study

The standard period of study (*Regelstudienzeit*) for this Master's degree programme is four semesters.

2
Degree and awarded certificate

(1) TU Braunschweig will award the academic degree Master of Science (MSc) to candidates who have successfully passed the Master's examination. The University will confirm this by issuing a transcript of results and a degree certificate according to Section 17, Paragraph 1 of the General Part of the Examination Regulations for Bachelor's, Master's, Diplom and Magister Degree Programmes at Technische Universität Braunschweig (Allgemeiner Teil der Prüfungsordnung für die Bachelor-, Master-, Diplom- und Magisterstudiengänge an der Technischen Universität Braunschweig, APO). A diploma supplement (APO, Appendix 1) will be attached to the degree certificate.

(2) According to the APO, Section 17, Paragraph 1, the transcript of results will specify the student's grade point average (GPA) as well as list the marks for the individual modules and the credits awarded. In case of a GPA of 1.2 or better, the distinction *mit Auszeichnung bestanden* will be awarded. Non-graded modules will be listed along with earned credits (APO, Section 3, Paragraph 9).

3
Degree programme structure

(1) The Master's degree programme in Data Science comprises the following parts:

- Ramp-up Phase (10 credits)
- Electives from the "Methods and Concepts in Computer Science" field (25 credits)
- Electives from the "Methods and Concepts in Mathematics" field (25 credits)
- Electives from the "Data Science in Practical Application" field (15-20 credits)

- Electives from the “Key Qualifications and Ethics” field (10-15 credits)
- Master's thesis and presentation (30 credits)

(2) The modules that may be chosen from each subject field are listed in Appendices 2 and 3.

(3) The Ramp-up Phase is meant to ensure a successful entry into the study programme for students with different academic backgrounds. The fields in which modules must be attended during the Ramp-up Phase (either Mathematics or Computer Science) is determined by the Admissions Committee. The specific modules for the Ramp-up Phase will be selected in agreement with the student’s advisor and according to the requirements of the Examination Office.

(4) In the Data Science in Practical Applications field, students acquire specific skills for the practical use of Data Science in different application areas.

(5) The Key Qualifications and Ethics field covers methodical, social and personal skills. It consists of modules with an interdisciplinary, action-orientated focus that impart comprehensive and work-related qualifications and competencies.

(6) To successfully complete the degree programme, students must provide evidence of having accumulated a total of 120 credits. In addition to the Master’s thesis (30 credits), at least 65 credits points must be earned in graded modules. The same lecture/course may not be counted towards multiple modules.

4
Examinations and course achievements

(1) The modules and learning objectives, as well as the type and scope of the associated examinations and course achievements and the associated number of credits are set out in Appendices 2 and 3. The examination topics will reflect the learning objectives of the modules as well as work-related requirements.

(2) In addition to the options laid down in the APO, Section 9, an internship is a possible way of earning academic credits. An internship serves to deepen insights by applying the knowledge acquired in class to specific computing issues in a real work environment. There,

students are expected to successfully handle specific tasks, individually and as a team, and become skilled in subject-specific work methods.

(3) Homework assignments are another type of course achievement. Homework serves as a means to revise, follow up and deepen the content taught in the course. In a homework assignment, students independently practice and reinforce the terms and methods learnt in lectures by applying them to examples, and, if necessary, delve deeper into the topic.

(4) Colloquiums and protocols are additional types of course achievements which cover the student's planning, preparation and execution of assignments, as well as their critical evaluation. A protocol consists of a description and a critical evaluation of the assignment and its solutions. A colloquium is an oral examination in the form of an interview between student and examiner concerning the description and critical evaluation of the assignment and its solution.

(5) For term papers, there is a special deadline for withdrawals and submissions. As an exception to the APO, Section 11, Paragraph 1, students may withdraw without giving a reason through 15 February of the winter semester in question and through 15 August of the summer semester in question. In addition to the APO, Section 9c, the due date for term papers is 15 March for winter semesters and 15 September for summer semesters. Students may only register to submit a term paper if they have received a topic for the term paper in advance. Registration for a term paper is considered proof that the student was given a term paper topic.

(6) In addition to Section 9i APO, a separate registration and deregistration period applies to portfolio examinations. Registration and deregistration for portfolio examinations is only possible up to four weeks after the start of the lecture period of the respective semester.

(7) During their Data Science Master's degree programme, every student must complete one compulsory seminar that concludes with an assessment. The seminar must relate to the field of Data Science. A seminar from the module "Seminar Data Science - Section Mathematics" or "Seminar Data Science - Section Computer Science" can be chosen.Additional seminars will not be counted. For seminars, there is a special deadline for withdrawals and submissions. Registration for a seminar is possible up until the day of the kick-off event for the particular seminar. Withdrawals are only possible during the first two weeks of lectures for the semester in question.

(8) The topic of the seminar may be determined by lecturers in the Department of Computer Science and the Department of Mathematics or by the full-time private lecturers in those Departments. In agreement with the Examination Office, the topic may also be determined by retired lecturers from the Departments of either Computer Science or Mathematics and by other persons authorised to hold examinations as set out in the APO, Section 5, Paragraph 1.
(9) The optional project work comprises 15 credit points and is assigned to the elective area "Data Science in Applications". The processing time from the issue of the topic to the

submission of the project work is three months. Withdrawal is possible up to two weeks after the issue of the topic. The issue of the topic of the project work must be recorded. An extension of the duration of the project work is possible at the student's request if the reasons for this are not the student's responsibility. The extension must be recorded. If the processing time is exceeded without approval, the work must be graded as “not sufficient”.

(10) The topic of the project work can be assigned by the members of the university teaching group, as well as the full-time private lecturers in the departments of computer science, mathematics and those responsible for the module in the elective area “Data Science in Applications”. With the approval of the examination board, the topic can also be assigned by retired professors from the departments of computer science and mathematics.

(11) A module that does not appear in the Appendices hereto nor in a list of additional modules approved by the Data Science Examination Office may be accepted at a student’s request made to the Data Science Examination Office if that module provides a useful complement the student’s study plan.

(12) If the examination is again assessed as “not sufficient” in the last attempt or if it is assessed as “not sufficient”, the Master's examination is definitively failed. If this repeat examination is a written examination, the grade “fail” may only be awarded after a supplementary oral examination. The examinee must obtain a date for the supplementary oral examination from the examiner within one month of being notified of the grade and inform the Examination Board. If the examinee does not inform the examination board of the examination date within the one-month period, the examination board will assign the candidate a date for the supplementary oral examination. Notwithstanding Section 13 (5) APO, the date of the supplementary oral examination must be set by the examiner so that it has taken place by 15.11. at the latest for the previous summer semester and by 15.05. for the previous winter semester. If the examinee does not appear for the examination, the supplementary oral examination and thus the entire examination will be assessed with a grade of 5.0 and will result in the final failure of the degree program in accordance with Section 16 (3) APO. The Data Science Examination Board may extend the deadline in individual cases if there are valid reasons. These reasons must be presented to the Data Science Examination Board in writing without delay. If the supplementary oral examination cannot be taken for reasons of illness, a medical certificate must be submitted to the Examination Office within three working days in accordance with Section 11 (3) APO, with the proviso that this certificate must be issued by a specialist or a member of the professions specified therein. The examination day counts as the first working day. A Saturday also counts as a working day.

(13) Examinations in free or compulsory electives that were not passed, must be repeated during the degree programme. As an exception to this and to the APO, Section 13, Paragraph 4, a student may, in a maximum of three different failed attempts, apply to the Data Science Examination Office for waiver of the requirement to repeat the free or compulsory elective(s) if the student has passed alternative examinations. This application must be filed

until the first day of the exam registration period of the second semester following the failed attempt. Compulsory modules cannot be waived.

(14) If an examination cannot be taken on the day of the examination due to illness, a medical certificate is required. This must be submitted to the examination office within three working days. The examination day counts as the first working day. A Saturday also counts as a working day. Otherwise, the examination will be assessed as “failed” (grade 5.0). If the student is unable to take part in the same examination for the third time due to illness, Section 11 (3) APO applies with the proviso that this certificate must always be issued by a specialist doctor or a member of the professions specified therein. The same submission deadline of three working days applies.

(15) According to the APO, Section 18, additional credits may be earned through the end of the semester in which the last credit required to complete the Data Science Master’s degree programme is earned. An application to count these additional credits may only be filed if at least 30 credits have already been earned in Data Science modules.

(16) If an examination has only been completed in part, credits will not be awarded. Any applications for recognition of credits have to be filed within the first semester of the Master’s degree programme or, if the credits are earned at a later date, by the end of the following semester. If parts of a module have been credited by the Data Science Examination Office, that particular module must necessarily be completed by the end of the degree programme.

(17) Students must register for all examinations and assessments with the Data Science Examination Office, within the semester’s examination registration period – either in writing or electronically via the portal provided for this purpose within the examination registration period.

(18) For electronic communications during their studies, students must use their TU Braunschweig e-mail address to verify their identity.

(18) In addition to the APO, Section 12, Paragraph 2, examinations can also be graded as pass/fail (ungraded).

5
Master’s thesis

(1) The Master’s thesis is the final paper as set out in the APO, Section 14. In addition, the following rules are binding:

(2) Only students who have completed modules of the Data Science Master’s degree programme totalling a minimum of 75 credits will be permitted to register for their Master’s thesis.

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(3) The Master's thesis must address a topic in the field of Data ScienceThe topic of the Master's thesis may be issued by lecturers in the Department of Computer Science and the Department of Mathematics or by full-time private lecturers in those Departments. At a student's request and in agreement with the Examination Office, the topic may also be issued by a lecturer in the Data Science in Practical Application field or by a retired lecturer from the Departments of either Computer Science or Mathematics. In this case, the second examiner must be a full-time university professor in the Departments of either Computer Science or Mathematics.

(4) At a student's request, the Data Science Examination Office may agree that the second examiner may come from outside TU Braunschweig. Such a request must be filed one week before the written registration of the Master's thesis itself.

(5) The Master's thesis must be completed within six months of receiving the topic. Candidates wishing to change their topic may do so only once and only within two months of having been given the topic. At the student's justified request, the Examination Office may extend the deadline for completion by up to two months.

(6) In the case of illness during the period of the Master's thesis, a doctor's certificate must be submitted. The doctor's certificate must be submitted to the Examinations Office on the third working day following the discovery of the illness (if sent by post, the date of the postmark counts); the day on which the illness is discovered counts as the first working day. Saturday is also considered a business day. If the last day for submitting a medical certificate is a Saturday, Sunday or holiday, the deadline will be extended by that day and the medical certificate may be submitted on the next business day. If two medical certificates have already been submitted during the processing period for the Master's thesis, § 11 (3) APO applies, with the proviso that this certificate must always be issued by a specialist doctor or a member of the professions specified therein. The same deadline of three working days applies. The same deadline of three working days applies.

(7) Before the Master's thesis' grading, the student must give an oral presentation of it, lasting approximately 30 minutes. The presentation may count for up to 3 of the 30 credits towards the grading of the thesis if, for the chosen topic, the presentation makes a useful contribution towards reaching the degree programme's objectives. The examiner will announce the extent to which the presentation will count towards the overall mark on the day the topic is issued.

6
Calculation of the grade point average (GPA)

(1) Subject to the APO, Section 16, Paragraph 2, the GPA of the Master's examination derives from the average of the different module marks, weighted by number of credits, including the Master's thesis. If module marks are weighted differently than set out in the APO, Section 16,

Paragraph 2, this will be indicated in Appendix 3.

(2) Course achievement may be completed either graded or ungraded. Course achievement marks will not be listed on the degree certificate and will not count towards the student's GPA.

(3) If more modules have been completed than required by the Examination Regulations and the student has not requested them to be counted as additional examinations, module marks will be counted chronologically, according to the date they were earned, until the maximum number of credits has been reached or exceeded, in accordance with the APO, Section 16, Paragraph 2. Extra modules will be deleted. Deleted modules will not be listed on the degree certificate and cannot be converted into additional examinations.

(4) A student may request the inclusion of additional examinations on their degree certificate. Such a request must be filed within four weeks after passing the last additional examination, in accordance with the APO, Section 18, Paragraph 2. Examination results and course achievements listed as additional examinations will not count towards the final degree. Once this request has been made, it cannot be reversed.

7
Mentors and consultations

(1) At the start of their studies, the Examination Office will assign each student a mentor from the lecturers in the Departments of either Computer Science or Mathematics to support the student. A change of mentor is possible at any time at the request of one of the parties.

(2) The mentor's task is to set individual study priorities together with the student (cf. § 3 para. 4 and 5). At the student's request, regular meetings are held with the mentor to discuss the student's progress.

(3) Students who have not accrued at least 30 credits by the end of their second semester must attend a consultation. To be permitted to complete further course achievement or examinations, candidates must provide proof that they have attended this consultation by the first day of the examination registration period for their third semester. If such proof is not provided during the third semester, permission to complete further course achievements or examinations will be withheld for all following semesters until proof is provided within the deadline (the first day of the examination registration period of a semester).

Section II

(1) This new version (regulations) will come into force on 1 October 2024.

(2) For students who, at the time these regulations come into force, are in the examination regulations for the Master's degree program "Data Science" of 27.09.2021, TU Announcement No. 1373, last amended on 30.08.2023, TU Announcement No. 1517, the

following amendments apply:

a. § 3 para. 3 is deleted. The numbering of the following paragraphs shall be adjusted accordingly.
b. In the new § 3 para. 3, the last sentence is deleted.
c. § 4 is replaced by § 4 of these regulations.
d. § 5 para. 6 is replaced by § 5 para. 6 of these regulations.
e. § 7 para. 2 is replaced by § 7 para. 2 of these regulations.

(3) Students who are in their second or higher semester on 01.10.2024 and have successfully completed the module “Deep Learning in Remote Sensing” (BAU-STD5-59 - 6 CP) will get it recognized in the area of application. The modules “Deep Learning in Remote Sensing” (BAU-STD5-86 - 5 CP) and “Machine Learning” (BAU-STD5-87 - 5 CP) can then no longer be taken and included.

(4) Students who, at the time these regulations come into force, are in the examination regulations for the Master's degree program “Data Science” dated 27.09.2021, TU Announcement No. 1373, last amended on 30.08.2023 with TU Announcement No. 1517, can be examined according to the new regulations and annexes upon request. A subsequent change back to the previous regulations is excluded.

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Annex 1 Diploma Supplement: Programme-specific components

2. ANGABEN ZUR QUALIFIKATION	2. INFORMATION IDENTIFYING THE QUALIFICATION
2.1 Bezeichnung der Qualifikation und (wenn vorhanden) verliehener Grad (in Originalsprache)	**2.1 Name of qualification and (if applicable) title conferred (in original language)**
Master of Science (M. Sc.)	Master of Science (M. Sc.)
2.2 Hauptstudienfach oder –fächer für die Qualifikation	**2.2 Main Field(s) of study for qualification**
Data Science	Data Science
2.3 Name und Status (Typ/Trägerschaft) der Einrichtung, die die Qualifikation verliehen hat (in Originalsprache)	**2.3 Name and status of awarding institution (in original language)**
Technische Universität Carolo-Wilhelmina zu Braunschweig Carl-Friedrich-Gauß-Fakultät Universität/Staatliche Einrichtung	Technische Universität Carolo-Wilhelmina zu Braunschweig Carl-Friedrich-Gauß-Fakultät University/State institution
2.4 Name und Status (Typ/Trägerschaft) der Einrichtung (falls nicht mit 2.3 identisch), die den Studiengang durchgeführt hat (in Originalsprache)	**2.4 Name and status of institution (if different from 2.3) administering studies (in original language)**
Technische Universität Carolo-Wilhelmina zu Braunschweig Carl-Friedrich-Gauß-Fakultät Universität/Staatliche Einrichtung	Technische Universität Carolo-Wilhelmina zu Braunschweig Carl-Friedrich-Gauß-Fakultät University/State institution
2.5 Im Unterricht / in der Prüfung verwendete Sprache(n)	**2.5 Language(s) of instruction/examination**
Englisch, in einigen Fällen Deutsch	English, in some cases German
3. ANGABEN ZU EBENE UND ZEITDAUER DER QUALIFIKATION	**3. INFORMATION ON THE LEVEL AND DURATION OF THE QUALIFCATION**
3.1 Ebene der Qualifikation	**3.1 Level of the qualification**
Master-Studium (Graduate/Second Degree)	Graduate/Second Degree, by research with thesis
3.2 Offizielle Dauer des Studiums (Regelstudienzeit) in Leistungspunkten und/oder Jahren	**3.2 Official duration of programme in credits and/or years**
2 Jahre Vollzeitstudium (inkl. Schriftlicher Abschlussarbeit), 120 ECTS Leistungspunkte	2 years full-time study (incl. thesis), 120 ECTS credits
3.3 Zugangsvorraussetzung(en)	**3.3 Access requirements**
Qualifizierter Bachelor-Abschluss (oder gleichwertiger Abschluss) Bachelor in Informatik oder Mathematik oder vergleichbarer Abschluss im selben oder thematisch ähnlichen Gebiet	Bachelor Degree in Computer Science or Mathematics or equivalent degree (three or four years) in the same or closely related field
4. ANGABEN ZUM INHALT DES STUDIUMS UND ZU DEN ERZIELTEN ERGEBNISSEN	**4. INFORMATION ON THE PROGRAMME COMPLETED AND THE RESULTS OBTAINED**
4.1 Studienform	**4.1 Mode of study**
Vollzeitstudium	Full-time
4.2 Lernergebnisse des Studiengangs	**4.2 Programme learning outcomes**
Gegenstand des Masterstudiums sind fachliche Vertiefungen und fortgeschrittene Kenntnisse in allen für Data Science relevanten Bereichen. Die Absolventen erlangen vertiefte Kenntnisse über mathematische und informatische Methoden der Data Science. Sie erlangen ergänzend Einblicke in Anwendungsgebiete für Techniken der Data Science und in die damit verbundene aktuelle Forschung. In einem der ausgewählten Vertiefungsbereiche aus mathematischen oder informatischen Grundlagen oder aus einem Anwendungsbereich muss eine Master-Abschlussarbeit im Umfang eines Semesters selbständig angefertigt werden. Die Absolventen • können Methoden und Konzepte der Datenakquisition, Datenintegration und Datenhaltung analysieren und effektiv nutzen. • können Analysemethoden und Algorithmen für verschiedene Fragestellungen kompetent	Subject of the Master programme is the deepening of knowledge in the data science field. Students get deepened knowledge about mathematical and informatical methods of data sciene. They get additional insights into application areas for techniques of data science and the connected research. The students have to complete a master thesis of one semester in the mathematical, computer science or application fields of the data science programme. The graduates • can analyze methods and concepts of data acquisition, data integration and data storage and use them effectively. • can competently select analysis methods and algorithms for various problems, combine them, adapt them to a selected field of application and develop them further.

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auswählen, kombinieren, an ein ausgewähltes Anwendungsfeld anpassen und weiterentwickeln. • können die Aussagekraft von Dateninstanzen und den verwendeten Analysemethoden korrekt und dem Analysezweck entsprechend einschätzen. • können in einem ausgewählten Anwendungsfeld datengetriebene Lösungen entwickeln und Analysemethoden zielführend einsetzen. • können Datenprojekte in Unternehmen leiten und Entscheidungsprozesse in der Datenhaltung und -analyse effektiv managen. • tragen zur Lösung von Aufgabenstellungen im Bereich Data Science sowohl aus erklärungsorientierter als auch aus gestaltungsorientierter Sicht bei. • kennen, auch zur eigenständigen Weiterentwicklung, relevante Informationsquellen sowie die einschlägigen Regelwerke und den Zugang zu diesen Materialien. • können analytisch denken, komplexe Zusammenhänge erkennen, vorhandene und neue Problemlösungen einschätzen und mit Hilfe einer Anwendung integraler Kenntnisse aus dem Bereich Data Science eigene Lösungen entwickeln. • können erfolgreich in einer Gruppe arbeiten und effizient mit verschiedenen Zielgruppen kommunizieren. • können sich in aktuelle Forschungsergebnisse des Fachs einarbeiten und diese weiter entwickeln. • sind damit befähigt eine wissenschaftliche Tätigkeit mit dem Ziel einer Promotion auszuüben.	• are able to correctly assess the informative value of data instances and the analysis methods used and in accordance with the purpose of the analysis. • can develop data-driven solutions in a selected field of application and use analysis methods in a targeted manner. • can lead data projects in companies and effectively manage decision-making processes in data storage and analysis. • contribute to solving tasks in the field of data science from both an explanatory and a design-oriented perspective. • know, also for independent further development, relevant sources of information as well as the relevant regulations and access to these materials. • can think analytically, recognize complex relationships, assess existing and new solutions to problems and develop their own solutions with the help of integral knowledge from the field of data science. • can work successfully in a group and communicate efficiently with different stakeholders. • can familiarize themselves with current research results in the subject and develop them further. • are thus able to carry out a scientific activity with the aim of a doctorate.
4.3 Einzelheiten zum Studiengang, individuell erworbene Leistungspunkte und erzielte Noten Einzelheiten zu den belegten Kursen und erzielten Noten sowie den Gegenständen der mündlichen und schriftlichen Prüfungen sind im „Prüfungszeugnis“ enthalten. Siehe auch Thema und Bewertung der Masterarbeit.	**4.3 Programme details, individual credits gained and grades/ marks obtained** See (ECTS) Transcript for list of courses and grades; and “Prüfungszeugnis” (Final Examination Certificate) for subjects assessed in final examinations (written and oral)thesis; and topic of thesis, including grading.
4.4 Notensystem und (wenn vorhanden) Notenspiegel Allgemeines Notenschema (Abschnitt 8.6): 1,0 bis 1,5 = „sehr gut“ 1,6 bis 2,5 = „gut“ 2,6 bis 3,5 = „befriedigend“ 3,6 bis 4,0 = „ausreichend“ Schlechter als 4,0 = „nicht bestanden“ 1,0 ist die beste Note. Zum Bestehen der Prüfung ist mindestens die Note 4,0 erforderlich. Ist die Gesamtnote 1,2 oder besser wird das Prädikat „mit Auszeichnung bestanden“ vergeben. ECTS-Note: Nach dem European Credit Transfer System (ECTS) ermittelte Note auf der Grundlage der Ergebnisse der Absolvent*innen der zwei vergangenen Jahre: A (beste 10 %), B (nächste 25 %), C (nächste 30 %), D (nächste 25 %), E (nächste 10 %)	**4.4 Grading system and (if available) grade distribution table** General grading scheme (Sec. 8.6): 1.0 to 1.5 = “excellent” 1.6 to 2.5 = “good” 2.6 to 3.5 = “satisfactory” 3.6 to 4.0 = “sufficient” Inferior to 4.0 = “Non-sufficient” 1.0 is the highest grade, the minimum passing grade is 4.0. In case the overall grade is 1.2 or better the degree is granted “with honors”. In the European Credit Transfer System (ECTS) the ECTS grade represents the percentage of successful students normally achieving the grade within the last two years: A (best 10 %), B (next 25 %), C (next 30 %), D (next 25 %), E (next 10 %)

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6. WEITERE ANGABEN	**6. ADDITIONAL INFORMATION**
6.2 Weitere Informationsquellen	**6.2 Further information sources**
www.tu-braunschweig.de www.tu-braunschweig.de/fk1 www.tu-braunschweig.de/data-science	www.tu-braunschweig.de www.tu-braunschweig.de/fk1 www.tu-braunschweig.de/en/data-science

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Annex 2 Field: Key Qualifications and Ethics

In the Key Qualifications and Ethics field, the ”Ethics and Epistemology” and “Scientific and Method-Oriented Working” modules are compulsory.

Additional ECTS credits can be earned in courses that allow students to acquire key qualifications. These can be selected from the general programme of interdisciplinary courses (Pool) at Technische Universität Braunschweig and will be completed with course achievements. Courses in the fields Computer Science, Mathematics or Application, as well as Sports Centre courses, will not be credited towards the Key Qualifications field.

The Data Science Examination Office can exclude courses from the Pool or permit additional courses. To receive credit towards the Key Qualifications field for other courses/modules, a written request must be submitted to the Examination Office.

Language Centre courses can be included up to a maximum of 5 credits.

Language courses may be included from the following level:
- Foreign languages level B1 or higher
- German language courses may only be included by foreign students (level B1 or higher) after prior request to the Examination Office.

Language courses in the student’s native language or in the official language of their home country will not be credited, nor will English courses.

An active performance record is required for the selected courses/modules (written examinations, term papers, presentations, notes, etc.). A certificate of attendance is not sufficient. The type of academic assessment used will depend on the module or course.

Annex 3 Module descriptions

Module descriptions (see module handbook)

Modules of the degree program

Data Science (Master)
PO 2

Date: 21.08.2024

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ECTS	120

Ramp Up Phase	
ECTS	10

Title	Ramp up Course Mathematics
Number	1294580
ECTS	10,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	1 ungraded examination (Prüfungsleistung): 1 written exam (120 minutes) according to examiner's specifications. After approval by the examination board mathematics (Prüfungs-ausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination. The exact examination specifications will be announced at the beginning of the course.
Course achievement	
Module grade composition	
Objective qualification	
The students - know understand the underlying concepts of mathematics that are necessary for data science - understand the concepts of analysis, algebra, optimization, discrete mathematics, stochastics and numerics and are able apply them in the context of data science	

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Title	Ramp up Course Computer Science
Number	4298040
ECTS	10,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	Ungraded examination (Prüfungsleistung): 1 written exam (120 min.), oral exam (30 minutes) or Take-Home-Exam
Course achievement	
Module grade composition	

Objective qualification

After successful completion of this module, students have a basic understanding of the underlying concepts of computer science that are necessary for data science. They are able to
- design and develop software systems for data analysis
- understand and implement distributed analysis processes
- apply and operate modern database systems
- evaluate and protect the security and privacy of data

Further, students have a general overview of the methods of data science and the application areas. They know the general principles and processes of data science projects.

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Methods and concepts of Computer Science	
ECTS	25

Title	Pattern Recognition
Number	2424690
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	Oral exam 30 min. or written exam 90 min.
Course achievement	
Module grade composition	
Objective qualification	
Upon completion of this module, students gain fundamental knowledge about methods and algorithms for classification of data. They are capable to select the appropriate means for real-world problems, to design a solution and to evaluate it.	

↑

Title	Deep Learning Lab
Number	2424750
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	
Course achievement	
Module grade composition	
Objective qualification	

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Title	Knowledge based systems and deductive database systems
Number	4214620
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	1 written exam (90 minutes) or oral exam (30 minutes)
Course achievement	50% of the exercises must be passed
Module grade composition	
Objective qualification	
On completion of this module, students are aware of the challenges and problems which arise from reasoning processes over large knowledge bases. This covers technical aspects (algorithms,implementations, etc.) and also methodological aspects (e.g. uncertainty, etc.). Furthermore, the students will be able to discuss the strengths and weaknesses of different approaches to reasoning and will be able to competently propose solution strategies to practical problem scenarios.	

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Title	Warehousing and Data Mining Techniques
Number	4214680
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	1 written exam (90 minutes), oral exam (30 minutes) or Take-Home-Exam
Course achievement	50% of the exercises must be passed
Module grade composition	
Objective qualification	
Data warehousing and mining the data within warehouses represent an important basis for corporate decision support. Students understand possible data warehouse architectures and their essential processes and know the details of the major data mining algorithms used, to be able to correctly and meaningfully underpin decisions with data. They are enabled to critically analyze and evaluate the respective application of various algorithms.	

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Title	Information retrieval and web search engines
Number	4214690
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	1 written exam (90 minutes) or oral exam (30 minutes)
Course achievement	50% of the exercises must be passed
Module grade composition	
Objective qualification	
Information retrieval techniques play a central role not only in Web search engines, but in all kinds of document-centric applications. Students need to understand different techniques, their typical application areas and limitations, as well as their advantages and disadvantages. They are enabled to choose the right techniques for the respective practical problem and to critically reflect their use in the respective application context.	

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Title	Introduction to Machine Learning
Number	4215370
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	1 graded work: Written exam (90 minutes) or oral exam (30 minutes)
Course achievement	
Module grade composition	

Objective qualification

With successful completion of the module, the students possess the following knowledge and capabilities. They are able to
- understand and correctly apply basic concepts of machine learning
- analyse and formalize a machine learning problem
- distinguish between typical machine learning methods
- select a suitable method for a learning problem
- compare and judge machine learning methods wrt their capacity
- implement machine learning methods and apply them practically
apply and parametrise respective tools
- judge strength and weaknesses of machine learning in applications
- recognize ethical issues in the application of machine learning

↑

Title	Visualization Techniques
Number	4216340
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	
Course achievement	1 Presentation
Module grade composition	
Objective qualification	
This course offers an overview of computer graphics visualization. It conveys the psychological foundations of visual information perception and provides insight into their algorithmic implementation as basis for various visualization techniques. Graduates of this course will be familiar with relevant aspects of visual perception and cognition theory as well as algorithmic concepts of visualization.	

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Title	Image Aspects
Number	4216350
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	
Course achievement	1 Presentation
Module grade composition	
Objective qualification	
This course offers insight into the formation, perception, and cognition of images. The natural phenomenon of images will be considered from the viewpoint of physics, information theory, neuroscience, and arts history. Graduates of this course will be familiar with relationships between optics, digital image processing, image statistics, visual perception, cognitive science and visual arts	

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Title	Python Lab
Number	4217850
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	
Course achievement	1 Team-based development and documentation of a data science software tool
Module grade composition	
Objective qualification	
After successful completion of this module, students will have the competence to apply Python for designing and implementing small to medium software projects and analytic workflows with a focus on statistics and machine learning. During an interactive learning phase during which the students will be able to apply common packages such as scikit-learn, and they will be able to synthesize analysis workflows for diverse data science questions. These workflows will be presented and discussed in a mini-conference among the students. After the mini-conference, students will form small teams to develop data science software tools which will be presented during the closing event. They will gain the competence to critically evaluate machine learning workflows.	

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Title	Computational Geometry
Number	4227250
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded work: written exam (120 minutes) or oral exam (30 minutes)
Course achievement	nongraded work: 50% of the exercises must be passed
Module grade composition	
Objective qualification	
Participants know basic modeling for geometric algorithms. They can gauge the algorithmic difficulty of geometric problems and formulate appropriate objectives. They can master different solution techniques and are capable of developing algorithmic methods for new problems. They understand the practical relevance of problems and solutions.	

↑

Title	Approximation Algorithms
Number	4227270
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded work: written exam (120 minutes) or oral exam (30 minutes)
Course achievement	non-graded work: 50% of the exercises must be passed
Module grade composition	
Objective qualification	
Participants know the necessity and role of approximation algorithms. They can master the most important techniques for analysis and complexity of approximation algorithms for designing, including the validity of upper and lower bounds.	

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Title	Seminar Data Science - Section Computer Science
Number	4299990
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	1 Presentation
Course achievement	
Module grade composition	The grade is determined by the active participation in the seminar and the quality of the presentation and the accompanying paper.
Objective qualification	
- The students are able to independently familiarize themselves with a scientific Topic. - They are able to prepare the topic and present it in an oral presentation. - The students are able to use adequate presentation technique and rhetorical skills.	

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Title	
Number	4227300
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	
Course achievement	
Module grade composition	
Objective qualification	

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Title	Fundamentals of High-Performance Computing for CFD simulations
Number	2518000010
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	1 examination element: written exam (90 min) or oral exam (30 min)
Course achievement	
Module grade composition	
Objective qualification	
Attending the course, the students will be able to: • Understand and use the fundamentals of the Linux-operating system and basic Unix tools • Automate HPC workflows using Shell-scripts • Write, compile and debug programs in C++ • Automate the steps of compiling, testing and executing • To structure the development process of program code using software	

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Title	Software Product Lines
Number	4217000010
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	1 graded work: Written exam+ (90 minutes) or oral exam+ (20 minutes)
Course achievement	1 non-graded work: Solve exercises relevant to the lecture
Module grade composition	

Objective qualification

Students are able to
- identify the limitations of traditional programming techniques regarding the development of variable software.
- describe modeling, analysis and configuration of variability in software product lines.
- apply different implementation techniques for the development of software product lines.
- evaluate the suitability of presented programming techniques for different development scenarios.
- explain quality assurance techniques for software product lines and the associated challenges.

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Methods and concepts of Mathematics	
ECTS	25

Title	Algorithms and complexity for quantum computing
Number	1294480
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded examination (Prüfungsleistung): 1 written exam (90 minutes) or 1 oral exam (20-30 minutes) according to examiner's specifications. After approval by the examination board mathematics (Prüfungsausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination. The exact examination specifications will be announced at the beginning of the course.
Course achievement	Non-graded coursework (Studienleistung): Homework according to examiner's specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	
Objective qualification	
The students - understand the of the complex links between their previous mathematical knowledge and the contents of the lecture - understand the theoretical body of the lecture as a whole and master the corresponding methods - are able to analyze and apply the methods of the lecture - master the fundamentals to understand the model of a quantum computer - know the algorithmic applications of this model - know and understand the quantum computer model in light of the theory complexity	

↑

Title	Computational Algbraic Geometry
Number	1294470
ECTS	10,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded examination (Prüfungsleistung): 1 written exam (120 minutes) or 1 oral exam (25-35 minutes) according to examiner's specifications. After approval by the examination board mathematics (Prüfungsausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination. The exact examination specifications will be announced at the beginning of the course.
Course achievement	Non-graded coursework (Studienleistung): Homework according to examiner's specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	

Objective qualification

The students
- understand the of the complex links between their previous mathematical knowledge and the contents of the lecture
- understand the theoretical body of the lecture as a whole and master the corresponding methods
- are able to analyze and apply the methods of the lecture

- understand the basic concepts of computer algebra techniques in theory and practice, such as the Euclidean algorithm and Gröbner bases, their calculation and application
- understand number theoretic and algebraic techniques and are able to apply and analyze them
- are able to calculate factorizations and to apply and analyze methods to solve systems of nonlinear equations and for working with algebraic objects

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Title	Discrete Optimization
Number	1294460
ECTS	10,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded examination (Prüfungsleistung): 1 written exam (120 minutes) or 1 oral exam (25-35 minutes) according to examiner's specifications. After approval by the examination board mathematics (Prüfungsausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination. The exact examination specifications will be announced at the beginning of the course.
Course achievement	Non-graded coursework (Studienleistung): Homework according to examiner's specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	
Objective qualification	
The students - understand the of the complex links between their previous mathematical knowledge and the contents of the lecture - understand the theoretical body of the lecture as a whole and master the corresponding methods - are able to analyze and apply the methods of the lecture - know and understand combinatorial and discrete optimization problems - understand the notions and results of theory of complexity - understand the important theorems, proofs and procedures of discrete and combinatorial optimization and are able to apply and analyze them - know general algorithmic principles and problem structures - are able to design, apply and analyze algorithms for applications, in particular, for NP-hard problems	

↑

Title	Dynamic Optimization
Number	1294450
ECTS	10,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded examination (Prüfungsleistung): 1 written exam (120 minutes) or 1 oral exam (25-35 minutes) according to examiner's specifications. After approval by the examination board mathematics (Prüfungsausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination. The exact examination specifications will be announced at the beginning of the course.
Course achievement	Non-graded coursework (Studienleistung): Homework according to examiner's specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	
Objective qualification	
The students - understand the of the complex links between their previous mathematical knowledge and the contents of the lecture - understand the theoretical body of the lecture as a whole and master the corresponding methods - are able to analyze and apply the methods of the lecture - know and understand the problems of optimal control, parameter estimation, optimal experimental design and model discrimination - know and understand the different fundamental approaches in the field of optimal control are are able to apply and analyze them - are able to analyze, interpret, refine and enhance the methods, especially to increase the efficiency of numerical algorithms exemplified for optimal control	

↑

Title	Introduction to Quantum Information Theory
Number	1294540
ECTS	6,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded examination (Prüfungsleistung): 1 written exam (90 minutes) or 1 oral exam (20-30 minutes) according to examiner's specifications. After approval by the examination board mathematics (Prüfungsausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination. The exact examination specifications will be announced at the beginning of the course.
Course achievement	Non-graded coursework (Studienleistung): Homework according to examiner's specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	
Objective qualification	
The students - understand the of the complex links between their previous mathematical knowledge and the contents of the lecture - understand the theoretical body of the lecture as a whole and master the corresponding methods - are able to analyze and apply the methods of the lecture - acquainted with the basic objects, constructions, and mathematical theorems and their proofs of quantum information theory - obtain an understanding of the similarities of, and the fundamental differences between, classical information theory and quantum information theory - learn about applications of quantum information theory in quantum computing and communication.	

↑

Title	Inverse problems
Number	1294430
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded examination (Prüfungsleistung): 1 written exam (90 minutes) or 1 oral exam (20-30 minutes) according to examiner's specifications. After approval by the examination board mathematics (Prüfungsausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination. The exact examination specifications will be announced at the beginning of the course.
Course achievement	Non-graded coursework (Studienleistung): Homework according to examiner's specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	
Objective qualification	
The students • understand the of the complex links between their previous mathematical knowledge and the contents of the lecture • understand the theoretical body of the lecture as a whole and master the corresponding methods • are able to analyze and apply the methods of the lecture • know and understand the notion of well- and ill-posedness and of regularization methods and their properties • are able to understand, analyze and apply methods to approximately solve ill-posed problems and use them with mathematical software	

↑

Title	Continuous Optimization in Data Science
Number	1294420
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded examination (Prüfungsleistung): 1 written exam (90 minutes) or 1 oral exam (20-30 minutes) according to examiner's specifications. After approval by the examination board mathematics (Prüfungsausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination. The exact examination specifications will be announced at the beginning of the course.
Course achievement	Non-graded coursework (Studienleistung): Homework according to examiner's specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	

Objective qualification

The students
- understand the of the complex links between their previous mathematical knowledge and the contents of the lecture
- understand the theoretical body of the lecture as a whole and master the corresponding methods
- are able to analyze and apply the methods of the lecture

- remember and understand exemplary problems in Data Science
- master selected problem solving abilities using methods of continuous optimization and are able to apply them
- understand theory and algorithms of continuous optimization in the context of statistical phenomena of the data basis

↑

Title	Machine learning with neural networks
Number	1294410
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded examination (Prüfungsleistung): 1 written exam (90 minutes) or 1 oral exam (20-30 minutes) according to examiner's specifications. After approval by the examination board mathematics (Prüfungsausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination. The exact examination specifications will be announced at the beginning of the course.
Course achievement	Non-graded coursework (Studienleistung): Homework according to examiner's specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	
Objective qualification	
The students - understand the of the complex links between their previous mathematical knowledge and the contents of the lecture - understand the theoretical body of the lecture as a whole and master the corresponding methods - are able to analyze and apply the methods of the lecture - know and understand neural networks and are able to characterize them in mathematical terms - know different use cases and applications of neural networks - know and understand optimization methods for the training of neural networks and are able to apply them	

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Title	Mathematical Foundations of Information Theory and Coding Theory
Number	1294600
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	1 oral exam (20-30 minutes) according to examiner's specifications. The exact examination specifications will be announced at the beginning of the course.
Course achievement	Non-graded coursework (Studienleistung): Homework or presentation according to examiner's specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	
Objective qualification	
The students - understand the of the complex links between their previous mathematical knowledge and the contents of the lecture - understand the theoretical body of the lecture as a whole and master the corresponding methods - are able to analyze and apply the methods of the lecture - understand the applied methods and are able to analyze these - master the foundations of the field - are able to them into a larger context	

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Title	Model Order Reduction
Number	1294500
ECTS	10,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded examination (Prüfungsleistung): 1 written exam (120 minutes) or 1 oral exam (25-35 minutes) or "Portfolio" according to examiner’s specifications. After approval by the examination board mathematics (Prüfungsausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination. The exact examination specifications will be announced at the beginning of the course.
Course achievement	Non-graded coursework (Studienleistung): Homework according to examiner’s specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	
Objective qualification	
The students - understand the of the complex links between their previous mathematical knowledge and the contents of the lecture - understand the theoretical body of the lecture as a whole and master the corresponding methods - are able to analyze and apply the methods of the lecture - understand the concept of model reduction - know and understand the most important methods of (non)linear model reduction - are able to analyze the method and understand of the basic limits of the applicability of the methods - are able to interpret the goodness and optimality of the achievable approximation	

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Title	Nonnegativity and polynomial optimization
Number	1294380
ECTS	10,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded examination (Prüfungsleistung): 1 written exam (120 minutes) or 1 oral exam (25-35 minutes) according to examiner's specifications. After approval by the examination board mathematics (Prüfungsausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination. The exact examination specifications will be announced at the beginning of the course.
Course achievement	Non-graded coursework (Studienleistung): Homework according to examiner's specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	
Objective qualification	
The students - understand the of the complex links between their previous mathematical knowledge and the contents of the lecture - understand the theoretical body of the lecture as a whole and master the corresponding methods - are able to analyze and apply the methods of the lecture - know and understand the core statements of real algebraic geometry on nonnegativity and its relation to polynomial optimization - know and understand the common methods in polynomial optimization in theory and practice	

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Title	Numerical Linear Algebra in Data Science
Number	1294360
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded examination (Prüfungsleistung): 1 written exam (90 minutes) or 1 oral exam (20-30 minutes) according to examiner's specifications. After approval by the examination board mathematics (Prüfungsausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination. The exact examination specifications will be announced at the beginning of the course.
Course achievement	Non-graded coursework (Studienleistung): Homework according to examiner's specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	
Objective qualification	
The students - understand the of the complex links between their previous mathematical knowledge and the contents of the lecture - understand the theoretical body of the lecture as a whole and master the corresponding methods - are able to analyze and apply the methods of the lecture - know and understand the methods of linear algebra in the context of data mining - are able to anaylze and evaluate problems in this field and to develop methods for their solution on the basis of the content of the lecture	

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Title	Numerical Methods and Learning from Data
Number	1294350
ECTS	10,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded examination (Prüfungsleistung): 1 written exam (120 minutes) or "Portfolio" according to examiner’s specifications. After approval by the examination board mathematics (Prüfungsausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination. The exact examination specifications will be announced at the beginning of the course.
Course achievement	Non-graded coursework (Studienleistung): Homework according to examiner’s specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	
Objective qualification	
The students - understand the of the complex links between their previous mathematical knowledge and the contents of the lecture - understand the theoretical body of the lecture as a whole and master the corresponding methods - are able to analyze and apply the methods of the lecture - know and understand numerical methods that are employed for Data Science applications such as Deep Learning or Machine Learning - know and understand basics of machne learning, e.g. deep neural networks	

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Title	Optimization in machine learning and data analysis 1
Number	1294340
ECTS	5,0
Compulsory requirements	Knowledge of Linear Algebra, Analysis, Linear and combinatorial optimization and Discrete optimization is required, as well as basic knowledge of probability theory.
Compulsory attendance	
Expected performance/ Type of examination	graded examination (Prüfungsleistung): 1 written exam (90 minutes) or 1 oral exam (20-30 minutes) according to examiner's specifications. After approval by the examination board mathematics (Prüfungsausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination. The exact examination specifications will be announced at the beginning of the course.
Course achievement	Non-graded coursework (Studienleistung): Homework according to examiner's specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	
Objective qualification	
The students - understand the of the complex links between their previous mathematical knowledge and the contents of the lecture - understand the theoretical body of the lecture as a whole and master the corresponding methods - are able to analyze and apply the methods of the lecture - know and understand optimization methods for machine learning and machine learning in algorithms for optimization, in particular, discrete optimization and network optimization	

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Title	Statistical and machine learning
Number	1294310
ECTS	7,0
Compulsory requirements	Mathematical knowledge in "Einführung in die Stochastik", "Wahrscheinlichkeitstheorie" and linear regression is required.
Compulsory attendance	
Expected performance/ Type of examination	graded examination (Prüfungsleistung): 1 written exam (90 minutes) or 1 oral exam (20-30 minutes) according to examiner's specifications. After approval by the examination board mathematics (Prüfungsausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination. The exact examination specifications will be announced at the beginning of the course.
Course achievement	Non-graded coursework (Studienleistung): Homework according to examiner's specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	
Objective qualification	
The students - understand the of the complex links between their previous mathematical knowledge and the contents of the lecture - understand the theoretical body of the lecture as a whole and master the corresponding methods - are able to analyze and apply the methods of the lecture - know and understand the basic ideas and methods in machine and statistical learning - are able to analyze and evaluate these method and apply them to practical problems	

↑

Title	Advanced Computerlab
Number	1294440
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	
Course achievement	Homework according or Portfolio to examiner’s specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	
Objective qualification	
The students - remember and understand the basic tasks and method of mathematicl algorithms and their praktical appliastion - are able to use mathematical programming tools - are able to apply, analyze and implement mathematical algorithms - are able to document and present mathematical algorithms	

↑

Title	Seminar Data Science - Section Mathematics
Number	1296916850
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	1 "Referat" according to examiner’s specifications. The exact examination specifications will be announced at the beginning of the course.
Course achievement	
Module grade composition	

Objective qualification

- Acquisition of social and professional skills
- Competencies and skills in free speech, selected conversation techniques and selected moderation and presentation techniques
- In-depth knowledge of and ability to deal with information and communication technologies
- In-depth knowledge of writing mathematical-technical texts, bibliographies, excerpts and information management, as well as basics scientific reasoning
- basic knowledge of the history of science of mathematics
- In-depth knowledge of the societal references of mathematics (economic, political, social, ethical references)
- Acquisition of action-oriented skills for communication in everyday professional life when presenting, conveying and documenting content.

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Title	Mathematical Foundations of Data Science
Number	1296916020
ECTS	10,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded examination (Prüfungsleistung): 1 written exam (120 minutes) or 1 oral exam (25-35 minutes) according to examiner's specifications. After approval by the examination board mathematics (Prüfungsausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination. The exact examination specifications will be announced at the beginning of the course.
Course achievement	Non-graded coursework (Studienleistung): Homework according to examiner's specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	
Objective qualification	
The students are able to understand the mathematical foundations of statistical learning theory and their practical applications. They have the ability to analyze and evaluate the generalization ability of learning algorithms. The students develop a solid theoretical background for independent research and application in the fields of mathematics and data science.	

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Data Science in Applications - Engineering	
ECTS	15

Title	Ecological Modelling
Number	1116130
ECTS	6,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	Examination: Generation and documentation of computer programs
Course achievement	
Module grade composition	
Objective qualification	
After successful completion of the module, students have knowledge of the key - statistical and machine learning - methods of species distribution modelling. They also have knowledge of the most important approaches to population dynamic modelling. The students are able to apply both modelling methods for dealing with geoecological and conservation biological questions and they know the advantages and disadvantages of these methods. They are capable to visualise and interpret data and models and to check underlying assumptions as well as to evaluate parameter sensitivities.	

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Title	Fundamentals of Turbulence Modeling
Number	2512380
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	1 Examination element: written exam (90 min) or oral exam (30 min to 45 min)
Course achievement	
Module grade composition	
Objective qualification	
Students acquire the concepts and fundamentals of engineering turbulence modeling. Students learn the underlying physics, assumptions and application of various turbulence models. They know the assumptions, governing equations, and the numerical algorithms of each methodology. Students are able to explain and evaluate the results of scale-resolution simulations in a critical way. At the end of the course, students will be able to use concepts from turbulence modeling for the solution of problems within the engineering field.	

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Title	Basic Coastal Engineering
Number	4398090
ECTS	6,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	Written exam (90 min.)
Course achievement	Term paper
Module grade composition	

Objective qualification

After successful completion of the module, students will have a broad and solid basic knowledge of the mechanics of water waves and hydrodynamic processes in the coastal area, which enables them to determine the load, erosion and transport parameters for the required constructive and functional planning of engineering measures.
The students are able to use the linear and nonlinear theory of water waves to calculate the total wave induced current parameters and the associated effects on sediments, structures and other obstacles. By the mediated calculation basics for wave transformation the students can calculate the effects of the bottom in shallow water (shoaling, refraction, wave breaking) as well as of buildings and other obstacles (reflection, diffraction) on the parameters (height, length, direction) of the waves and their stability (refraction criterion) at the given planning location.
On the basis of the acquired basics of the origin, parameterization, mathematical/statistical description and prediction of the sea state, the students are able to determine the design waves for the functional and constructive planning. They can determine the design water levels on the basis of the acquired knowledge on the formation and prediction of tides on open coasts and in estuaries as well as of storm surges on the German North Sea and Baltic Sea coasts. In the seminar, students are enabled to conduct scientific research and to present research results from current publications in an appropriate manner.

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Title	Introduction to Finite Element Methods
Number	4398470
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	
Course achievement	
Module grade composition	
Objective qualification	

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Title	Deep Learning in Remote Sensing
Number	4398860
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	
Course achievement	
Module grade composition	
Objective qualification	
Upon completion of this module, the students will be able to understand basic principles and applications of deep learning and to apply them on Remote Sensing as well as similar problems.	

↑

Title	
Number	4398870
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	
Course achievement	
Module grade composition	
Objective qualification	
Upon completion of this module, the students will be able to understand basic principles and applications of machine learning and to apply them on practical examples.	

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Title	Data-Driven Material Modeling
Number	4398690
ECTS	6,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	
Course achievement	
Module grade composition	
Objective qualification	

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Title	Experimental Fluid Dynamics
Number	2512000030
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	1 examination element: written exam (90 min) or oral exam (30 min)
Course achievement	
Module grade composition	
Objective qualification	
The students are able to explain mechanical, electrical and optical measurement techniques to determine fluid mechanical quantities like pressure, density, velocity, temperature and shear stress. Beyond the basic principle and the accuracy of the different measurement techniques, the students can evaluate the limitations of the techniques and use methods to improve and expand them. The students are able to apply selected measurement techniques in the laboratory course.	

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Data Science in Applications - Image and Signal Processing	
ECTS	15

Title	Mathematical Image Processing
Number	1294300
ECTS	10,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded examination (Prüfungsleistung): 1 written exam (120 minutes) or 1 oral exam (25-35 minutes) according to examiner's specifications. After approval by the examination board mathematics (Prüfungsausschuss Mathematik), the examiner can also choose the take-home exam as the form of examination. The exact examination specifications will be announced at the beginning of the course.
Course achievement	Non-graded coursework (Studienleistung): Homework according to examiner's specifications. The exact examination specifications will be announced at the beginning of the course.
Module grade composition	
Objective qualification	
The students - understand the of the complex links between their previous mathematical knowledge and the contents of the lecture - understand the theoretical body of the lecture as a whole and master the corresponding methods - are able to analyze and apply the methods of the lecture - know and understand the characterization of the quality of an image through mathematical quantities - know and understand the most important basic tasks in image processing and various methods of solving them	

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Title	Deep Learning for imaging in nano and quantum science
Number	1520500
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	
Course achievement	
Module grade composition	
Objective qualification	

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Title	Network Information Theory
Number	2424650
ECTS	6,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	Written exam (90 min) or oral exam (30 min)
Course achievement	
Module grade composition	
Objective qualification	
After completing the lecture, the students will know the building blocks of complex communications networks, i.e., the multiple-access channel, the broadcast channel, the relay channel and the interference channel, their achievable rates and capacity regions including coding and decoding schemes. In addition, the students obtain knowledge to design future wireless and multi-hop as well as ad-hoc networks. They master information-theoretic and mathematical tools to prove coding theorems. They know the state of the art as well as open problems in network information theory.	

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Title	Spoken Language Processing
Number	2424680
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	Oral exam 30 minutes or written exam 90 minutes (depending on number of participants)
Course achievement	
Module grade composition	
Objective qualification	
After successful completion of the module, students will be able to classify time series (e.g., speech signals) using hidden Markov modeling. The students acquire all the necessary knowledge to suitably select, design, and evaluate methods and algorithms for automatic speech recognition to solve problems in practice.	

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Title	Fundamentals of Digital Signal Processing
Number	2424760
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	
Course achievement	
Module grade composition	
Objective qualification	

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Title	Digital Signal Processing
Number	2424770
ECTS	8,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	
Course achievement	
Module grade composition	
Objective qualification	

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Title	Computer Vision and Machine Learning
Number	4216330
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	1 exam: written exam, 90 minutes or oral exam, 30 minutes
Course achievement	1 study achievement: 50% of the exercises must be passed
Module grade composition	
Objective qualification	
Upon successful completion of this module, students will have a basic understanding of how to develop complex computer vision applications. They are able to analyze computer vision problems and to design and implement appropriate solutions.	

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Title	Biomedical Image and Signal Analysis
Number	4217760
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded work: written exam (90 minutes) or oral exam (30 minutes) or experimental work or Portfolio
Course achievement	
Module grade composition	
Objective qualification	
Passing this module, the students can classify and compare different methodologies for medical signal and image acquisition. They can differ and compare linear with non-linear filtering and analyze electrocardiography (ECG) data into their components. They can segment medical images in two and three dimensions and are able to apply model-based approaches for image and signal analytics.	

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Title	Deep Learning in Remote Sensing
Number	4398860
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	
Course achievement	
Module grade composition	
Objective qualification	
Upon completion of this module, the students will be able to understand basic principles and applications of deep learning and to apply them on Remote Sensing as well as similar problems.	

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Title	
Number	4398870
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	
Course achievement	
Module grade composition	
Objective qualification	
Upon completion of this module, the students will be able to understand basic principles and applications of machine learning and to apply them on practical examples.	

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Title	Computer Lab Pattern Recognition
Number	2424000020
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	
Course achievement	
Module grade composition	

Objective qualification

In this course, students acquire the competencies to independently select and apply appropriate machine learning and deep learning methods for complex problems. The students ...

- ... master the programming language Python as well as the basics of the deep learning libraries PyTorch and Tensorflow.
- ... evaluate the effectiveness of simple machine learning models and neuronal networks for classification and regression problems.
- ... evaluate the quality of deep learning models on appropriate data (sub)sets with meaningful metrics
- ... know and use different types of neural networks for problems in the areas of image processing, time series processing and generative problems
- ... know and use different strategies for data preprocessing and data augmentation
- ... know and use different training and regularization methods for the optimization of neural networks
- ... evaluate the complexity of a neural network on the basis of various parameters

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Data Science in Applications - Biology, Chemistry and Pharma	
ECTS	15

Title	Immunmetabolism
Number	1398590 Bio-BB 31
ECTS	10,0
Compulsory requirements	none
Compulsory attendance	
Expected performance/ Type of examination	- term paper - oral presentation
Course achievement	Successful participation in the practical course and seminar
Module grade composition	
Objective qualification	
After completing the module, students are able to - explain the importance of the metabolism of immune cells during infection/inflammation - apply modern analytical techniques, such as isotope labelling, mass spectrometry and metabolic flux analysis - evaluate and interpret GC-MS data. - interpret the energy metabolism by means of respiration measurements. - develop concepts for solving systems biology problems with the help of different methods. - present and discuss scientific work - discuss controversial scientific topics and questions	

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Title	CM-B-3 Elucidation and Modelling of Biological Structures
Number	1498680
ECTS	8,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	oral or written exam+ (30% of the practical work mark are taken into account in the overall module mark)
Course achievement	Practical work (marked)
Module grade composition	Practical work (marked) oral or written exam+ (30% of the practical work mark are taken into account in the overall module mark)
Objective qualification	
The students are familiar with modern methods for modelling the structure of biomacromolecules and for simulating their thermodynamic properties. The know empirical force field methods, methods for performing molecular dynamics simulations, as well as modern multicale simulation methods. The students are able to judge the applicability and the limitations of such methods, to choose suitable simulation methods for their own research projects and to perform, analyze, and evaluate molecular dynamics simulations.	

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Title	Network Biology
Number	4217840
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	written exam, 90 minutes, or oral exam, 30 minutes or Take-Home-Exam
Course achievement	50% of exercises must be passed
Module grade composition	
Objective qualification	
After successful completion of this module, students will have a basic understanding of graph theory and its applications for the analysis of biomedical data. They will be able to use network biology tools and critically assess network analyses. They will be capable to devise new graph-based strategies for the analysis of biomedical data.	

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Title	Biophysical Chemistry
Number	1498670 CM-B-2
ECTS	8,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	oral exam or written exam (PL) nach BPO §5 (3)
Course achievement	completing exercises (SL)
Module grade composition	
Objective qualification	
The students know the basics of the most important physicochemical methods for the elucida-tion of biomolecular interactions and structures and are able to decide which modern or traditional method is most efficient to answer such biochemical questions. They know the limitations and dy-namic range of these methods and the importance of struc-ture and dynamics of biomolecules for their function. Students will be able to classify which methods are suitable for studying biomolecules and answering biomolecular questions in the different environments of industrial or basic rese-arch.	

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Title	Biomolecular Modelling
Number	1499680 CM-B-3
ECTS	8,0
Compulsory requirements	none
Compulsory attendance	
Expected performance/ Type of examination	Oral or written exam+ (30% of the practical work mark are taken into account in the overall module mark)
Course achievement	Practical work (marked)
Module grade composition	see expected performance
Objective qualification	
The students are familiar with modern methods for modelling the structure of biomacromolecules and for simulating their thermodynamic properties. The know empirical force field methods, methods for performing molecular dynamics simulations, as well as modern multicale simulation methods. The students are able to judge the applicability and the limitations of such methods, to choose suitable simulation methods for their own research projects and to perform, ana-lyze, and evaluate molecular dynamics simulations.	

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Title	Advanced Theoretical Chemistry
Number	1499170 AM-A-9
ECTS	8,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	Oral or Written Exam+ (20% of the coursework and 20% of the practical work mark are taken into account in the overall module mark)
Course achievement	Solve coursework problems (umarked) Practical work (marked)
Module grade composition	
Objective qualification	
The students have aquired knowledge on modern methods of quantum chemistry. They are familiar with the foundations of important methods and possess an overview of commonly used quantum-chemical methods, their implementation in scientific software, and their use in chemistry. They are able to judge the applicability and the limits of different quantum-chemical methods and to use choose suita-ble methods for their own research projects, to perform quantum-chemical calculations and to analyse, evaluate, and assess their results.	

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Title	Machine Learning in Computational Chemistry
Number	1499180 AM-A-10
ECTS	8,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	oral or written exam+ (PL, 20% of the coursework and 20% of the practical work mark are taken into account in the overall module grade)
Course achievement	solve coursework problems (ÜbA, SL unmarked) practical work (expA, SL marked)
Module grade composition	
Objective qualification	
The students have acquired knowledge on modern methods of molecular machine learning and molecular artificial intelligence. They are familiar with the foundations of important methods and possess an overview of commonly used methods, their implementation, and their use in chemistry. They are able to judge the applicability and the limits of different methods and to use choose and apply suitable methods for their own research projects and to analyse, evaluate, and assess their results.	

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Title	Theoretical Spectroscopy
Number	1498120 AM-B-8
ECTS	8,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	oral or written exam+ (PL, 20% of the coursework and 20% of the practical work mark are taken into account in the overall module grade)
Course achievement	solve coursework problems (ÜbA, SL unmarked) practical work (expA, SL marked)
Module grade composition	
Objective qualification	
The students have acquired knowledge in time-dependent quantum mechanics and on modern methods of theoretical spectroscopy. They are familiar with the foundations of important methods and possess an overview of commonly used quantum-chemical methods in theoretical spectroscopy, their implementation in scientific software, and their use in chemistry. They are able to judge the applicability and the limits of different methods and to use choose suitable methods for their own research projects, to perform calculations and to analyse, evaluate, and assess their results.	

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Data Science in Applications - Medicine	
ECTS	15

Title	Medical-methodological specialization module 1
Number	4217720
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded work: oral exam (30 minutes) or development and documentation of computer programs or Portfolio
Course achievement	
Module grade composition	
Objective qualification	
Passing this module, the students develop a fundamental understanding for methodological aspects of medical informatics. They can plan and conduct scientific studies and can develop novel research projects in the field of electronic health. The students can use, compare, and evaluate specific IT tools in medical informatics. They know about data privacy and security issues for medical data in Europe.	

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Title	Medical Methodology Course 2
Number	4217730
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	written exam (90 minutes) or oral exam (30 minutes) or Portfolio
Course achievement	
Module grade composition	
Objective qualification	
Passing this module, the students have earned a fundamental understanding of the methodological aspects of medical informatics. They can plan and conduct clinical trials and apply appropriate statistics to evaluate the recorded data. They can assess the systematics of scientific research in the broad biomedical field of applied computer science. They can compare IT tools for medical statistics and significance tests.	

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Title	Accident Informatics
Number	4217740
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded work: written exam (90 minutes) or Portfolio
Course achievement	
Module grade composition	
Objective qualification	
Passing this module, the students can define the goals and perform a technical analysis of traffic accidents. The understand accident and emergency informatics on a more general level, and know the components of this novel field of research. They can use IT systems for accident research and build systems using appropriate data formats, standards, and protocols. Furthermore, they can construct scientific experiments in the field of accident and emergency informatics.	

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Title	Biomedical Image and Signal Analysis
Number	4217760
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded work: written exam (90 minutes) or oral exam (30 minutes) or experimental work or Portfolio
Course achievement	
Module grade composition	
Objective qualification	
Passing this module, the students can classify and compare different methodologies for medical signal and image acquisition. They can differ and compare linear with non-linear filtering and analyze electrocardiography (ECG) data into their components. They can segment medical images in two and three dimensions and are able to apply model-based approaches for image and signal analytics.	

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Title	Health-Enabling Technologies A
Number	4217800
ECTS	6,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded work: written exam, 90 minutes, or oral exam, 30 minutes, or Portfolio
Course achievement	
Module grade composition	
Objective qualification	
Passing this module, the students are able to name different health enabling technologies (HET) and explain their ethical, regulatory and social aspects. The students can use methods and tools to build HET systems.	

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Title	Health-Enabling Technologies B
Number	4217810
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	graded work: written exam (90 minutes) or oral exam (30 minutes) or Portfolio
Course achievement	
Module grade composition	
Objective qualification	
Passing this module, the students can explain and compare health enabling technologies (HET). This includes knowledge and practical use of HET applications, and its underlying scientific foundation. The students are able to build HET systems using recent technologies and can plan, conduct, and analyze experiments to evaluate HET technologies.	

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Title	Selected Topics of Representation and Analysis of Medical Data
Number	4217880
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	written exam (90 minutes) or oral exam (30 minutes) or Portfolio or Take-Home-Exam
Course achievement	
Module grade composition	
Objective qualification	
The students can recall recent trends and technologies to represent and analyze medical data. They are able to compare approaches and report their key characteristics resp. differences. They can construct tools and scientific methodologies for data modelling and analytics. The students recognize quality criterions and can recommend specific approaches.	

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Data Science in Applications - Project Work	
ECTS	15

Title	Project Work Data Science
Number	4299980
ECTS	15,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	Software/program development and report on a data science project.
Course achievement	
Module grade composition	
Objective qualification	
The project thesis can serve as preparation for the master's thesis. The students are able to use scientific methods systematically to solve a complex task in the area of data science. They are able to plan the work independently and estimate the work time required. They are able to carry out the project controlling and quality assurance e.g. using milestones which they have set for themselves.	

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Key Qualifications and Ethics	
ECTS	5

Title	Ethics and Epistemology
Number	4411440
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	1 graded examination (Prüfungsleistung): written exam, 120 minutes
Course achievement	1 non graded examination (Studienleistung): Protokoll, 2 pages
Module grade composition	

Objective qualification

The course:
- provides a philosophical framework and moral compass for guiding the judgement of students regarding data science and its applications (artificial intelligence, robotics, etc.).
- aims to develop communication skills, social and civic competences,
- reassures students on the limits of machines, machinery settings, and machine ethics,
- strengthens personal development in the light of digit(al)ization and related claims of social change.

The students will be able to recognize and interpret social and technical problems in technology and information processingn based in classical and recent position in theoretical and practical philosophy. They will be able to interpret these problems ethically and support their position with arguments from machine ethics.

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Title	Data Privacy & Data Governance
Number	2216010
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	written exam, 60 minutes, or oral exam, 20 minutes, or term paper or Portfolio or Take-Home-Exam
Course achievement	
Module grade composition	
Objective qualification	
The students understand the differences between the two main legal systems (case law vs. common law) in the EU. They know different sources of legal knowledge. The students are able to assess company privacy regulations and business models in relation to the legal provisions.	

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Title	Key Qualifications
Number	4298010
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	
Course achievement	An active performance record is required for the selected courses/modules (e.g. written examination, term paper, presentation, minutes). A certificate of attendance is not sufficient. The type of academic achievement depends on the module or course.
Module grade composition	
Objective qualification	
Superordinate reference/ embedding of the field of study Students will be able to classify their field of study in societal, historical, legal or professionally oriented references (depending on the focus of the course). They are able to recognize, analyze and evaluate higher-level, subject-related connections and their significance. The students acquire an insight into the networking possibilities of the field of study and application references of their field of study in professional life.	

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Title	Scientific and Method-Oriented Working
Number	4217000000
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	Homework (Term Paper)
Course achievement	active participation in group work
Module grade composition	
Objective qualification	
Upon successful completion of the module, students will be able to independently familiarize themselves with a scientific topic, plan and document a project, and write a scientific report.	

↑

Title	Better Scientific Presentations and Writing
Number	4217000020
ECTS	5,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	Portfolioexam
Course achievement	
Module grade composition	
Objective qualification	
Students will learn the principles of scientific writing and gain insights into how to improve their writing. They will be enabled to properly criticize existing visualizations and create new visualizations that are effective, efficient, and appropriate.They will also learn how to properly structure a talk, how to prepare adequate visual aids (“presentations”), and how oral presentations are different from written text.	

↑

Master's Thesis	
ECTS	30

Title	Master's Thesis Data Science
Number	4299970
ECTS	30,0
Compulsory requirements	
Compulsory attendance	
Expected performance/ Type of examination	Written thesis (final thesis) The presentation can be included in the evaluation with up to 3 of 30 credit points according to § 5 paragraph 7 (BPO)
Course achievement	
Module grade composition	

Objective qualification

The students are able to work on a problem in the field of data science independently using scientific methods within a given time period.

The following points are particularly important:
- The student can familiarize themselves with the topic of the work independently.
- They can systematically work on a research problem relevant to data science using scientific methods.
- They are able to present the methods and the results in the form of an report.
- They present the main results in an understandable form in a presentation.
- They able to research literature and put their work into context.

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