



Technische  
Universität  
Braunschweig



# Welcome to Data Science @ TU Braunschweig!

[www.tu-braunschweig.de/data-science](http://www.tu-braunschweig.de/data-science)

<https://www.ibr.cs.tu-bs.de/users/fekete/Videos/DataScience.mp4>



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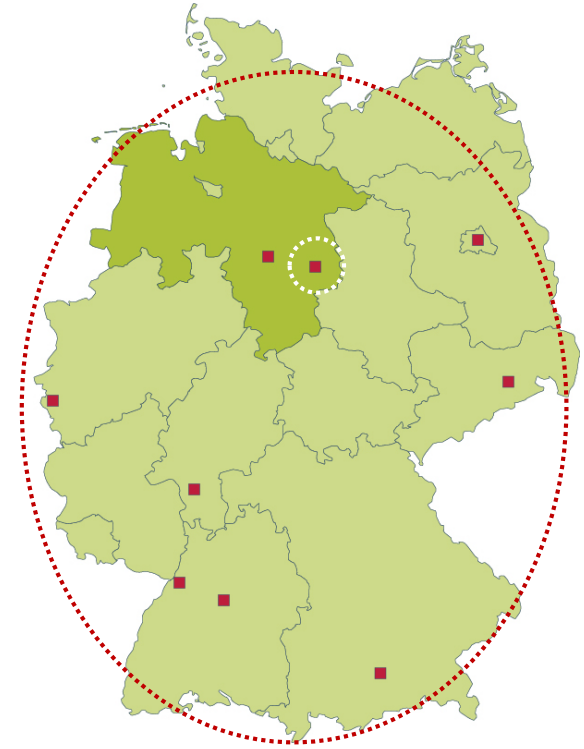
18.10.2022 | Prof. Dr. Wolf-Tilo Balke, Prof. Dr. Tim Kacprowski | Orientation Meeting Data Science| Slide 1

# Technische Universität Braunschweig

<b>84</b>	<b>Study Programms</b>
<b>3.600</b>	<b>First Year Students</b>
<b>18.500</b>	<b>Students</b>
<b>120</b>	<b>Institutes</b>
<b>2.300</b>	<b>Researchers</b>
<b>3.800</b>	<b>Total Staff</b>



# Europe's Most Active Research Area



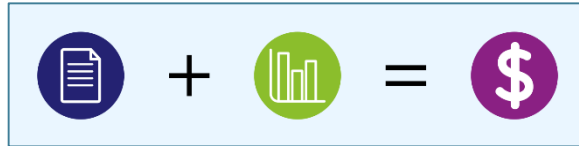
# Data Science @ TU Braunschweig

- Foundational Master Programme in Mathematics and Computer Science
- Innovative Application Areas in Core Research Areas of TU Braunschweig
- International Master Programme – Fully taught in English
- Mentoring Concept
- Flexible Choice of Modules
- 30 – 40 Study Places per Year



# Data Science - Relevance

- **Bitkom e.V.** Study of 2015
  - 48% of all companies generate value from data analyses.
  - 59% of all companies complain about the lack of data analysis specialists.
  - The added value of data analysis extends over all phases of the value chain.
- **Simple Message:**



- **Harvard Business Review: Data Scientist is the Sexiest Job of the 21st Century!**

# Skills and Competencies

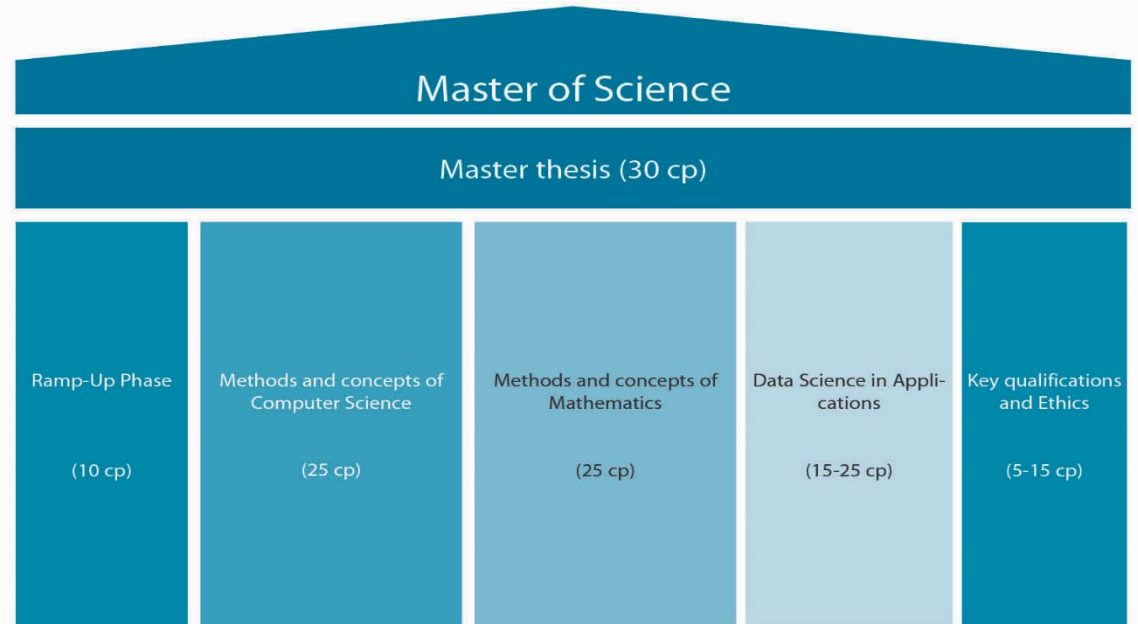
- Graduates as **Master of Data Science** can
  - Use Methods of Data Acquisition, Data Integration and Data Management efficiently
  - Select Analysis Methods competently and adapt it to the Special Requirements of an Application
  - Evaluate and assess the Expressiveness of Analysis Methods and Results
  - Lead Data Projects in Companies and effectively manage Corporate Decision Processes



- **Simply: Data Science = Mathematics + Computer Science + Applications**

# Design and Structure of the Study Program (120 Credits)

- 3 Core Areas:
  - 25 Credits **Mathematics**
  - 25 Credits **Computer Science**
  - 15-25 Credits **Applications**
- Application Areas
  - Biology, Chemistry, Pharmacy
  - Medicine
  - Engineering
  - Image and Signal Processing
- Mandatory seminar and lab courses
- Optional research project



# Modularization of the Degree Program

The course contents taught in the individual areas are combined into modules. A module consists of courses with related content.

Example "Approximation Algorithms":  
Excerpt from the module guide for the  
Examination Regulations

(=> see study program website "Documents"  
[Module Guide](#))

Technische Universität Braunschweig | Modulhandbuch: Master Data Science (MPO 2022)

Modulbezeichnung: <b>Approximation Algorithms (MPO 2014)</b>			Modulnummer: <b>INF-ALG-27</b>		
Institution: <b>Algorithmik</b>			Modulabkürzung: <b>AA</b>		
Werkstoff:	150 h	Prüferzeit:	56 h	Semester:	1
Leistungspunkte:	5	Selbststudium:	94 h	Anzahl Semester:	1
Pflichtform:	Wahlpflicht	SWS:			4
Lehrveranstaltungen/Überschriften: Approximation Algorithms (V) Approximation Algorithms (U) Approximation Algorithms (KIU)					
Belegungslogik (wenn alternative Auswahl, etc.): ---					
Lehrende: <b>Prof. Dr. Sándor Fekete</b>					
Qualifikationsziele: (DE) Die Absolventen dieses Moduls kennen die Notwendigkeit und Berechtigung von Approximationsalgorithmen. Sie beherrschen die wichtigsten Techniken zur Analyse der Komplexität von Algorithmen und zum Entwurf von Approximationsmethoden, einschließlich des Beweises oberer und unterer Schranken. (EN) 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.					
Inhalte: (DE) - NP-Vollständigkeit - Approximationsbegriff - Vertex Cover - Set Cover - Scheduling - Packprobleme - Geometrische Probleme - Fallstudien aus der aktuellen Forschung (EN) - A basic introduction to NP-completeness and approximation - Approximation for vertex and set cover - Packing problems - Tour problems and variations - Current research problems In the context of various problems, a wide spectrum of techniques and concepts will be provided.					
Leistungsform: (DE) Vorlesung und Übung (EN) Lectures and Exercises					
Prüfungsmodalitäten / Voraussetzungen zur Vergabe von Leistungspunkten: (DE) 1 Studienleistung: 50% der Übungen müssen bestanden sein 1 Prüfungsleistung: Klausur, 120 Minuten oder mündliche Prüfung, 30 Minuten. Prüfungsform ist abhängig von der Teilnehmerzahl und wird zu Beginn der Vorlesung bekanntgegeben. (EN) graded work: written exam (30 minutes) or oral exam (30 minutes) non-graded work: 50% of the exercises must be passed					
Turnus (Beginn): alle zwei Jahre im Sommersemester					



# Modules in Mathematics Core

- **Optimization:** Discrete Optimization, Dynamic Optimization, Polynomial Optimization, Optimization in Machine Learning, ...
- **Statistics:** Statistical Learning, Risk and Extreme Value Theory, Non-parametric Statistics, Time Series Analysis, ...
- **Numerics:** Model Reduction, Numerical Analysis and Learning from Data, ...
- **Applied Analysis and Algebra:** Inverse Problems, Computer Algebra, Machine Learning with Neural Networks, ...

# Modules in Computer Science Core

- **Algorithmics:** Online Algorithms, Approximation Algorithms, Computational Geometry, ...
- **Machine Learning:** Foundations of Machine Learning, Pattern Recognition, Machine Learning for IT-Security, Deep Learning Lab, ...
- **Databases and Information Systems:** Data Warehousing and Data Mining, Information Retrieval und Web Search Engines, Knowledge-based Systems, ...
- **Software Engineering:** Software Architecture, Software Quality, Python Lab, Project Management, ...
- **Distributed Systems:** Cloud Computing, Replication and Consistency, ...

# Application Areas

- **Biology, Chemistry and Pharmacy:** Network Biology, System Biology, Immune Metabolism, Bioinformatics, Theoretical Chemistry, Chemometrics, ...
- **Medicine:** Biomedical Data Analysis, Introduction to Medicine, Health-Enabling Technologies, ...
- **Data Science in Engineering:** Deep Learning for Remote Sensing, Coastal Engineering, Automotive Software Engineering, Railway Timetabling, Fundamentals of Turbulence Modeling, Ecological Modeling, ....
- **Image and Signal Processing:** Speech Dialogue Systems, Mathematical Image Processing, Digital Signal Processing, Computer Vision and Machine Learning, Deep Learning for Quantum and Nano Science, ...

# Area „Key Qualifications and Ethics“ (5-15 CP)

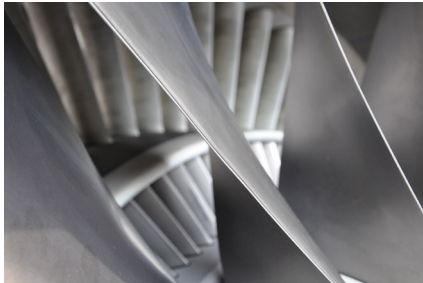
- modules (**compulsory module “Ethics and Epistemology” 5 CP**) provide students with interdisciplinary qualifications → course **“Ethics and Epistemology”** only available in winter semester
  - Future Data Scientists must be able to reflect on the ethical implications of their actions and must be able to recognize and interpret social and technical problems in the light of theoretical and practical philosophy.*
- additional credit points can be selected from the overall program (**pool**) of interdisciplinary courses or the Language Center (max. 8 CP)
- courses from computer science and mathematics or the application area as well as events of the sports center are excluded**

The screenshot shows the TU Braunschweig Stud.IP interface. At the top, there is a search bar and navigation icons. The main content area displays course information for 'Online-Seminar: Ethics and Epistemology [WiSe 2022/23]'. A notification banner at the top of the course page reads 'Course under special admission. Please read the note.' The course details are as follows:

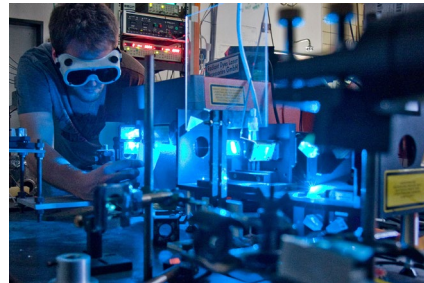
General information	
Course name	Online-Seminar: Ethics and Epistemology [WiSe 2022/23]
Course number	4411516
Semester	WiSe 2022/23
Current number of participants	0
expected number of participants	40
Home institute	Institut für Philosophie
Courses type	Online-Seminar in category Teaching
Next date	Wed., 02.11.2022 15:00 - 16:30
Synchronisierung mit LSF	ja
Letzte Nachricht des Synchronisierungsskriptes	Tue, 27.09.2022 at 04:00 Die Veranstaltung wurde erfolgreich mit HIS-LSF synchronisiert

Below the general information, there are sections for 'Lecturers' (Prof. Dr. Nicole Karafyllis, Prof. Dr. Hans-Christoph Schmidt am Busch), 'Mitwirkende' (Felix Sebastian Mayer), 'Course location / Course dates' (n.a., Wednesday: 15:00 - 16:30, weekly(13x)), and 'Fields of study'.

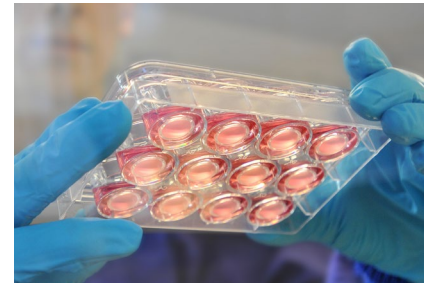
# Core Research Areas @ TUBS



**Mobility**



**Metrology**



**Infections &  
Therapeutics**



**Future Cities**

# Your Rights and Obligations: The Examination Regulations

- On the program websites you will find the General and the Special **Examination Regulations** for Data Science degree program
- Please read these Examination Regulations carefully so that there won't be any "unpleasant surprises" afterwards.
- Where can I find the Examination Regulations: Program Websites



<https://www.tu-braunschweig.de/en/data-science/documents>

## Examination Regulations, Entry and Admission Regulations and Module Manuals




Master Data Science

### Examination Regulations

#### Allgemeiner Teil der Prüfungsordnung für die Bachelor- und Masterstudiengänge an der TU Braunschweig (APO)

- Allgemeiner Teil der Prüfungsordnung für die Bachelor- und Masterstudiengänge an der TU Braunschweig (Stand: 06.06.2019)  [\(PDF\)](#) 

#### Additional Part to the Examination Regulations to the Master's Degree Programme Data Science (MPO)

- Additional Part to the Examination Regulations to the Master's Degree Programme Data Science at Brunswick Technical University (TU Braunschweig) Wintersemester 2021/2022  [\(PDF\)](#) *(ends 30.09.2022)*
- Additional Part to the Examination Regulations to the Master's Degree Programme Data Science at Brunswick Technical University (TU Braunschweig) Wintersemester 2022/2023  [\(PDF\)](#) *(binding from 01.10.2022)* 

### Admission Regulations

### Module Guide

### Course Catalogue

# Duration of Study and Credit Points

## Duration of study:

- Master Data Science: 4 semester

## Credit point system:

- 1 LP (Credit Point) = Workload 25-30 hours
- 30 LP should be achieved per semester
- 120 LP's are required for successful completion of your studies.

# Sample Study Plan: Application Field Image and Signal Processing

Data Science - Profile 3 (BSc Mathematics, Application Field Image and Signal Processing)					
	1st Semester (SS)	2nd Semester (WS)	3rd Semester (SS)	4th Semester (WS)	
Computer Science	RampUp Computer Science 10 CP	Computer Science Elective 5 CP  Computer Science Elective 5 CP	Computer Science Seminar 5 CP  Computer Science Elective 5 CP  Computer Science Elective 5 CP		35 CP
Mathematics	Mathematics Elective 10 CP  Mathematics Elective 10 CP	Practical Course Mathematics 5 CP			25 CP
Applications		Computer Vision and Machine Learning 5 CP  Spoken Language Processing 5 CP	Project Work 15 CP	Master Thesis 30 CP	55 CP
Key qualifications and Ethics		Ethics 5 CP			5 CP
Total	30 CP	30 CP	30 CP	30 CP	120 CP

■ Compulsory Modules    
 ■ Compulsory Electives



# Sample Study Plan: Application Field Data Science in Engineering

Data Science - Profile 4 (BSc Mathematics/Physics, Application Field Data Science in Engineering)

	1st Semester (SS)	2nd Semester (WS)	3rd Semester (SS)	4th Semester (WS)	
Computer Science	RampUp Computer Science 10 CP	Computer Science Elective 5 CP  Computer Science Elective 5 CP	Computer Science Seminar 5 CP  Computer Science Elective 5 CP  Computer Science Elective 5 CP		35 CP
Mathematics	Mathematics Elective 10 CP  Mathematics Elective 10 CP	Practical Course Mathematics 5 CP		Master Thesis 30 CP	55 CP
Applications		Basic Coastal Engineering 6 CP  Introduction to Finite Elements 5 CP	Ecological Modeling 6 CP  Modeling 5 CP		22 CP
Key qualifications and Ethics		Ethics 5 CP	Key qualifications 3 CP		8 CP
Total	30 CP	31 CP	29 CP	30 CP	120 CP

Compulsory Modules
Compulsory Electives

# Sample Study Plan: Application Field Medicine

Data Science - Profile 1 (BSc Computer Science, Application Field Medicine)					
	1st Semester (WS)	2nd Semester (SS)	3rd Semester (WS)	4th Semester (SS)	
Computer Science	Computer Science Elective 5 CP	Computer Science Elective 5 CP	Computer Science Seminar 5 CP	Master Thesis 30 CP	55 CP
	Computer Science Elective 5 CP				
	Computer Science Elective 5 CP				
Mathematics	RampUp Mathematics 10 CP	Mathematics Elective 10 CP	Mathematics Elective 10 CP	Practical Course Mathematics 5 CP	35 CP
Applications		Med-meth. Specialization 1 5 CP	Med.-meth. Specialization 2 5 CP		20 CP
		Accident Informatics 5 CP			
			Biomedical Image & Signal Analysis 5 CP		
Key qualifications and Ethics	Ethics 5 CP		Key qualifications 5 CP		10 CP
<b>Total</b>	<b>30 CP</b>	<b>30 CP</b>	<b>30 CP</b>	<b>30 CP</b>	<b>120 CP</b>


■ Compulsory Modules

■ Compulsory Electives

# Sample Study Plan: Application Field Biology, Chemistry, Pharmacy

Data Science - Profile 2 (BSc Bioinformatics, Application Field Biology, Chemistry, Pharmacy)

	1st Semester (WS)	2nd Semester (SS)	3rd Semester (WS)	4th Semester (SS)	
Computer Science	Computer Science Elective 5 CP  Computer Science Elective 5 CP	Computer Science Elective 5 CP	Practical Course Computer Science 5 CP  Computer Science Elective 5 CP		25 CP
Mathematics	RampUp Mathematics 10 CP	Mathematics Elective 10 CP  Mathematics Elective 10 CP	Mathematics Elective 5 CP		35 CP
Applications	Network Biology 5 CP	Numerical Ecology (Seminar) 5 CP	Project Work 15 CP	Master Thesis 30 CP	55 CP
Key qualifications and Ethics	Ethics 5 CP				5 CP
<b>Total</b>	<b>30 CP</b>	<b>30 CP</b>	<b>30 CP</b>	<b>30 CP</b>	<b>120 CP</b>

 Compulsory Modules

 Compulsory Electives

# What do I have to consider at the beginning of my studies? 1/2

## Mentoring and Study Planning:

At the beginning of their studies, **each student is assigned a mentor** by the Data Science Examination Committee from the university teaching staff of the Department of Computer Science or the Department of Mathematics.

- please get in touch with your mentor (within the first semester week)
- create a study plan together
- submit the countersigned study plan before the start of the first examination registration period (before 15.12.2022) to the Examination Office (pa-mathe@tu-braunschweig.de / Janine Werner)

# What do I have to consider at the beginning of my studies? 2/2

- **Joint RampUp Phase in the first two weeks of the semester**
- **On Wednesday, 26.10.2022**, 11:30 - 13:00 (CET) in RR 58.3: tba (*Tim Kacprowski*)
- **On Thursday, 27.10.2022**, 09:45 - 11:15 (CET) in PK 11.4: „DS needs Math!“ (*Nicole Mücke*)
- **On Friday, 28.10.2022**, 08:00 - 08:45 (CET) + 08:45 - 09:30 (CET) in PK 4.1: „Data Science at PLRI“ (*Thomas Deserno, Karsten Hiller*)
- **On Wednesday, 02.11.2022**, 11:30 - 13:00 (CET) in RR 58.3: "Data Science Life Cycle" (*Lisa-Marie Bente, Tilo Balke*)
- **On Thursday, 03.11.2022**, 09:45 - 11:15 (CET) in PK 11.4: "DS in Industry" (*Dirk Lorenz*)

further information about the following weeks:

- [Computer Science RampUp](#)
- [Mathematics RampUp](#)

# Stud.IP – The teaching and learning platform of TU Braunschweig

- central tool for the digital accompaniment of classroom courses
- it provides information on the organisation of teaching and serve as a communication platform
- registration for courses
- contact to the lecturers
- information and access to the courses
- access to the files of the courses
- create your own study groups

The screenshot displays the Stud.IP interface for a course titled "Lecture: Ramp up course Computer Science [WiSe...]" under special admission. The interface includes a navigation bar with icons for home, help, messages, users, calendar, search, and settings. A sidebar on the left offers actions like printing, navigating to the course, and sharing. The main content area is divided into sections: General information, Lecturers, Mitwirkende, Course location / Course dates, and Fields of study.

General information	
Course name	Lecture: Ramp up course Computer Science [WiSe 2022/23]
Course number	4299019
Semester	WiSe 2022/23
Current number of participants	0
Home institute	Department Informatik
Courses type	Lecture in category Teaching
Next date	Mon., 24.10.2022 15:00 - 16:30, Room: (Raum 4204.00.003 - PK 4.1: Hörsaal PK 4.1, Gebaeude Pockelsstraße 4 (4204): Hauptgeb.Trakt Pockelsstr.)
Synchronisierung mit LSF	ja
Letzte Nachricht des Synchronisierungskriptes	Tue, 27.09.2022 at 04:00 Die Veranstaltung wurde erfolgreich mit HIS-LSF synchronisiert

Lecturers	
Wolf-Tilo Balke , Prof. Dr.-Ing. Rüdiger Kapitza , Prof. Dr. Konrad Rieck , Dr.-Ing. Sandro Schulze	

Mitwirkende	
M. Sc Florian Pilötzy , M. Sc Tobias Runge	

Course location / Course dates	
(Raum 4204.00.003 - PK 4.1: Hörsaal PK 4.1, Gebaeude Pockelsstraße 4 (4204): Hauptgeb.Trakt Pockelsstr.)	Monday: 15:00 - 16:30, weekly (13x) Friday: 08:00 - 09:30, weekly (13x)

**Fields of study**

Vorlesungsverzeichnis WS 2022/2023 > Data Science > Master (MPO 2022) > Ramp Up Phase [10 LP] > Ramp up Course Computer Science (2022) (Modulnr.: INF-STD2-04)  
Vorlesungsverzeichnis WS 2022/2023 > Data Science > Master (MPO 2021) > Ramp Up Phase [10 LP] > Ramp up Course Computer Science (Modulnr.: INF-STD-95)

# Stud.IP – Support

Our support team is your central address for all questions and problems concerning Stud.IP. We are at your disposal for questions concerning the daily use and support you in the use of tools and plugins as well as in the implementation of didactic concepts.

## Support Times

Monday to Friday: 09:00-11:00 (CET)

Monday to Thursday: 13:30-16:00 (CET)

## Contact

✉ [studip@tu-braunschweig.de](mailto:studip@tu-braunschweig.de)

☎ +49 531 391-14040

# Exam registration

## Exam registration:

- online: <https://vorlesungen.tu-bs.de>
- registration period in winter semester: 15.12.2022 – 15.01.2023
- TAN numbers for online registration are issued by the Examination Office
- written exam registration: only for additional exams and other exceptions

## Cancelling exam registrations:

- written exam: until penultimate working day before exam (Saturday and Sunday = no working day)
- oral exam: until one week before exam (please use deregistration form)
- homework (term paper): until 15.02. (winter semester), 15.08. (summer semester)

## Seminar:

- registration: until day of kick-off event of the particular semester
- withdrawal: until 2 weeks after beginning of lectures in that particular semester



# Mailinglist Data Science

In the study it is essential to be always quickly supplied with the most important information.

The central information channel for Data Science is **the mailing list**.

**Please make sure that you are registered as a subscriber to the list with your TU mail address and that you receive the messages at the beginning of the semester.**

- **Mailinglist Data Science ([ds-studs@lists.tu-braunschweig.de](mailto:ds-studs@lists.tu-braunschweig.de))**

# Always stay up to date (Weblinks)

1. [Additional Part to the Examination Regulations to the Master's Degree Programme Data Science \(MPO\)](#)
2. [Module Guide Winter Semester 2022/2023](#)
3. [QIS Portal & Electronic Course Catalogue](#)
4. [StudIP TU Braunschweig](#)
5. [Data Science first-semester students](#)
6. [Institutes](#)
7. [Contacts](#)

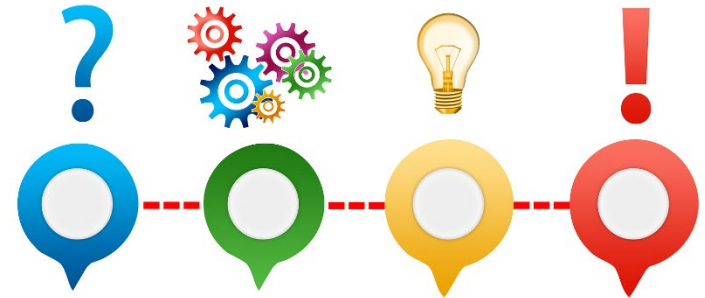


# Examination Office

## Contact

### Janine Werner

- Rebenring 58 A (1st floor)
- Room 117
- Phone: +49-531-391-2851
- Mail: [pa-mathe@tu-braunschweig.de](mailto:pa-mathe@tu-braunschweig.de)
- Office hours: By arrangement



# Program Coordination and Study Guidance

## Contact

### Marvin Plagge

- Rebenring 58 A (1st floor)
- Room 124
- Phone: +49-531-391-2831
- Mail: [ds-studium@tu-braunschweig.de](mailto:ds-studium@tu-braunschweig.de)
- Office hours: By arrangement

