



Computational Linguistics and Language Technology

Master Minor 30

Modulkatalog

Aktualisiert am 05.06.2026



Einleitung

Der Modulkatalog hilft Ihnen bei der Planung Ihres Studiums, indem er Ihnen eine Übersicht über alle Module Ihres Studienprogramms bietet. Das Dokument enthält folgende Rubriken:

- Übersicht über die Modulgruppen Ihres Studienprogramms
- Übersicht über die Module in den Modulgruppen
- Katalog der Pflichtmodule, Wahlpflichtmodule und Wahlmodule

Der Modulkatalog ist ein Informationsdokument und nicht rechtsverbindlich. Zu Beginn jedes Semesters wird eine aktuelle Version auf die Website der Philosophischen Fakultät hochgeladen.



Übersicht über die Modulgruppen

06M-7521i01	Scientific Specialization
06M-7521i02	Core Modules of Computational Linguistics and Language Technology
06M-7521i03	Computer Science
06M-7521i04	Computational Linguistics and Language Technology in Practice

Übersicht über die Module in den Modulgruppen

Modulnummer	Modultitel	Modultyp	ECTS
06M-7521i01	Scientific Specialization		
06SM521-s09	[Seminar]	Wahl	6
06M-7521i02	Core Modules of Computational Linguistics and Language Technology		
03SM22MI0034	Advanced Machine Learning (L+E)	Wahlpflicht	6
06SM523-501	Advanced Techniques of Machine Translation	Wahlpflicht	6
06SM523-505	Machine Learning for Natural Language Processing 1	Wahlpflicht	6
06SM523-506	Machine Learning for Natural Language Processing 2	Wahlpflicht	6
06SM523-519	Fundamentals of speech sciences and signal processing	Wahlpflicht	6
06SM523-520	Instrumental techniques of phonetic research	Wahlpflicht	6
06SM523-530	Eye Tracking and NLP	Wahlpflicht	6
06SM523-532	Artificial Intelligence for Language Accessibility	Wahlpflicht	6
06SM523-533	Advanced Machine Learning	Wahlpflicht	6
06SM523-534	Introduction to Forensic Speech Sciences	Wahlpflicht	6
06SM521-s06	[Summer School]	Wahl	6
06SM523-s15	[Excursion]	Wahl	3
06M-7521i03	Computer Science		
02SMMAWMF3	Artificial Intelligence: Technology and Law	Wahlpflicht	6
03SM22AINF05	Foundations of Computing I (L+E) (Formale Grundlagen der Informatik I)	Wahlpflicht	6
03SM22BI0001	Foundations of Computing II (L+E)	Wahlpflicht	6
03SM22BI0002	Fortgeschrittene Programmierung in C++ (V+Ü) (Advanced Programming in C++)	Wahlpflicht	3
03SM22BI0003	Numerical Methods in Informatics (L+E)	Wahlpflicht	6
03SM22BI0004	Software Construction (L+E) (Softwarekonstruktion)	Wahlpflicht	6
03SM22BI0005	Wirtschaftsinformatik II (V+Ü) (Business Informatics II)	Wahlpflicht	6
03SM22BI0006	Computer Networks and Distributed Systems (L+E) (Kommunikationsnetze und	Wahlpflicht	6
03SM22BI0008	Data Visualization Concepts (L+E)	Wahlpflicht	3
03SM22BI0009	Database Systems (L+E) (Datenbanksysteme)	Wahlpflicht	6
03SM22BI0010	Social Computing (L+E)	Wahlpflicht	6
03SM22BI0011	Software Engineering (L+E)	Wahlpflicht	3
03SM22BI0015	Informatik, Ethik, Gesellschaft (V) (Informatics, Ethics and Society)	Wahlpflicht	3
03SM22BI0018	Introduction to Artificial Intelligence (L+E)	Wahlpflicht	6
03SM22BMI002	Algorithmic Game Theory and Mechanism Design (L+E)	Wahlpflicht	6
03SM22BMI003	Requirements Engineering I (L+E)	Wahlpflicht	3
03SM22BMI004	CSCW (L+E)	Wahlpflicht	6
03SM22BMI005	Human-Computer Interaction (L+E)	Wahlpflicht	6
03SM22BMI006	Effective Software Testing (L+E)	Wahlpflicht	6
03SM22BMI007	Computer Graphics (L+E)	Wahlpflicht	6
03SM22BMI008	Mobile Communication Systems (L+E)	Wahlpflicht	6
03SM22BMI009	Temporal and Spatial Data Management (L)	Wahlpflicht	3
03SM22MI0001	Information Management (L+E)	Wahlpflicht	6
03SM22MI0002	Fundamentals of Software Systems (L+E)	Wahlpflicht	6



03SM22MI0003	Fundamentals of Human-Centered Computing	Wahlpflicht	6
03SM22MI0004	Advanced Topics in Artificial Intelligence (AI) (L+E)	Wahlpflicht	6
03SM22MI0005	Foundations of Data Science (L+E)	Wahlpflicht	6
03SM22MI0010	Protocols for Multi-media Communications (PMMK) (L+E)	Wahlpflicht	6
03SM22MI0011	Object-Oriented Software Development (V) (Objektorientierte	Wahlpflicht	3
03SM22MI0012	Enterprise IT-Architectures (L+E)	Wahlpflicht	3
03SM22MI0013	Digitalization and Sustainable Development (V)	Wahlpflicht	3
03SM22MI0014	Human Aspects of Software Engineering (L+E)	Wahlpflicht	6
03SM22MI0015	Digital Innovation (L)	Wahlpflicht	3
03SM22MI0016	How to manage an IT Company (L)	Wahlpflicht	3
03SM22MI0018	Combinatorial Algorithms (L+E)	Wahlpflicht	6
03SM22MI0019	Network Science (L+E)	Wahlpflicht	6
03SM22MI0020	Database Systems Lab MSc (Praktikum Datenbanksysteme MSc)	Wahlpflicht	3
03SM22MI0022	Computer Network Security Principles	Wahlpflicht	6
03SM22MI0023	Randomized Algorithms (L)	Wahlpflicht	6
03SM22MI0024	Foundations of Programming Languages and Program Analysis (L+E)	Wahlpflicht	6
03SM22MI0025	XML and Databases (L)	Wahlpflicht	3
03SM22MI0026	Advanced Software Engineering (L+E)	Wahlpflicht	6
03SM22MI0027	Deep Learning (L+E)	Wahlpflicht	6
03SM22MI0028	Interactive-Visual Data Analysis (L&E)	Wahlpflicht	6
03SM22MI0029	Web and mobile accessibility (L+E)	Wahlpflicht	3
03SM22MI0030	Systems for Data Science (L+E)	Wahlpflicht	6
03SM22MI0031	Digital technologies in medicine (L) (Digitale Technologien in der Medizin)	Wahlpflicht	3
03SM22MI0032	IT Security (L)	Wahlpflicht	3
03SM22MI0035	Blockchains and Overlay Networks (L+E)	Wahlpflicht	6
03SM22MI0043	Reinforcement Learning (L+E)	Wahlpflicht	6
03SMAINF1169	Informatics II (V+Ü) (Informatik II)	Wahlpflicht	6
03SMAINF1170	Foundations of Computing I (L+E) (Formale Grundlagen der Informatik I)	Wahlpflicht	6
03SMBINF2160	Database Systems (L+E) (Datenbanksysteme)	Wahlpflicht	6
03SMBINF601	Computer Graphics Lab (BSc PR)	Wahlpflicht	6
03SMBMINF002	Computer Graphics (L)	Wahlpflicht	3
03SMBMINF003	CSCW (L+E)	Wahlpflicht	6
03SMBMINF005	Software Maintenance and Evolution (L+E)	Wahlpflicht	3
03SMBMINF008	Temporal and Spatial Data Management (L)	Wahlpflicht	3
03SMBMINF015	Algorithmic Game Theory and Mechanism Design (L+E)	Wahlpflicht	6
03SMBMINF016	Human-Computer Interaction (L+E)	Wahlpflicht	6
03SMBMINF017	Mobile Communication Systems (L+E)	Wahlpflicht	6
03SMBMINF019	Combinatorial and Approximation Algorithms	Wahlpflicht	6
03SMBMINF020	Vision Algorithms for Mobile Robotics (L)	Wahlpflicht	6
03SMBMINF021	Software Testing (L)	Wahlpflicht	3
03SMDINF1132	Efficient Algorithms for Frequently Asked Questions (L+E)	Wahlpflicht	3
03SMDINF2035	Market Design and Machine Learning (L)	Wahlpflicht	6
03SMDINF2039	Vision Algorithms for Mobile Robotics (L+E)	Wahlpflicht	6
03SMMINF4217	XML and Databases (L)	Wahlpflicht	3
03SMMINF4221	IT Security (L)	Wahlpflicht	3



03SMMINF4224	Blockchains and Overlay Networks (L+E)	Wahlpflicht	3
03SMMINF4227	Data Warehousing (L)	Wahlpflicht	6
03SMMINF4529	Practical Artificial Intelligence (L+E)	Wahlpflicht	3
03SMMINF4532	Human Aspects of Software Engineering (L)	Wahlpflicht	6
03SMMINF4534	Advanced Software Engineering (L+E)	Wahlpflicht	6
03SMMINF4538	Big-Data Analytics (L+E)	Wahlpflicht	4
03SMMINF4547	Quantitative Methods in Human-Computer Interaction (L+E)	Wahlpflicht	3
03SMMINF4552	Advanced Software Engineering (L+E)	Wahlpflicht	6
03SMMINF4563	Ethical, legal and social aspects of cybersecurity (L+E)	Wahlpflicht	6
03SMMINF4564	Web and mobile accessibility (L+E)	Wahlpflicht	3
03SMMINF4568	Deep Learning (L+E)	Wahlpflicht	3
03SMMINF4570	Introduction to Interactive-Visual Data Analysis (V)	Wahlpflicht	6
03SMMINF4576	Systems for Data Science (L+E)	Wahlpflicht	3
06M-7521i04	Computational Linguistics and Language Technology in Practice	Modultyp	ECTS
06SM523-510	Practical Training In-House	Wahlpflicht	6
06SM523-511	Practical Training Off-Site	Wahlpflicht	6
06SM523-512	Programming Project 1	Wahlpflicht	6
06SM523-513	Student Teaching Assistant 1	Wahlpflicht	6
06SM523-516	Student Teaching Assistant 2	Wahlpflicht	6
06SM523-517	Programming Project 2	Wahlpflicht	6



Katalog der Pflichtmodule, Wahlpflichtmodule und Wahlmodule

Der Katalog enthält Informationen zu jedem Pflicht- und Wahlpflichtmodul.

Zum Teil finden Sie auch Informationen zu Wahlmodulen [Modultitel in eckigen Klammern]. Beachten Sie, dass die Titel von Wahlmodulen semesterweise wechseln können und dass oft weitere, nicht im Modulkatalog enthaltene Wahlmodule angeboten werden. Diese und alle anderen semesterbezogenen Informationen (wie Veranstaltungstitel, Termine, Dozierende, Informationen zur Buchung) entnehmen Sie dem aktuellen Vorlesungsverzeichnis.



Modulkürzel	06SM521-s09
Modulgruppe	Scientific Specialization
Modultyp	Wahl
Organisation	Institut für Computerlinguistik

[Seminar]

ECTS	6
Lehrformen	Seminar
Allg. Beschreibung	A seminar serves the scientific deepening of knowledge in a particular subject area. Students learn the methods of scientific work, e.g. how to deal with research literature, how to interpret facts and theories as well as to properly evaluate empirical results. Moreover, they learn how to prepare and give a talk. Students learn how to discuss and evaluate other talks. Finally, they acquire the skill to elaborate their talk in a written format.
Lernziel	The students (1) gain further insight in a specific area of Natural Language Processing (2) acquire basic methodological skills needed for scientific research (3) get practice in presenting complex topics in a clear manner (4) can write a scientific paper
Unterrichtssprache	siehe Vorlesungsverzeichnis
Voraussetzungen	This module is open only to Master's students. It may not be booked by Bachelor's students as a pre-Master's module.
Leistungsnachweis	schriftliche Arbeit und Referat
Notenskala	1-6, in Halbschritten
Repetierbarkeit	keine Wiederholungsmöglichkeit
Angebotsmuster	1-semesterig (einmalig)



Modulkürzel	03SM22MI0034
Modulgruppe	Core Modules of Computational Linguistics and Language Technology
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Advanced Machine Learning (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>First, this course covers an in-depth discussion of state-of-the-art methods in supervised and unsupervised machine learning including (Retrieval) Transformers, Graphical Neural Networks and Diffusion Models as well approaches to combine elements from these architectures. We will further discuss how transfer learning (including zero- and N-shot learning) can be applied in different types of problem settings.</p> <p>Second, this course provides an introduction to Reinforcement Learning that introduces the reinforcement problem setting as Markov Decision Process and covers Dynamic Programming approaches, Monte Carlo methods, Temporal Difference Learning and approximate solution methods.</p>
Lernziel	Students will acquire theoretical knowledge of state-of-the-art machine learning techniques and the practical skills to apply these methods to different kinds of problem settings.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	06SM523-501
Modulgruppe	Core Modules of Computational Linguistics and Language Technology
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Advanced Techniques of Machine Translation

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	In this course we present and experience the latest research in Machine Translation. Topics include building and evaluating Machine Translation systems, and integrating the systems into various application scenarios. We take a broad perspective and look at Machine Translation for different language situations (written, spoken, and signed language). And we take a deep perspective by studying the underlying linguistic knowledge sources and statistical techniques in detail.
Lernziel	The students (1) will be acquainted with the latest research and developments in Machine Translation (2) will learn how to build Machine Translation systems with state-of-the-art performance (3) will learn how to perform Machine Translation experiments and publish the results
Unterrichtssprache	Englisch
Voraussetzungen	Basic knowledge in Machine Translation and Machine Learning.
Leistungsnachweis	Portfolio (75% final exam und 25% exercises)
Notenskala	1-6, in Halbschritten
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	06SM523-505
Modulgruppe	Core Modules of Computational Linguistics and Language Technology
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Machine Learning for Natural Language Processing 1

ECTS	6
Lehrformen	Tutorat, Vorlesung
Allg. Beschreibung	Modern Natural Language Processing (NLP) requires a high level of expertise in neural machine learning techniques. This course first covers the basic supervised and unsupervised methods used in NLP. The second part focuses on transfer learning and prediction of linguistic structures. Participants will gain theoretical and practical experience in this course.
Lernziel	Students know about relevant machine learning techniques for NLP. They understand advanced neural methods for transfer learning and linguistic structure prediction. They gain practical experience in applying machine learning to NLP problems.
Unterrichtssprache	Englisch
Voraussetzungen	Good programming skills in Python and basic knowledge in statistics and probability theory.
Leistungsnachweis	Portfolio (75% written exam and 25% proof of academic achievements in self-study)
Notenskala	1-6, in Halbschritten
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	06SM523-506
Modulgruppe	Core Modules of Computational Linguistics and Language Technology
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Machine Learning for Natural Language Processing 2

ECTS	6
Lehrformen	Tutorat, Vorlesung
Allg. Beschreibung	This course focuses on current neural machine learning (ML) methods that achieve state-of-the-art performance in Natural Language Processing (NLP) tasks. Participants study and present current research articles from the NLP literature. As a practical preparation for a modern empirical master thesis, they learn how to plan, conduct and evaluate ML-based NLP experiments and how to describe their approach and results in a scientific paper.
Lernziel	Students know the current state of machine learning methods for various NLP tasks. They know how to conduct machine learning-based empirical research in computational linguistics and how to present it in the scientific format of a workshop paper.
Unterrichtssprache	Englisch
Voraussetzungen	Successfully completed module «Machine Learning for Natural Language Processing I».
Leistungsnachweis	Portfolio: 50% Referat/Diskussionsbeiträge, 50% schriftliche Arbeit
Notenskala	1-6, in Halbschritten
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	06SM523-519
Modulgruppe	Core Modules of Computational Linguistics and Language Technology
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Fundamentals of speech sciences and signal processing

ECTS	6
Lehrformen	Vorlesung
Allg. Beschreibung	Experience the captivating world of speech signal processing. Discover the essential techniques that enable us to decode, manipulate, and reproduce the human communication with speech. Learn about signal and system theory necessary for speech processing in both human interaction and cutting-edge technological applications. This lecture series will equip you with the fundamental knowledge needed to unravel the intricacies of speech communication and embrace the possibilities it holds.
Lernziel	(1) Fundamental skills in speech signal processing (2) Understanding of speech acoustics like signal types, signal transformations, acoustic systems, signal and system theory (3) Application of the signal processing techniques in research and industrial products.
Unterrichtssprache	Englisch
Voraussetzungen	An interest in speech signal processing with computers is required.
Leistungsnachweis	Portfolio: (a) weekly assignments, 40% (b) end of term exam, 60%
Notenskala	1-6, in Halbschritten
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	06SM523-520
Modulgruppe	Core Modules of Computational Linguistics and Language Technology
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Instrumental techniques of phonetic research

ECTS	6
Lehrformen	Übung
Allg. Beschreibung	Since speech is a transient event, phoneticians regularly resort to the aid of technical devices in order to record, describe and analyse the production, the acoustics and the perception of speech sounds. Hence, in this module we look at the technical side of phonetic research and the students acquire and develop skills and techniques necessary for the successful deployment of such devices, ranging from sound recording equipment (especially recorders and microphones) to more specialized phonetic equipment (such as the laryngograph) to software solutions geared specifically towards the need of phoneticians (such as Praat or the R-package 'vowels').
Lernziel	Students know how to make high-quality audio recordings for phonetic research purposes. They can annotate sound files, make reliable measurements in them (formants, pitch, intensity, etc.) and produce meaningful visualizations (wave forms, spectra, spectrograms, etc.) with suitable software. They also understand how to read spectrograms so as to draw informed conclusions about the temporal and spectral characteristics of speech events. Moreover, students understand the most important key notions and concepts in automatizing measurements and in making them replicable (scripting).
Unterrichtssprache	Englisch
Voraussetzungen	Students are required to have attended an introductory module in phonetics at bachelor or master level.
Leistungsnachweis	During the semester students run guided analyses on spoken material both as part of the course but also as personal homework. In addition students are required to hand in a small-scale empiric study (7-10 pages) to be handed in a fortnight after the last meeting of the semester. Both their analyses during the semester and their final report form their portfolio and thus the basis for the evaluation of their performance.
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	06SM523-530
Modulgruppe	Core Modules of Computational Linguistics and Language Technology
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Eye Tracking and NLP

ECTS	6
Lehrformen	Übung
Allg. Beschreibung	<p>This course introduces a growing research area that combines eyetracking during reading with natural language processing (NLP). Students will learn how eye movements in reading can be leveraged for enhancing and interpreting language models, and how eye movements can be exploited for a range of new human-centered applications. The course covers the following topics: (i) fundamentals of eye movements in reading, (ii) experimental methodologies and available data sets, (iii) generative models of eye movements, iv) leveraging eye movement data for NLP and v) human-centered applications.</p>
Lernziel	Students will acquire theoretical knowledge and develop practical skills in the topics covered by this course.
Unterrichtssprache	siehe Vorlesungsverzeichnis
Voraussetzungen	<p>Python programming skills at least on the level of the Module «Programmiertechniken in der Computerlinguistik 2», and familiarity with foundational knowledge in machine learning and NLP. This module is open only to Master's students. It may not be booked by Bachelor's students as a pre-Master's module.</p>
Leistungsnachweis	Portfolio (80% written exam und 20% theoretical and practical assignments)
Notenskala	1-6, in Halbschritten
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	06SM523-532
Modulgruppe	Core Modules of Computational Linguistics and Language Technology
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Artificial Intelligence for Language Accessibility

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>Blind persons and persons with visual impairments, deaf persons and persons with hearing impairments, persons with cognitive impairments, motor impairments, and persons with speech and language disorders face many barriers in their everyday lives, often related to language. This course provides an overview of common barriers and introduces artificial intelligence approaches developed to reduce some of these barriers.</p> <p>Specifically, the course deals with tasks such as sign language recognition, translation, and production; intralingual subtitling; audio description; diagnostics of speech and language disorders; automatic text simplification; and speech recognition and synthesis as part of Augmentative and Alternative Communication (AAC) and Ambient Assisted Living (AAL). A focus is on research approaches; transversal topics are those of multimodality and ethics. Students will gain hands-on practice applying some of the approaches as part of the exercises accompanying the course.</p> <p>This course is preceded by a "Digital Accessibility" course on Bachelor's level.</p>
Lernziel	<p>Students (1) are aware of different target groups in the context of accessibility; (2) are aware of language barriers that these target groups face; (2) know about research approaches from the area of artificial intelligence towards reducing some of these barriers; (3) know how to apply a selection of these approaches.</p>
Unterrichtssprache	Englisch
Voraussetzungen	Knowledge to the extent of the courses "Einführung in die Computerlinguistik 1" and "Programmiertechniken der Computerlinguistik 1"; familiarity with model training
Leistungsnachweis	Written exam
Notenskala	1-6, in Halbschritten
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	06SM523-533
Modulgruppe	Core Modules of Computational Linguistics and Language Technology
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Advanced Machine Learning

ECTS	6
Lehrformen	Tutorat, Vorlesung mit integrierter Übung
Allg. Beschreibung	This course examines advanced methods in supervised and unsupervised machine learning, with a focus on deep learning architectures. Topics include state-of-the-art models such as Transformers, Graph Neural Networks, Diffusion Models, and State Space Models, with attention to both their theoretical principles and practical implementation.
Lernziel	Students will acquire theoretical knowledge of state-of-the-art machine learning techniques and the practical skills to apply these methods to different kinds of problem settings.
Unterrichtssprache	siehe Vorlesungsverzeichnis
Voraussetzungen	Solid knowledge of supervised and unsupervised machine learning, probability theory, linear algebra, multivariate calculus as well as fluent Python programming skills are required.
Leistungsnachweis	Portfolio (20% practical assignments, 80% written exam)
Notenskala	1-6, in Halbschritten
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	06SM523-534
Modulgruppe	Core Modules of Computational Linguistics and Language Technology
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Introduction to Forensic Speech Sciences

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	Forensic Speech Science is a multidisciplinary field that applies various aspects of phonetics, linguistics, signal processing, and automatic speaker recognition for legal and investigative purposes. This module aims to introduce the goals, tasks (e.g. transcription, speaker comparison, disambiguation of disputed utterances) and practices of forensic speech and audio analysis. This module blends frontal teaching and hands-on sessions.
Lernziel	By the end of this module, students will have achieved the following learning objectives: - A fundamental understanding of factors affecting the perception, analysis, and transcription of speech signals within investigative settings. - Develop familiarity with diverse methods for transcribing forensic audio materials, including using state-of-the-art automatic speech recognition systems. - Gain familiarity with multiple approaches to forensic voice comparison, including auditory assessment, acoustic-phonetic analysis, and automatic techniques. - Showcase their abilities through practical demonstrations in voice comparison and the transcription of forensic recordings
Unterrichtssprache	Englisch
Voraussetzungen	The participation to modules on Phonetics and Phonology is highly recommended.
Leistungsnachweis	Portfolio: 50% assignments, 50% final course exam
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	06SM521-s06
Modulgruppe	Core Modules of Computational Linguistics and Language Technology
Modultyp	Wahl
Organisation	Institut für Computerlinguistik

[Summer School]

ECTS	6
Lehrformen	Selbststudium
Allg. Beschreibung	<p>Summer schools are designed to give students an in-depth insight into specific subject areas. This way, they consolidate what they have learned so far during their studies, expand their knowledge of core theories and understand new approaches in a compact way. They become aware of current trends, they exchange experiences and assessments with students from other universities, and thus get the opportunity to get to know the international level and at the same time establish relationships that can be helpful beyond their studies. This module can be booked to credit the attendance at summer schools that are related to Natural Language Processing. This module can be booked with 3 or 6 ECTS points.</p> <p>The amount of points will be decided in consultation with the module coordinator.</p>
Lernziel	<p>Learning objectives are (1) repeat and consolidate what you have learned (2) acquire new content / topic areas in a compact form (3) get to know the latest trends (4) exchange of experiences with students from other universities (5) networking at international level</p>
Unterrichtssprache	siehe Vorlesungsverzeichnis
Voraussetzungen	<p>This module can not be booked by the students themselves, the booking has to be authorized by the module coordinator. In order to credit the attendance at a summer school, it is essential to submit a request to the module coordinator before the start of the summer school.</p> <p>This module is open only to Master's students. It may not be booked by Bachelor's students as a pre-Master's module.</p>
Leistungsnachweis	Nachweis von im Selbststudium erbrachten Studienleistungen
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	keine Wiederholungsmöglichkeit
Angebotsmuster	1-semesterig (einmalig)



Modulkürzel	06SM523-s15
Modulgruppe	Core Modules of Computational Linguistics and Language Technology
Modultyp	Wahl
Organisation	Institut für Computerlinguistik

[Excursion]

ECTS	3
Lehrformen	Exkursion
Allg. Beschreibung	Excursions, similar to practical training off-site, offer the opportunity to gain insight into the daily work of computational linguists. In contrast to these, however, the emphasis is not on concrete work in a company, but on the ability to recognize and assess the problems and methods of a field of application of computational linguistics in direct contact as accurately as possible. This provides insights into problem areas, allows one to measure one's own specific interests and, if necessary, to fix future work areas and employers. The students prepare for the excursion by effectively researching and studying relevant literature. This module can be booked to credit the participation in excursions.
Lernziel	The students (1) gain insight into language technology companies and university or non-university research departments (2) get to know the theory and practice of computational linguistics in a concrete example (3) find or develop one's own specific interests (4) gain the ability to get insight into practical problems and methods through interviews with practitioners (5) get in contact with potential employers
Unterrichtssprache	siehe Vorlesungsverzeichnis
Voraussetzungen	This module can not be booked by the students themselves, the booking has to be authorized by the module coordinator. In order to credit the participation in an excursion, it is essential to contact to the module coordinator before the start of the excursion.
Leistungsnachweis	Nachweis von im Selbststudium erbrachten Studienleistungen
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	keine Wiederholungsmöglichkeit
Angebotsmuster	1-semesterig (einmalig)



Modulkürzel	02SMMAWMF32
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Rechtswissenschaftliche Fakultät

Artificial Intelligence: Technology and Law

ECTS	6
Lehrformen	Vorlesung
Allg. Beschreibung	<p>Machines are increasingly capable of performing tasks considered to require "intelligence" if performed by human beings. Recent developments in the field of Artificial Intelligence (AI) are fueled by novel data processing technologies, ever growing amounts of data, and increased computing power. AI systems come with great promises and opportunities, but they also raise concerns in many respects and they pose significant challenges to the application of today's legal order. Accordingly, regulators around the globe are currently investigating if and how the law should be adapted to meet these challenges.</p> <p>This course provides participants with an interdisciplinary view on Artificial Intelligence by focusing on the capabilities of AI systems and the regulatory as well as technical responses in Switzerland and Europe. In doing so, it also highlights some of the fundamental differences in preventing undesired outcomes in law and computer science and challenges all participants to reflect on practical solutions for the future.</p>
Lernziel	<p>Students will gain a basic understanding of the technical and legal foundations of Big Data and will learn how to interact and achieve scientific output in an interdisciplinary team and how to communicate their findings to a cross-disciplinary audience.</p>
Unterrichtssprache	siehe Vorlesungsverzeichnis
Voraussetzungen	Bachelor's degree
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Halbschritten
Repetierbarkeit	keine Wiederholungsmöglichkeit
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22AINF05
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Foundations of Computing I (L+E) (Formale Grundlagen der Informatik I)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	This course introduces mathematical tools used in computer science (from database management to artificial intelligence, machine learning, data analysis and visualization, cryptography and security, computer graphics, computer vision, and image processing). In particular, the course will teach the following topics: propositional logic, digital logic circuits, induction and recursion, convolution, relations, modular arithmetic with application to cryptography, graphs, and trees.
Lernziel	Students will learn propositional logic, digital logic circuits, induction and recursion, convolution, relations, modular arithmetic with application to cryptography, graphs, and trees.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22BI0001
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Foundations of Computing II (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	Required second-year course covering topics from discrete math and formal methods building the foundations of computing. The material of this course is pervasive in the areas of algorithms, data structures and programming but appears virtually in all areas of computer science as well. The course will cover topics such as, but not limited to, proof methods, formal languages, deterministic and nondeterministic finite automata, grammars and pushdown automata, Turing machines, computability, decidability and complexity, P and NP, NP-completeness.
Lernziel	The goal of the course is to familiarize the student with formal methods of computing and their value for computer science and related disciplines, and to provide basic training in applying formal methods to many different kinds of problems. Students should learn the fundamental limits of computation and extend their knowledge on formal languages as well as on formal programming models. Principles of interference, deduction, induction and contradiction should regularly be applied to demonstrate the formal correctness of models and limits.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22BI0002
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Fortgeschrittene Programmierung in C++ (V+Ü) (Advanced Programming in C++)

ECTS	3
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>C++ wird in vielen Bereichen verwendet. In Open Source Projekten, wie zum Beispiel der Implementierung von Desktopsystemen (KDE) oder Datenbanken (mysql), oder in smart phones, wie zum Beispiel zur Implementierung der Dalvik VM, der virtuellen Maschine des Android Betriebssystems. Insbesondere auch für embedded systems bietet sich C++ durch seine Hardwarenähe an und aufgrund der Tatsache, dass C++ Programme direkt, daher ohne virtuelle Maschine, durch den Prozessor ausgeführt werden, und so ressourcensparender ist. Die Vorlesung wird komplementiert durch einen Übungsteil in dem die Vorlesung besprochenen Konstrukte an kleinen Programmen anzuwenden ist um deren Verwendung in der Praxis zu erlernen.</p>
Lernziel	<p>Das Ziel der Vorlesung ist es, dass Design von C++ und dessen Verwendung zu erklären. Dies geschieht insbesondere auch anhand von Vergleichen mit anderen Programmiersprachen, wie zum Beispiel Java. Nach einer kurzen Einführung in C++, konzentriert sich die Vorlesung insbesondere auf Templates und wie diese in der C++ Standard Library verwendet werden. C++ Templates bieten Entwicklern eine Mächtigkeit verleihen, die in keiner anderen Programmiersprache zu finden ist.</p>
Unterrichtssprache	Deutsch
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22BI0003
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Numerical Methods in Informatics (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	The course presents the basic numerical and linear algebra techniques to solve mathematical problems that arise in computer science. The topics cover a wide range such as e.g.: basic concepts of scientific programming, solution of systems of linear equations and of nonlinear equations; interpolation and least-square approximation of data and functions; eigenvalues and eigenvectors computation; integration and differentiation and numerical optimization. The course consists of lectures, exercises and homework assignments.
Lernziel	By the end of the course, the students will be able to identify a suitable method to solve basic problems of scientific computing, understand the main implications of the method and implement it directly or apply it using existing libraries. The students will learn how to solve such problems and to implement required algorithms and solutions in Python. The course will provide to the students the basis to understand more complex numerical tools that they may encounter in future courses or in their professional career.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22BI0004
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Software Construction (L+E) (Softwarekonstruktion)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	Knowing how to program does not make a student a software designer. The next step involves learning and practicing the fundamental principles and techniques for designing long-lived software systems. This course helps students learn software design by building examples of small versions of tools that programmers use every day. The course includes a practical component, highlighting the engineering skills needed to design robust software systems. Primarily, the course is taught using Python, with the final lectures introducing Java.
Lernziel	As a result of this course, students will acquire: A solid understanding of the principles and techniques of modern software design, including: A.1 Concepts and issues of software quality and maintainability A.2 Code as data A.3 Object-oriented programming A.4 Fundamental design patterns (recognized best practices of software architectures) A.5 Fundamentals of software testing A.6 Fundamentals of modern software engineering tools B. Experience in collaborative tasks applying these principles and techniques
Unterrichtssprache	English
Voraussetzungen	Informatics I (or equivalent)
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22BI0005
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Wirtschaftsinformatik II (V+Ü) (Business Informatics II)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<ul style="list-style-type: none">- Die Vorlesung behandelt Prozessmanagement und ERP Systeme. Sie hat folgenden Aufbau: Einführung in die Lehrveranstaltung- Prozesse- Business Process Model and Notation (BPMN)- Strategisches Prozessmanagement- Ist/Soll-Modellierung- Implementierung- Process Mining- Enterprise Resource Planning (ERP)- Organisatorische Implementierung- Die begleitenden Übungen behandeln das Modellieren von BPMN, die Ist/Sollmodellierung, die Implementierung mit einer Process Engine sowie die Nutzung von ERPSim. Projektaufgabe.
Lernziel	<p>Lernziel 1: Betrieblich Prozesse analysieren, modellieren, implementieren und managen können.</p> <p>Lernziel 2: ERP Systeme nutzen und implementieren können. (ERP = Enterprise Ressource Planning)</p>
Unterrichtssprache	Deutsch; Hintergrundliteratur und Software kann auf Englisch sein
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22BI0006
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Computer Networks and Distributed Systems (L+E) (Kommunikationsnetze und Verteilte Systeme)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>The Information and Communications Technology (ICT) age has arrived within our daily life, not only during work and business hours, but at a good deal of entertainment and social interactions, too. Thus, the society has to cope with such developments of digitization. Many of those human-centric statements only refer to or try to analyze the impact of these changes and the society. However, in very many cases the fundamentals to derive reliable, correct, and transparent conclusions requires a detailed know-how of Communication Networks and Distributed Systems (CNDS). Therefore, once stand-alone systems are discussed, their interconnection across physical boundaries of an office or building site forms the major development of the ICT society. While fundamental communication architectures did introduce communications by technical means, achieved over the past 100 years, the development of telephone communications to today's Internet will be covered. Protocols, reliable, unreliable, and secure services, algorithms for finding the corresponding receiver, routing, and basic mechanisms for Internet operations will form this lecture's part one. Furthermore, once stand-alone systems have been interconnected, they constitute Distributed Systems, which form a collection of independent computers that appear to their users as a single coherent system, embedding hardware, within which all machines are fully autonomous, and software, for which users think they deal with a single system. Thus, basic theory and techniques of Distributed Systems are covered in this lecture's part two. Driven by an introduction, naming principles and distributed file systems are outlined. To ensure an application-driven interoperability, approaches for synchronization and coordination are discussed. Examples of Distributed Systems in use are overviewed. Finally, part three will overview the role of security in Computer Networks and Distributed Systems concludes this class.</p>
Lernziel	<p>Students will receive the required insights into basic foundations on Communication Networks and Distributed Systems. More specifically, the lecture will teach communication architectures, network building blocks, shared links, packet switching, end-to-end protocols, selected Internet applications, naming principles, distributed file systems synchronization, coordination, and basic security elements as well as mechanisms. Overall, students will be able to understand which communication systems exist, how Internet-based systems operate world-wise, which communications can be reliable, how the basic inter-operations of Distributed Systems work, and which ones may be secured.</p>
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22BI0008
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Data Visualization Concepts (L+E)

ECTS	3
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	This course covers the fundamental concepts of interactive data visualization and related techniques, e.g. such as fundamental visual perception and color concepts, data types, basic data processing and data analysis, as well as various visualization techniques with a focus on multivariate data visualization.
Lernziel	The participating students will be introduced to the fundamental principles and techniques for the visualization of various data types, such as scalar, abstract, spatial and multidimensional data.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22BI0009
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Database Systems (L+E) (Datenbanksysteme)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	Comprehensive introduction to the foundations of database systems. The course is based on the relational data model and covers the following topics: relational data model, relational algebra and calculus, SQL, relational database design, physical data organization, query processing and optimization, transactions, concurrency, recovery.
Lernziel	The goal is a solid understanding of the foundations of database systems; to understand how these are implemented in concrete systems; and gaining experience in working with database systems.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22BI0010
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Social Computing (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>Social computing studies the intersection of social behavior and computing systems. This intersection is not static: social behavior affects how computing systems are designed and computing systems affect how humans interact. Traditionally, social computing was more concerned with the first direction, how social norms and individual behavior affect the growth, success, and usage of online platforms. In recent years however, it is increasingly recognized that online platforms affect how people perceive the world, interact with each other, and ultimately how societal norms develop. Today, online platforms affect people's daily lives in essentially all domains: in healthcare, the labor market, social and family lives, education, information access, etc, and thus have a growing social, economical, and political impact.</p> <p>Regulatory action tries to react to changes in technology (GDPR, online discrimination law, competition law, etc) but as argued in this course, still much power and social responsibility remains in the hands of online platform providers.</p>
Lernziel	<p>Studying the ecosystem of online platforms and their users poses a multitude of challenges, given their complexity and how quickly they evolve. Understanding them requires the combination of technical skills (platform design, digital trace data collection, software tools), social science knowledge (from political science, social science, economics, law), and research design knowledge.</p> <p>Throughout the semester we will discuss the evolution of online platforms and smart phone apps, their use, structure, and purpose in society. We will learn about the underlying data and algorithmic eco- systems. The students will learn to scrape digital trace data and use this data to answer societally relevant research questions.</p> <p>By the end of the course students will be able to a) summarize the most important papers addressing societal problems from different domains related to online platforms, b) design an empirical research project bringing together research questions and technical/societal background, and c) identify and critically discuss ethical and bias-related issues with their research design.</p>
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22BI0011
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Software Engineering (L+E)

ECTS	3
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>The world runs on software, and this course (and the SE Lab / SoPra) is all about taking the skills and knowledge you learned in software construction and extending your abilities to design and build non-trivial software systems.</p> <p>This course will cover topics relevant to developing large, multi-module software systems, including their specification, design, implementation, and maintenance, as well as topics such as REST, agile development, and refactoring.</p>
Lernziel	<p>When you have completed this course, you should be able to:</p> <ul style="list-style-type: none">&sect; Understand the benefits and disadvantages of various designs for constructing large, multi-version, multi-component software systems.&sect; Demonstrate knowledge of the steps involved in building a large, complex software project using modern software engineering technologies.&sect; Communicate your rationale and provide insight into requirements traceability to code.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22BI0015
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Informatik, Ethik, Gesellschaft (V) (Informatics, Ethics and Society)

ECTS	3
Lehrformen	Vorlesung
Allg. Beschreibung	Die Vorlesung behandelt ethische und gesellschaftliche Aspekte der Informatik und ihrer Anwendungen. Nach einer generellen Einführung in die ethische Entscheidungsfindung und in verschiedene Positionen zum Verhältnis von Technik und Gesellschaft behandeln wir aktuelle Beispiele, an denen sich ethische und soziale Fragen der Digitalisierung diskutieren lassen.
Lernziel	Sensibilisierung für die gesellschaftlichen Bedingungen und Auswirkungen der technischen Entwicklung im digitalen Zeitalter; die Fähigkeit, im Diskurs über neue Technologien und ihre Anwendungen deskriptive (beschreibende) und normative (wertende) Argumente zu unterscheiden; die Fähigkeit, über Verantwortung in Informatikberufen zu reflektieren.
Unterrichtssprache	Deutsch
Voraussetzungen	Interesse an interdisziplinären Fragestellungen und die Bereitschaft, sich aktiv zu beteiligen (Referate, Diskussionen).
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22BI0018
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Introduction to Artificial Intelligence (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>Artificial Intelligence is not just an empty buzzword: it is a research area that can trace its origins back to the early decades of computing. This course will introduce the foundations of this broad field, as well as a selection of more recent topics and applications.</p> <p>After an overview of mathematical prerequisites and key concepts in AI, the course will cover topics relating to problem solving, reasoning and planning, and reasoning under uncertainty. Later lectures will turn to the basics of natural language processing, supervised learning and deep learning.</p>
Lernziel	<p>Students learn the theoretical and practical foundations of classical problems in artificial intelligence and their algorithmic solution. In particular, participants will obtain the necessary knowledge and skills to independently solve typical AI problems by selecting, implementing and evaluating standard algorithms from the AI literature.</p>
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22BMI002
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Algorithmic Game Theory and Mechanism Design (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>In this lecture, we will cover the interplay between economic thinking and computational thinking as it relates to the analysis and design of electronic markets in particular, and socio-economic systems in general.</p> <p>Topics covered include: algorithmic game theory, mechanism design, p2p file-sharing, eBay auctions, advertising auctions, combinatorial auctions, matching markets and voting systems. Emphasis will be given to core methodologies necessary to design such systems with good economic and computational properties. Students will be engaged in theoretical, computational, and empirical exercises.</p>
Lernziel	<ol style="list-style-type: none">1. Understand the importance of economic thinking in computational domains, and of computational thinking in economic domains.2. Be able to develop applicable models of complex Internet systems.3. Be able to analyze the behavior of systems that include people, computational agents as well as firms, and involve strategic behavior.4. Be able to solve both mathematical and conceptual problems involving such systems.5. Be able to write programs that implement strategic agents and mechanisms.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22BMI003
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Requirements Engineering I (L+E)

ECTS	3
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	Specifying requirements is a crucial prerequisite for successful software development. This course gives an introduction to the principles, practices, languages, methods, processes, and tools for specifying and managing requirements.
Lernziel	The students acquire basic knowledge, understanding and skills in the core principles, practices, languages, methods, and processes of Requirements Engineering.
Unterrichtssprache	English
Voraussetzungen	Basic knowledge of software development and modeling. Having taken a course in Software Engineering or read a SE textbook is strongly recommended. Students enrolled in the BSc in Informatics program must have passed the assessment level successfully.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22BMI004
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

CSCW (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	We will look at computer supported collaboration of collaborative units of any size: dyads, small groups, large groups, organizations, communities and social networks. For each collaborative unit, we will first look at their collaboration problems and what theories have to say about them. Then we will analyse how, and to what extent collaboration can be engineered for each of them. Finally we will discuss systems supporting their collaboration and how they should be designed.
Lernziel	The student will learn how to analyze and design computer supported collaboration.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22BMI005
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Human-Computer Interaction (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>The Human-Computer Interaction (HCI) course provides students with a comprehensive "toolkit" of principles, processes, and approaches for designing interactive systems that address human needs and provide a good user experience. Central to the course is the human-centered design process which focuses on understanding problems from the human perspective, the iterative design cycle, and continuous analysis of design through gathering design feedback.</p> <p>The course is structured around a semester-long team project addressing a real-world human problem through HCI approaches. Lectures will teach the principles, theory, and methods that are fundamental to Human-Computer Interaction. Students will learn to apply this knowledge in practice through the multi-part team project.</p>
Lernziel	<p>Students will learn principles, processes, and methods pertaining to the topics below, and will be able to apply them in practice to the design and analysis of interactive systems and technologies:</p> <ul style="list-style-type: none">- Approaches for understanding human needs- Principles for usability and design- Iterative design and prototyping- User and expert evaluation processes
Unterrichtssprache	English
Voraussetzungen	<p>As all course materials and the exam will be in English; students should have a good command of spoken and written English.</p> <p>A group project is a core component of this course. Students should be prepared to work in teams, potentially with students who come from different backgrounds of study.</p>
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22BMI006
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Effective Software Testing (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	Software testing is a crucial activity that developers perform to produce high-quality and reliable software. However, this practice and its theory is often neglected in academic curricula. This course aims to fill this gap by providing students with an updated theoretical and practical knowledge on the most relevant software testing methods. The module includes a practical part that aims at providing students with hands-on experience on updated software testing methods. Students will test existing open source software system, applying theoretical concepts to the practice.
Lernziel	At the end of the course students: <ul style="list-style-type: none">- are able to recall and list the most important software testing practices- can describe the most common applications of software testing practices- can judge the benefits/drawbacks of using specific software testing practices- are able to recall and list coverage criteria and judge their usefulness- are able to apply software testing practices to existing code bases
Unterrichtssprache	English
Voraussetzungen	<ul style="list-style-type: none">- Informatics I (or equivalent)- Informatics II (or equivalent)- Software Construction
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22BMI007
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Computer Graphics (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	Introduction to the fundamental concepts, algorithms, and data structures of interactive 3D computer graphics such as graphics systems, polygonal modeling, geometric transformations, illumination and shading, texturing, viewing in 3D, and visibility. Furthermore, we will cover some additional advanced topics such as physically based rendering, photorealistic rendering, e.g. using recursive ray-tracing and path-tracing, geometry and point cloud processing, and scientific visualization.
Lernziel	This course will teach the participating students the fundamental concepts of 3D image synthesis, covering not only basic interactive rendering but also more physically based rendering. The students will learn how real-time image formation as used in interactive 3D games, virtual reality simulation and scientific visualization applications is performed through the pipelined processes of perspective projection, visibility determination, illumination, rasterization and shading. A number of advanced techniques for improved physically based rendering and geometry processing will also be discussed.
Unterrichtssprache	English
Voraussetzungen	Successful completion of introductory computer science, programming and math courses, plus experience with C/C++.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22BMI008
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Mobile Communication Systems (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	Based on the basic knowledge on communication systems as well as distributed systems the specifics of communications in the wireless and mobile domain are addressed within this course. Those include technical basics, media access schemes, and signals. In a more detailed view mobile and wireless telecommunication systems are discussed, which include GSM, UMTS, LTE, LTE-A, 5G, satellites, and radio. The wireless local area is addressed in terms of WLAN technology, Bluetooth, IoT, sensor networks, and security. The development of these systems into an Internet usage is shown by discussing Mobile IP as well as mobile transport protocols.
Lernziel	This lecture's goals encompass the gaining of knowledge of principles and protocols for wireless and mobile communications. While telecommunications and Internet aspects are of utmost importance, their integration and future needs are discussed. Thus, respective protocol details and technology aspects for mobile and wireless communications will be covered.
Unterrichtssprache	English
Voraussetzungen	The content of the lecture on "Computer Networks and Distributed Systems (CNDS)" is essential, the lecture on "Computer Engineering and Systems Software (CESS)" is highly recommended.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22BMI009
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Temporal and Spatial Data Management (L)

ECTS	3
Lehrformen	Vorlesung
Allg. Beschreibung	Temporal and spatial data are ubiquitous and are present in almost all application areas. We discuss the challenges that arise from the management of time-varying and spatial data, the solutions offered by current database systems, and the state-of-the-art of the research in this area. The basic principles will be illustrated with concrete data models, query languages, relational algebras and algorithms. Throughout the course we will solve representative exercises.
Lernziel	Understanding of the basics of temporal and spatial database systems.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes 2. Herbstsemester)



Modulkürzel	03SM22MI0001
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Information Management (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	This lecture covers the management challenges and opportunities posed by information systems and offers methods to solve those problems. After completion of this course, the student is able to describe the problems and the tasks related to IT management, to explain these problems and tasks and to solve example tasks.

Topics covered:

1. Intro, IT and Strategy
2. Business Models
3. IT Outsourcing
4. IT Governance + IT Organization
5. Portfolios
6. Architectures
7. IT Projects
8. IT Benefits Management
9. Agile IT
10. IT Service Management
11. ITIL
12. Oracle Guest Lecture
13. Digital Organizations
14. Future of Work

Exercises will include case studies, small projects and paper reading.

There will be guest lectures.

Lernziel	This lecture covers the management challenges and opportunities posed by information systems and offers methods to solve those problems. After completion of this course, the student is able to describe the problems and the tasks related to IT management, to explain these problems and tasks and to solve example tasks. Furthermore, students will be able to critically reflect on information management literature.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22MI0002
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Fundamentals of Software Systems (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	Introduction to advanced topics pertaining to the development and evolution of software systems, particularly distributed, data-intensive systems.
Lernziel	<p>The students will acquire and be able to apply knowledge on:</p> <ul style="list-style-type: none">- Encoding and Distributed Systems- Unreliable Communication Systems- Consistency and Consensus in Distributed Systems- Distributed Concurrency Control- Distributed Reliability- The Technical Evolution of Software- Software Architecture- Social Aspects of software development- Open Source, Sustainability and Inclusion <p>This will enable students to develop and analyze on their own, at a later stage, maintainable, efficient, performing, and reliable distributed software systems.</p>
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22MI0003
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Fundamentals of Human-Centered Computing

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	This course is an introductory module for Human-Centered Computing.

Students will gain learn knowledge and skills in individual and collaborative work, to work with scholarly literature, and to conduct scholarly discourses. They will learn concepts and processes from cognitive psychology and how to apply them to improve their thinking and work by themselves and with others. Students will learn several conceptual frameworks that could help them understand and assess research contributions. They will learn about components and forms of arguments and critiques. This course will use the scholarly literature from various fields related to Human-Centered Computing.

Lernziel	<ol style="list-style-type: none">1. Students understand concepts and processes in cognitive psychology and can articulate how these theories apply to work situations.2. Students know conceptual frameworks for understanding and assessing research contributions.3. Students can identify the primary contributions of research papers.4. Students can assess the credibility of sources of scholarly publications.5. Students can analyze scholarly arguments and assess their quality.6. Students can synthesize knowledge from multiple readings.7. Students can formulate and communicate constructive critiques in scholarly contexts.8. Students can articulate the strengths and weaknesses of selected research methods.
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Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22MI0005
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Foundations of Data Science (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	Introduction to data science and different paradigms of machine learning; Linear prediction, Regression; Maximum Likelihood; Regularization, Generalization, Cross Validation; Optimization; Logistic Regression; Generative Models for Classification, Gaussian Discriminative Analysis, Naïve Bayes; Support Vector Machines; Kernel Methods; Neural Networks, Backpropagation; Clustering; Dimensionality Reduction, PCA.
Lernziel	This course introduces supervised and unsupervised learning. Students will learn the algorithms that underpin popular machine learning techniques. They will also develop an understanding of the theoretical relationships between these algorithms. The practicals will concern the implementation of machine learning algorithms and applications of machine learning.
Unterrichtssprache	English
Voraussetzungen	Introductory courses on continuous mathematics, linear algebra, probability theory, such as: WWF courses Mathematics I, Mathematics II, and Statistics.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22MI0010
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Protocols for Multi-media Communications (PMMK) (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>Based on the basic course on communication networks, this PMMK lecture will deepen concepts and principles of efficient networking, advanced communication protocols, data formats and procedures, and their respective Quality-of-Service (QoS) management. It does address the basics in high-speed networks and optical networks, including Passive Optical Networks (PON) being complemented by ADSL, the IP Technology, and MPLS.</p> <p>It is important to note that the PMMK lecture does address an integrated viewpoint of a full communication system, which does outline dependencies of networks, protocols, QoS and network or protocol architectures, especially by addressing QoS basics and its modeling, QoS methods, and QoS monitoring.</p> <p>Additionally, protocols for an operations management, multimedia transport protocols (RTP, SCTP), messaging and overlays (VPN, CDN), optimized transport for multimedia and real-time streaming, and Software-defined Networks (SDN) are introduced and discussed.</p>
Lernziel	<p>Students will receive a deep insight into protocols for multi-media communications, Quality-of-Service (QoS) models, and supporting network technologies. More specifically, the lecture will teach up-to-date knowledge in networks, covering available technology and research. This will enable students to develop on their own at a later stage efficient, performing, and globally applicable multi-media communications. Those protocols and mechanisms taught may leave the grounds of typical text books, which provides hooks to students to see in which way research in that field is undertaken. The finalizing discussion of technologies and QoS-based services offered takes into account where applicable economic incentives, which may limit or encourage the use of a dedicated communication service.</p>
Unterrichtssprache	English
Voraussetzungen	The lecture "Computer Networks and Distributed Systems (CNDS)" is recommended highly, but formally not mandatory, in case of a personal dedication to get hold of those basics on the students' own will.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22MI0011
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Object-Oriented Software Development (V) (Objektorientierte Softwareentwicklung)

ECTS	3
Lehrformen	Vorlesung
Allg. Beschreibung	The lecture provides a comprehensive overview of object-oriented software development. After a short introduction to the basics of object-orientation, the focus is on class libraries, design patterns, and frameworks. Primarily Java and Java-based frameworks such as Spring are used for illustration.
Lernziel	The participants know the core concepts of object-oriented software development. They can apply common design patterns to typical problems. Furthermore, they are able to evaluate a simple software design, suggest improvements and also implement them.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22MI0012
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Enterprise IT-Architectures (L+E)

ECTS	3
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	The course addresses Enterprise IT Architectures in a digital world by providing an introduction to the work of an architect in the IT industry. Architectural Methods are used to structure, describe, and specify solutions, and to define scope and context as well as logical and runtime architectures based on functional and non-functional requirements. Work products, documents, diagrams and models are discussed and used in order to specify and communicate the architecture of a solution. The students will work in a team on a proposal of a real case and will present their case studies in one of the lectures. In addition, current important technology concepts like cloud computing, web security, SOA (Service Oriented Architecture) and BPM (Business Process Management) will be introduced. Finally, Enterprise Architecture concepts and Governance of architectures within a complex organizational structure of a company will be discussed.
Lernziel	Students learn how architects work and which basic work products are used to specify architectures.
Unterrichtssprache	English
Voraussetzungen	Basis in Software Engineering and Modeling
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22MI0013
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Digitalization and Sustainable Development (V)

ECTS	3
Lehrformen	Vorlesung
Allg. Beschreibung	<p>The digital transformation involves both opportunities and risks for sustainable development. The course addresses how the digital transformation can help society to face the challenges of sustainable development as reflected in the UN Sustainable Development Goals (SDGs). It provides an overview of results from the emerging research field "Information and Communication Technology for Sustainability (ICT4S)".</p> <p>Topics:</p> <ul style="list-style-type: none">- Positive and negative effects of ICT on energy consumption and climate change- The ICT hardware life cycle- Reducing carbon emissions with ICT- The role of digitalization in decoupling GDP from resource consumption- Rebound effects- Topics selected by the participants
Lernziel	<p>The students</p> <ul style="list-style-type: none">- understand the opportunities and risks of the digital transformation for sustainable development,- know how to contribute to sustainable development in the field of ICT.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Unterrichtssprache	English
Voraussetzungen	Lecture Information Management (before or paralell recommended)
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22MI0016
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

How to manage an IT Company (L)

ECTS	3
Lehrformen	Vorlesung
Allg. Beschreibung	Challenges and Lessons Learned from management of a software company <ul style="list-style-type: none">- processes and procedures in a traditional software company- Failing and Learning- market trends, standard way of working and cooperating- new organization form, roles and meeting format- (new) challenges (e.g. resources) and best practice
Lernziel	<ul style="list-style-type: none">- software company (working models in the software industry, Industry standards, regulatory (external) requirements)- market trends and standard way of working and cooperating (associated challenges, Agile: definition of agile management, agile playbook, bimodal approach, the new organization - holacracy, micro methods, examples for innovations in projects in current organization structures)- new organization form, roles and meeting format (breakup with traditional positions and summary of roles vs. positions in a Software company, examples of innovations in projects in current organization structures)- (new) challenges (e.g. resources) (best practice and how to avoid the old challenges)
Unterrichtssprache	English
Voraussetzungen	Lecture information management should be heard before or in parallel to the lecture
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22MI0018
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Combinatorial Algorithms (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>This lecture covers central and classical results in the area of combinatorial optimization. In particular, the design and analysis of combinatorial as well as approximation algorithms are treated. Combinatorial algorithms are exact and (mostly) polynomial-time methods, often based on dynamic programming, graphs, flows, and linear programs. Approximation algorithms produce (potentially sub-optimal) feasible solutions for (usually NP-hard) computational problems. The quality of these solutions is determined by comparison against an optimal solution.</p> <p>The analysis is an important and integral part of the lecture. That is, we will not only state the properties of an algorithm, e.g. its correctness or running time, but also prove them mathematically.</p> <p>In particular, we plan to treat the following topics:&nbsp;</p> <ol style="list-style-type: none">1. Introduction2. Model of Computation: P, NP, Approximation3. Shortest Paths: Variants, DAG, Dijkstra, Bellman-Ford4. Network Flows: Maximum Flow, Minimum Cost Flow, Network Simplex, Minimum Assignment5. Matchings: Blossom Algorithm6. Linear Programming: Polyhedra, Farkas Lemma, Simplex, Duality7. Set Cover: Greedy, Primal-Dual, LP-Rounding8. Makespan Scheduling: Identical Machines, Unrelated Machines9. Knapsack: Exact Algorithm, FPTAS
Lernziel	The goal is to learn about the most important algorithmic design principles and techniques for their analysis related to combinatorial optimization.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes 2. Herbstsemester)



Modulkürzel	03SM22MI0019
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Network Science (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>Network Science is an interdisciplinary field of research that has become synonym with the study of multiple complex systems that pervade social and economic systems. Network refer to representations of systems whose constituents are linked together because of social ties, information flow, economic relations, etc. Network modelling is a methodology with ample applications in modern data-intensive fields which has multiple applications in management, marketing, informatics, among multiple others.</p> <p>The course covers topics a wide range of topics: it starts with an introduction to the basic concepts about networks; it then deals with the most important properties that real-world networks exhibit, and how they can be modelled; then, it introduces network analytic techniques to uncover the most important properties of empirical networks. Finally, an introduction to the diffusion of technologies, opinions and rumours (and viruses!) are taught.</p> <p>During the course, special emphasis is employed in introducing network analysis and visualisation tools. The course is highly interactive. All the lectures consist of a theoretical part, then, the students must develop (in small groups and always supported by the instructors) the some practical exercises themselves. This permits them to gain direct experience and familiarity with the concepts taught and the techniques involved. In this participatory environment, multiple exercises and the creation of visualisations play an important role.</p>
Lernziel	<p>At the end of the course students:</p> <ul style="list-style-type: none">- are able to construct network representations of complex datasets- characterise and understand topological properties of networks- know the typical characteristics of networks in social, economic and technology systems- can understand mechanisms that lead to the emergence of large scale network properties
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22MI0020
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Database Systems Lab MSc (Praktikum Datenbanksysteme MSc)

ECTS	3
Lehrformen	Praktikum
Allg. Beschreibung	In the database lab students apply their database skills in order to implement the database component of a complex yet doable application. They develop conceptual and logical data models, define consistency constraints, formulate SQL queries, and implement user-defined functions and triggers.
Lernziel	Consolidation of knowledge and practical experiences in database technology
Unterrichtssprache	English
Voraussetzungen	Course "Database Systems" is mandatory.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22MI0022
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Computer Network Security Principles

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>This class on "Computer Network Security Principles (CNSP)" involves the study of mechanisms related to security in computer network environments as well as studies of protection mechanisms, policies and security culture, and necessary mitigation options of attacks. Furthermore, it includes selected aspects of practical relevance, such as viruses, fraud, cryptography, and unauthorized access.</p> <p>Students will be able to enhance their competencies with respect to their understanding of the design, development, and prototyping of security policies, being essential to manage security in computer networks. For this, a variety of mechanisms are discussed, such as basic security concepts, cryptographic principles on different layers, network security guidelines and information risk management, intrusion detection and prevention combined with network forensics based in Artificial Intelligence, security policies and metrics, and selected cybersecurity aspects and systems. In consequence, the design and management of security mechanisms for information systems as well as the determination and deployment of mitigation approaches in case of certain attacks will be possible.</p>
Lernziel	<p>Students will deepen their knowledge on basic concepts and applied cryptography of network security principles, in particular to (a) understand basic principles of network security (such as confidentiality, integrity, availability), major threats, cryptography mechanisms (symmetric and asymmetric), essentials of cloud security, existing security guidelines and risk assessment frameworks, as well as to understand the intersection between Machine Learning (ML) and Cybersecurity; (b) identify basic and advanced (i.e., basics of penetration testing) network security problems and propose associated solutions, being necessary the evaluation and classification of risk, as well as the association of basic mitigation measures, and (c) apply basic security concepts (such as security policies, access control mechanisms, firewalls and intrusion detection systems) in different network architectures and protocols, as well as detailing advanced security mechanisms for communications.</p> <p>At the end of the course, students will be able to demonstrate the following skills: (a) know and apply security protocols based on threat models defined, (b) elaborate access control policies for networks and IT systems, (c) prepare failure recovery and incident response plans, and (d) install and configure security tools for computer networks and their devices.</p>
Unterrichtssprache	English
Voraussetzungen	The class on "Computer Networks and Distributed Systems (CNDS)" is highly recommended to be taken before. The attendance of "Computer Engineering and System Software (CESS)" is considered to be useful as well. The "Communication Systems Lab" can be either taken after or before CNSP.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar



Angebotsmuster

1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22MI0023
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Randomized Algorithms (L)

ECTS	6
Lehrformen	Vorlesung
Allg. Beschreibung	<p>This lecture covers several aspects of randomness in computation. Firstly, we establish basic probabilistic tools, such as linearity of expectation and bounds on probabilities. Building on these we cover the design and analysis of randomized algorithms. Such an algorithm is allowed to use "coin flips" in its decision making. Some randomized algorithms yield significantly better runtimes and/or solution qualities as their deterministic counterparts. We also treat stochastic processes, e.g. Markov chains in the lecture, and give classical applications like 3-SAT. More advanced topics like random graphs, the probabilistic method, and randomized rounding are also covered.</p> <p>Mathematically sound analysis is an important and integral part of this lecture. That is, we will not only state the properties of an algorithm, e.g. its correctness or running time, but also prove them mathematically.</p> <p>In particular, we plan to treat the following topics: Introduction Linearity of Expectation: Concept, Balls-Into-Bins, Coupon Collector, Quicksort Bounds on Probabilities: Markov, Chebyshev, Chernoff, Balls-Into-Bins, Coupon Collector, Quicksort Markov Chains: Concept, Hitting Times and Probabilities, Random Walks, Invariant Distributions, 3-SAT Randomized Rounding: Concept, SET COVER, MAX SAT, Derandomization Probabilistic Method: First- and Second Moment Method, MAX SAT, Random Graphs</p>
Lernziel	The goal is to learn about the most important algorithmic design principles and techniques for their analysis related to randomness in computation.
Unterrichtssprache	English
Voraussetzungen	The content of the following lectures are mandatory prerequisites: 1. Informatics I, 2. Informatics II, 3. Foundations of Computing I
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes 2. Herbstsemester)



Modulkürzel	03SM22MI0024
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Foundations of Programming Languages and Program Analysis (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>The course provides an overview of the fundamental concepts in programming languages, including various types of functions (high-order, first class), lexical/dynamic scoping, binding, state and mutability, objects, continuations, lazy evaluation. Based on this foundation, the course introduces the conceptual framework for different program analysis and verification techniques, such as type systems, symbolic execution, and abstract interpretation.</p> <p>Starting from a minimal interpreter for arithmetic expressions, the students develop interpreters of increasing complexity that support languages with more sophisticated abstractions. Similarly, students learn how to design static analysis tools that provide guarantees about programs before their interpretation.</p>
Lernziel	<p>Students will learn the foundations of the abstractions used in the design of programming languages (e.g., functions, state, types) and how they interact. They will be able to implement interpreters for languages of growing complexity that support the abstractions above. They will be able to explain (different variants of) language abstractions using proper programming language concepts (e.g., scope, binding, laziness). They will be able to understand static analysis techniques and their application in the context of real-world problems. They will be able to concretely apply such techniques to the languages they developed during the course.</p>
Unterrichtssprache	English
Voraussetzungen	Basic programming in a high-level language (e.g., Java, C, C++). Elementary mathematics: sets, functions, logical quantifiers.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22MI0025
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

XML and Databases (L)

ECTS	3
Lehrformen	Vorlesung
Allg. Beschreibung	The W3C standard XML is widely used as document format for exchanging data over the Internet. While the generation of XML data is easy, the management of XML data requires systems that can efficiently store, query, and process XML data. Hence, database technology is required for handling XML data. The goal of this lecture is to teach in the interplay between XML and databases. The following aspects are studied in detail: semi-structured data model of XML, query languages (XPath, XQuery) for declarative access to XML data, XML processor technologies, mapping between XML and databases including efficient storage and index structures for XML data. A further central concern of this lecture is to show the practical relevance of all presented concepts by demonstrating how they are realized in the leading database management systems Oracle, IBM DB2, Microsoft SQL Server, and PostgreSQL.
Lernziel	Deep understanding of XML and its interplay with database technology
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22MI0026
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Advanced Software Engineering (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	This course has the goal of deepening the knowledge about advanced software engineering practices. The lectures will be complemented by a software project developed in teams. The teams will work by applying most of the software engineering processes presented within the lectures. At the end of the course, the teams will present their project.
Lernziel	Learn advanced techniques, methods, and processes in software engineering and apply them in practice.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Semester)



Modulkürzel	03SM22MI0027
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Deep Learning (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	The Deep Learning lecture provides a mathematical understanding of artificial neural networks and, particularly, deep learning models. Additionally, an overview of modern deep learning architectures is provided. In the exercise, we will use a deep learning framework, PyTorch, to employ the theoretical knowledge in practical examples.
Lernziel	Students know the mathematical background of deep learning, which types of problems could be solved and what are the current issues with deep learning systems. They are able to solve problems at hand by deep learning using the PyTorch framework.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22MI0028
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Interactive-Visual Data Analysis (L&E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>Gaining knowledge from data is key in the age of data-driven research and decision-making. The same applies for the use of machine learning and other AI methods to support the knowledge generation process. But how can different user groups of different skills, application backgrounds, and expertise be supported to interact with their data? How can humans and the AI collaborate in knowledge generation processes? Finally, students will reflect upon ethical dimensions of human-AI-data interaction.</p> <p>This course introduces concepts and techniques for the design and development of interactive-visual data analysis systems. The main focus is on the combination of interactive visual interfaces with automatic data analysis methods, to enable users to engage with their data and to enhanced data analysis. Associated research fields are Information Visualization, Visual Analytics, Interactive Machine Learning, Explainable Artificial Intelligence, and Human-Centered Artificial Intelligence.</p>
Lernziel	<p>Students will learn characteristics of data; this is what we analyze. Students will learn goals and tasks of users; this is why we analyze. Students will learn about various types of effective visual data representations and interaction techniques, to enable users to get in a dialog with their data; this is how we analyze. For what, why, and how we analyze, students will get to know a design methodology that will also be applied in practice. Students will also learn how interactive visualization techniques can be combined with algorithmic data analysis, machine learning, and AI support, to create powerful visual analytics and interactive machine learning solutions. Along these lines, students will learn principal unsupervised, semi-supervised, and supervised machine learning techniques and gain a practical understanding of how these techniques can be leveraged for interactive visual data analysis. Finally, students will gain an understanding of personalized data analysis, human-centered machine learning, explainable artificial intelligence, and human-centered artificial intelligence.</p>
Unterrichtssprache	English
Voraussetzungen	Willingness to participate in class is mandatory. Willingness to participate actively in class is recommended. Willingness to work in groups to face data analysis challenges together is expected.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SM22MI0029
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Web and mobile accessibility (L+E)

ECTS	3
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>This course gives an overview of assistive technologies used by people with disabilities and elderly persons, and provides the fundamentals (including exercises) on web and mobile accessibility for these target groups. This lecture is a block lecture, consisting of 5 parts.</p> <p>Part I: Assistive technologies (lecture, 2 Half-days). Students get to know different so-called assistive technologies for persons with various disabilities, including visual, hearing, mobility, and cognitive disabilities.</p> <p>Part II: Web and mobile accessibility implementation (1 Day, self- study). Students learn techniques and tools to make web and mobile applications accessible for persons with disabilities, according to the international Web Content Accessibility Guidelines (WCAG 2.1). During this day, the lecturer will be available throughout the day to answer any questions. At the end of the day, students will receive the source code of an inaccessible website or mobile app, which will be used for the task in Part III.</p> <p>Part III: Student work (independent work). Working in groups of 4 people, students should re-implement the received source code of the inaccessible website/app, adjusting it into an accessible version that aligns with WCAG 2.1. If there are few students in the lecture, the student work should be carried out individually rather than in groups.</p> <p>Part IV: Presentation of the results (1 Day). Student groups present the results of their work in a 10-minute presentation.</p> <p>Part V: Discussions with student groups (1 Half-Day). Discussions will take place with each student group to provide feedback on their implementation.</p>
Lernziel	Understanding the needs of users with disabilities and elderly persons in interactions with digital systems, skills in web and mobile accessibility, familiarity with different types of assistive technologies.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (unregelmässig)



Modulkürzel	03SM22MI0030
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Systems for Data Science (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	Data-driven decisions are changing the way organizations and science operate. Many methods which were infeasible a couple of decades ago, can now be leveraged due to increasingly available large amounts of data. Processing this kind of data, though, is not just difficult because of its sheer size, but also because it is generated ever more rapidly, exhibits a more complex structure, and is often noisy. In this course, we look at the backend part of data science, i.e., what kind of technology and systems do we need to process and store huge amounts of data efficiently and in a scalable way. On the one hand, we look at principles underlying distributed systems in general; on the other hand, we also investigate the functionality of concrete systems. The latter part is enhanced by practical (programming) exercises, in which we take a closer look at the architecture of these systems and the programming models they employ.
Lernziel	Learn the general principles underlying distributed systems. Learn to process large amounts of data with massive parallel computations systems and understand their architecture and programming models. Learn about data processing and storage in these systems. Learn how to apply this knowledge in practical exercises using well-known systems (e.g. Apache Spark).
Unterrichtssprache	English
Voraussetzungen	An (introductory) module on database systems, such as BI0009 Database Systems.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22MI0031
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Digital technologies in medicine (L) (Digitale Technologien in der Medizin)

ECTS	3
Lehrformen	Vorlesung
Allg. Beschreibung	<p>The lecture covers digital technologies that are shaping medicine and surgery. Emphasis is placed on medical imaging, artificial intelligence, computer simulation, augmented reality, and surgical navigation and robotics.</p> <p>Fundamentals of computer science are taught, which are essential for the application of digital technologies in medicine. The main contents are requirement engineering, methods for medical image analyses (digital twins, image registration, various optimization and AI methods to solve classification, segmentation, regression problems), basics and methods for intraoperative application (calibration and 3D reconstruction of image and sensor data, tracking). A significant part of the lecture deals with augmented reality (devices and sensors, computer vision, visualization and human-computer interface). Besides real and exciting examples from medicine, an introduction to the evaluation&nbsp;&nbsp;&nbsp;validation of digital technologies is given (their design, ethics).</p>
Lernziel	<ul style="list-style-type: none">- Students will be able to apply computer methods of image processing, computer graphics and machine learning to real problems in medicine and surgery.- Students will develop interdisciplinary problem solving skills by combining methods from multiple subfields of computer science.- Students learn fundamental concepts for combining hardware and software for surgical applications.- Students learn theory and practice of Augmented Reality.- Students will gain programming experience in Python and Unity/C#.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22MI0032
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

IT Security (L)

ECTS	3
Lehrformen	Vorlesung
Allg. Beschreibung	Introduction; cryptography (self-study), threats and attacks; countermeasures; security management; conclusions and outlook.
Lernziel	The lecture provides a comprehensive introduction into IT security. It outlines the threats and attacks that can be mounted against IT systems and infrastructures, and it explains in detail the technical countermeasures that are available and can be put in place to mitigate them. The aim is to enable students to evaluate and judge the effectiveness and appropriateness of security technologies, mechanisms, and services that are provided on the market today and possibly tomorrow.
Unterrichtssprache	English
Voraussetzungen	Basic understanding of information technology
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SM22MI0035
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Blockchains and Overlay Networks (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>Fully distributed systems, typically termed Peer-to-peer (P2P) systems, seem to fade from the front row these days, especially due to their integrated and partially commercial use and application. Additionally, many new applications tend to prefer in certain cases an overlay networks approach, such as blockchain-based systems.</p> <p>This lecture outlines the major technology alternatives of P2P, introduces overlay networks, analyzes key features, checks on implementation and deployability&nbsp;aspects, details blockchains and Smart Contracts, and investigates on scalability, efficiency, reliability, and commercial applicability. Respective security mechanisms complete the overall view. Based on a number of sample systems, the potential of them is outlined and applied in a challenge task in practical exercises, which are mandatory.</p>
Lernziel	<p>This lecture's goals encompass the gaining of knowledge of principles and protocols in overlay networks and in fully decentralized (P2P) communications.</p> <p>Emerging blockchains and their integration into today's Internet is addressed in theory and in a practical challenge task, which includes designed and prototyping aspects. Thus, respective protocol details and system aspects for will be covered, showing potentials as well as problems.</p>
Unterrichtssprache	English
Voraussetzungen	Content of the lecture on "Computer Networks and Distributed Systems (CNDS)" is essential. The knowledge of "Computer Engineering and Systems Software (CESS)" is recommended, but not necessary.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes 2. Frühjahrssemester)



Modulkürzel	03SM22MI0043
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Reinforcement Learning (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	This class offers a comprehensive introduction to the field of Reinforcement Learning (RL). Students will explore the core challenges and various approaches within RL. By the end of the course, students will be well-versed in the key concepts and techniques essential for mastering Reinforcement Learning.
Lernziel	By the end of the course, students will understand the key concepts of Reinforcement Learning (RL). Specifically, students will be able to: <ul style="list-style-type: none">- Define the key features of RL that distinguishes it from the other fields in Machine Learning- Implement common RL algorithms in code.- Describe various criteria for analyzing RL algorithms and evaluate them based on metrics such as regret, sample complexity, computational complexity, empirical performance, and convergence, as assessed through assignments.- Formulate and solve sequential decision-making problems using relevant RL tools.
Unterrichtssprache	English
Voraussetzungen	<ul style="list-style-type: none">- Proficiency in Python- Calculus, Linear Algebra: you should be comfortable taking derivatives and understanding matrix vector operations and notation.- Basic Probability and Statistics: You should know basics of probabilities, Gaussian distributions, mean, standard deviation, etc.- Foundations of Machine Learning
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SMANF1169
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Informatics II (V+Ü) (Informatik II)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	Search and sorting algorithm, correctness and complexity of algorithms, pointers and C, lists, trees, hashing, dynamic programming, graphs.
Lernziel	Effective understanding and use of data structures and algorithms for software development. Ability to implement algorithms in C.
Unterrichtssprache	English
Voraussetzungen	Informatik I or equivalent knowledge.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SMAINF1170
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Foundations of Computing I (L+E) (Formale Grundlagen der Informatik I)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	This course introduces mathematical tools used in computer science (from database management to artificial intelligence, machine learning, data analysis and visualization, cryptography and security, computer graphics, computer vision, and image processing). In particular, the course will teach the following topics: propositional logic, digital logic circuits, induction and recursion, convolution, relations, modular arithmetic with application to cryptography, graphs, and trees.
Lernziel	Students will learn propositional logic, digital logic circuits, induction and recursion, convolution, relations, modular arithmetic with application to cryptography, graphs, and trees.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SMBINF2160
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Database Systems (L+E) (Datenbanksysteme)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	Comprehensive introduction to the foundations of database systems. The course is based on the relational data model and covers the following topics: relational data model, relational algebra and calculus, SQL, relational database design, conceptual database design, physical data organization, query processing and optimization, transactions.
Lernziel	The goal is a solid understanding of the foundations of database systems; to understand how these are implemented in concrete systems; and gaining experience in working with database systems.
Unterrichtssprache	Englisch
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SMBINFP601
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Computer Graphics Lab (BSc PR)

ECTS	6
Lehrformen	Praktikum
Allg. Beschreibung	Practical programming lab on interactive 3D computer graphics with projects covering polygonal modeling, illumination and shading, geometric transformations, viewing in 3D, visibility, clipping, rasterization, and ray-tracing.
Lernziel	<p>This practical course will involve the students in guided lab sections and programming exercises with the goal to get familiar with developing interactive 3D graphics applications. A sequence of increasingly complex 3D graphics programming tasks will be addressed which the students have to complete as part of the course. As part of this lab course a modern and flexible 3D graphics API will be introduced and learned through the programming tasks.</p>
Unterrichtssprache	English
Voraussetzungen	Students must take the lecture «Computer Graphics» to participate in this lab or have demonstrated prior equivalent knowledge of the fundamental concepts of interactive 3D graphics.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SMBMINF002
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Computer Graphics (L)

ECTS	3
Lehrformen	Vorlesung
Allg. Beschreibung	Introduction to the fundamental concepts, algorithms, and data structures of interactive 3D computer graphics such as graphics systems, polygonal modeling, illumination and shading, geometric transformations, viewing in 3D, visibility, clipping, rasterization, and ray-tracing.
Lernziel	This course will teach the participating students the fundamental concepts of 3D image synthesis, with a focus on interactive rendering. The students will learn how real-time image formation as used in interactive 3D games, virtual reality simulation and scientific visualization applications is performed through the pipelined processes of perspective projection, visibility determination, illumination, rasterization and shading. A number of techniques to improve realism such as depth-cues, texturing and advanced shading will be discussed.
Unterrichtssprache	English
Voraussetzungen	Successful completion of introductory computer science, programming and math courses, plus experience with C/C++.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semestrig (jedes Frühjahrssemester)



Modulkürzel	03SMBMINF003
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

CSCW (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	We will look at computer supported collaboration of collaborative units of any size: dyads, small groups, large groups, organizations, communities and social networks. For each collaborative unit, we will first look at their collaboration problems and what theories have to say about them. Then we will analyse how, and to what extent collaboration can be engineered for each of them. Finally we will discuss systems supporting their collaboration and how they should be designed.
Lernziel	The student will learn how to analyze and design computer supported collaboration.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SMBMINF005
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Software Maintenance and Evolution (L+E)

ECTS	3
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>Software maintenance is a substantial part in the life-cycle of a software system. Typical studies show that more than 2/3 of the efforts are invested into modifications after delivery to correct faults, to improve performance, or to adapt to various other requirements such as platform or business changes. It seems obvious, therefore, that we need effective techniques and tools to support these activities to save costs and personnel resources in development and testing.</p> <p>In this course, students will learn the foundations of software evolution and maintenance. This includes successful but aged software systems (i.e. legacy software), object-oriented reengineering, refactoring, change patterns, empirical analysis of software, classification/prediction models, software quality analysis. We will also discuss analysis platforms and tools, test case generation and continuous delivery technologies in the context of autonomous systems development (e.g., drones and self-driving cars).</p>
Lernziel	Learn theories, models, tools, and processes for the maintenance and evolution of large software systems and cloud applications.
Unterrichtssprache	English
Voraussetzungen	Sc Informatics students: Assessment, modules Software Engineering and Software-Praktikum
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SMBMINF008
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Temporal and Spatial Data Management (L)

ECTS	3
Lehrformen	Vorlesung
Allg. Beschreibung	Temporal and spatial data are ubiquitous and are present in almost all application areas. We discuss the challenges that arise from the management of time-varying and spatial data, the solutions offered by current database systems, and the state-of-the-art of the research in this area. The basic principles will be illustrated with concrete data models, query languages, relational algebras and algorithms. Throughout the course we will solve representative exercises.
Lernziel	Understanding of the basics of temporal and spatial database systems.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes 2. Herbstsemester)



Modulkürzel	03SMBMINF015
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Algorithmic Game Theory and Mechanism Design (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>In this lecture, we will cover the interplay between economic thinking and computational thinking as it relates to the analysis and design of electronic markets in particular, and socio-economic systems in general.</p> <p>Topics covered include: algorithmic game theory, mechanism design, p2p file-sharing, eBay auctions, advertising auctions, combinatorial auctions, matching markets and voting systems. Emphasis will be given to core methodologies necessary to design such systems with good economic and computational properties. Students will be engaged in theoretical, computational, and empirical exercises.</p>
Lernziel	<ol style="list-style-type: none">1. Understand the importance of economic thinking in computational domains, and of computational thinking in economic domains.2. Be able to develop applicable models of complex Internet systems.3. Be able to analyze the behavior of systems that include people, computational agents as well as firms, and involve strategic behavior.4. Be able to solve both mathematical and conceptual problems involving such systems.5. Be able to write programs that implement strategic agents and mechanisms.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SMBMINF016
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Human-Computer Interaction (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>The Human-Computer Interaction (HCI) course provides students with a comprehensive "toolkit" of principles, processes, and approaches for designing interactive systems that address human needs and provide a good user experience. Central to the course is the human-centered design process which focuses on understanding problems from the human perspective, the iterative design cycle, and continuous analysis of design through gathering design feedback.</p> <p>The course is structured around a semester-long team project addressing a real-world human problem through HCI approaches. Lectures will teach the principles, theory, and methods that are fundamental to Human-Computer Interaction. Students will learn to apply this knowledge in practice through the multi-part team project.</p>
Lernziel	<p>Students will learn principles, processes, and methods pertaining to the topics below, and will be able to apply them in practice to the design and analysis of interactive systems and technologies:</p> <ul style="list-style-type: none">- Approaches for understanding human needs- Principles for usability and design- Iterative design and prototyping- User and expert evaluation processes
Unterrichtssprache	English
Voraussetzungen	<p>As all course materials and the exam will be in English; students should have a good command of spoken and written English.</p> <p>A group project is a core component of this course. Students should be prepared to work in teams, potentially with students who come from different backgrounds of study.</p>
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SMBMINF017
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Mobile Communication Systems (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>Based on the basic knowledge on communication systems as well as distributed systems the specifics of communications in the wireless and mobile domain are addressed.</p> <p>Those include technical basics, media access schemes, and signals. In a more detailed view mobile and wireless telecommunication systems are discussed, which include GSM, UMTS, LTE, LTE-A, 5G, satellites, and radio. The Local Area Network is addressed in terms of WLAN technology, Bluetooth, IoT, and security.</p> <p>The development of these systems into an Internet usage is shown by discussing Mobile IP as well as mobile transport protocols. Finally, wireless sender networks are discussed.</p>
Lernziel	<p>This lecture's goals encompass the gaining of knowledge of principles and protocols for wireless and mobile communications. While telecommunications and Internet aspects are of utmost importance, their integration and future needs are discussed. Thus, respective protocol details and technology aspects for mobile and wireless communications will be covered.</p>
Unterrichtssprache	English
Voraussetzungen	The content of the lecture on "Computer Networks and Distributed Systems (CNDS)" is essential, the lecture on "Computer Engineering and Systems Software (CESS)" is highly recommended.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SMBMINF019
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Combinatorial and Approximation Algorithms

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	This lecture covers central and classical results in the area of combinatorial optimization. In particular, the design and analysis of "combinatorial" as well as "approximation" algorithms are treated.

"Combinatorial algorithms" are exact and (mostly) polynomial-time methods, often based on dynamic programming, graphs, and linear programs.

"Approximation algorithms" produce (potentially sub-optimal) feasible solutions for (usually NP-hard) computational problems. The quality of these solutions is determined by comparison against an optimal solution.

The analysis will be an important and integral part. That is, we will not only state the properties of an algorithm, e.g. its correctness or running time, but also prove them mathematically.

In particular, we plan to treat the following topics:

1. Introduction
2. Greedy Algorithms: Minimum Spanning Trees, Set Cover
3. Network Flows: Maximum Flow, Minimum Cost Flow, Assignment
4. Matchings: Blossom Algorithm
5. Linear Programming: Polyhedra, Simplex
6. Knapsack: Exact Algorithm, FPTAS
7. Bin Packing: Hardness, Heuristics, APTAS
8. Set Cover: Greedy, Primal-Dual, LP-Rounding
9. Makespan Scheduling: Identical Machines, Unrelated Machines

In the exercises, we plan to have a "friendly competition", where students are encouraged to design and implement their own algorithms to be tested on given instances. As an incentive, students can get credit for the exercises by active participation. The problems and the data of this competition are to be defined.

Lernziel	The goal is to learn about the most important algorithmic design principles and techniques for their analysis related to combinatorial optimization. Also, in the programming assignments, the correct and efficient implementation of algorithms will be exercised.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes 2. Herbstsemester)



Modulkürzel	03SMBMINF020
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Vision Algorithms for Mobile Robotics (L)

ECTS	6
Lehrformen	Vorlesung
Allg. Beschreibung	For a robot to be autonomous, it has to perceive and understand the world around it. This course introduces you to the key computer vision algorithms used in mobile robotics, such as feature extraction, multiple view geometry, dense reconstruction, tracking, image retrieval, event-based vision, and visual-inertial odometry (the algorithms behind Apple ARKit, Google Visual Positioning Service, Microsoft HoloLens, Magic Leap, Oculus Quest, Oculus Insight, and the Mars Curiosity rover). Each lecture will be followed by a lab session where you will learn to implement the building block of a visual odometry algorithm in Matlab. By the end of the course, you will integrate all these building blocks into a working visual odometry algorithm.
Lernziel	Learn to implement the fundamental computer vision algorithms used in mobile robotics, in particular: feature extraction, multiple view geometry, dense reconstruction, object tracking, image retrieval, event-based vision, and visual-inertial odometry (the algorithms behind Apple ARKit, Google Visual Positioning Service, Microsoft HoloLens, Magic Leap, Oculus Quest, Oculus Insight, and the Mars Curiosity rover).
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SMBMINF021
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Software Testing (L)

ECTS	3
Lehrformen	Vorlesung
Allg. Beschreibung	Software testing is a crucial activity that developers perform to produce high-quality and reliable software. However, this practice and its theory is often neglected in academic curricula. This course aims to fill this gap by providing students with an updated theoretical and practical knowledge on the most relevant software testing methods.
Lernziel	At the end of the course students: <ul style="list-style-type: none">- are able to recall and list the most important software testing practices- can describe the most common applications of software testing practices- can judge the benefits/drawbacks of using specific software testing practices- are able to recall and list coverage criteria and judge their usefulness- can apply various testing practices to existing pieces of code
Unterrichtssprache	English
Voraussetzungen	<ul style="list-style-type: none">- Informatik I (or equivalent)- Informatics II (or equivalent)- Software Construction
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SMDINF1132
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Efficient Algorithms for Frequently Asked Questions (L+E)

ECTS	3
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>This course gives a unifying overview of the latest research in efficient computation over relational data, with applications spanning databases, artificial intelligence and machine learning, theoretical computer science, and linear algebra. Besides their theoretical interest, algorithms overviewed in this course also represent the key differentiator for commercial database and relational AI engines. They represent essential knowledge for data system engineers.</p> <p>Syllabus: Computation over commutative (semi)rings; Functional aggregate queries (FAQ); Applications: database queries, constraint satisfaction problems, (count)SAT, inference in probabilistic graphical models, einsum expressions, gradients and cost functions for machine learning over relational data; Decompositions: hypertree decompositions, acyclic hypergraphs, join trees; Width measures: treewidth, fractional edge cover number, fractional hyper tree width, FAQ width; Solving joins optimally: Yannakakis algorithm, LeapFrog TrieJoin algorithm, Suboptimality of state-of-the-art join algorithms, optimal join algorithms, preprocessing time versus enumeration delay; Worst-case optimal size bounds for joins: Shannon inequalities, Shearer's lemma, linear program for fractional edge cover number; Solving SAT: The DP and DPLL procedures, acyclic SAT; Solving FAQ: Functional aggregate queries over several semirings, the InsideOut algorithm.</p>
Lernziel	<p>The students will learn how to formalise computational problems, analyse their computational complexity using a toolbox of techniques that exploit the algebraic and combinatorial structure of the problem, understand connections between different areas of computer science, familiarise themselves with simple yet powerful algorithms that exploit such structure, and implement and benchmark these algorithms.</p>
Unterrichtssprache	English
Voraussetzungen	Foundations of Computing I, Foundations of Computing II, Informatics II, Database Systems
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SMDINF2035
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Market Design and Machine Learning (L)

ECTS	6
Lehrformen	Vorlesung
Allg. Beschreibung	<p>Over the last two decades, the field of market design has developed sophisticated techniques to design practical market mechanisms with good economic and computational properties (taking into that market participants are strategic). At the same time, the field of machine learning has developed more and more powerful techniques to generalize from data, adapt to changing environments, and thereby improve a system's performance with experience. This course explores how these two seemingly unrelated fields can be usefully combined. In particular, we will discuss how we can use machine learning techniques to design better market mechanisms (like auctions or matching mechanisms) and how we can incorporate machine learning algorithms into the operation of complex marketplaces (like Uber, eBay, or AirBnB) to improve their performance. Students will read key papers from the literature (theoretical and applied) and get hands-on experience by working on a project combining market design with machine learning.</p>
Lernziel	<ol style="list-style-type: none">1. Understand how machine learning can be useful in the design of specific market mechanisms and in the design of complex marketplaces.2. Understand the difficulties involved when combining machine learning with market design techniques.3. Be able to read advanced research papers.4. Be able to critically reflect on and discuss a advanced research papers.5. Be able to identify how machine learning could help solve a new market design problem.6. Successfully complete a project combining machine learning and market design.
Unterrichtssprache	English
Voraussetzungen	<p>This course requires prior knowledge in (1) market design/mechanism design and (2) machine learning. To obtain the prior knowledge for market design, the successful completion of a course covering basic topics on market design (such as auction theory, mechanism design, matching, etc.) is required. Courses with the necessary background include "Economics and Computation" and "Introduction to Market Design" at UZH, as well as "Algorithmic Game Theory" at ETH. To obtain the prior knowledge for machine learning, any introductory course on machine learning is sufficient. Students who have not taken such courses beforehand may be eligible but must contact the instructor ahead of time to request explicit consent.</p>
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (unregelmässig)



Modulkürzel	03SMDINF2039
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Vision Algorithms for Mobile Robotics (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	Have you ever been curious to learn the perception algorithms used in today's self-driving cars and drones and what they have in common with virtual and augmented reality? Then this course is for you! This course introduces you to the key algorithms behind Apple ARKit, Google Visual Positioning Service, Microsoft Hololens, Magic Leap, Oculus Quest, Oculus Insight, and the NASA Mars rovers. In particular, we course will cover these topics: image formation, filtering, feature extraction, multiple view geometry, dense reconstruction, tracking, image retrieval, event-based vision, visualinertial odometry, and deep learning. Each lecture will be followed by a lab session where you will learn to implement the building block of a visual odometry algorithm in Matlab. By the end of the course, you will integrate all these building blocks into a working visual odometry algorithm.
Lernziel	By the end of the course you will know how to implement the fundamental computer vision algorithms used in mobile robotics, in particular: image formation, filtering, feature extraction, multiple view geometry, dense reconstruction, object tracking, image retrieval, event-based vision, visual-inertial odometry, and deep learning.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SMMINF4217
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

XML and Databases (L)

ECTS	3
Lehrformen	Vorlesung
Allg. Beschreibung	<p>Today, the W3C standard XML is widely used as document format for exchanging data over the Internet. While the generation of XML data is easy, the management of XML data requires systems that are able to efficiently store, query, and process XML data. With other words, more and more database technology is required for handling XML data. The goal of this lecture is to teach in the interplay between XML and databases.</p> <p>The following aspects are studied in detail: semi-structured data model of XML, query languages (XPath, XQuery) for declarative access to XML data, XML processor technologies, mapping between XML and databases including efficient storage and index structures for XML data. A further central concern of this lecture is to show the practical relevance of all presented concepts by demonstrating how they are realized in the leading (commercial) database management systems Oracle, IBM DB2, Microsoft SQL Server, and PostgreSQL.</p>
Lernziel	Deep understanding of XML and its interplay with database technology
Unterrichtssprache	English
Voraussetzungen	Content of Databases (Bachelor level)
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SMMINF4221
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

IT Security (L)

ECTS	3
Lehrformen	Vorlesung
Allg. Beschreibung	Introduction; cryptography (self-study); computer security; communication security; operational environments and applications; privacy and data protection; conclusions and outlook.
Lernziel	The lecture provides a comprehensive introduction into IT security. The security technologies, mechanisms, and services that are available today are overviewed, discussed, and put into perspective. The aim is to enable students to evaluate and judge the effectiveness of security technologies, mechanisms, and services that are provided on the market today and possibly tomorrow.
Unterrichtssprache	English
Voraussetzungen	Basic understanding of information technology
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SMMINF4224
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Blockchains and Overlay Networks (L+E)

ECTS	6
Lehrformen	Übung, Vorlesung
Allg. Beschreibung	Fully distributed systems, typically termed Peer-to-peer (P2P) systems, seem to fade these days, especially due to their partially commercial use and application. Additionally, many new applications tend to prefer in certain cases an overlay networks approach, such as blockchain-based systems. This lecture outlines the major technology alternatives of P2P, introduces overlay networks, analyzes key features, checks on implementation and deployability aspects, details blockchains and Smart Contracts, and investigates on scalability, efficiency, reliability, and commercial applicability. Respective security mechanisms complete the overall view. Based on a number of sample systems the potential of them is outlined and applied in a challenge task in practical exercises.
Lernziel	This lecture's goals encompass the gaining of knowledge of principles and protocols in overlay networks and in fully decentralized (P2P) communications. Emerging blockchains and their integration into today's Internet is address in theory and in a practical challenge task to be designed and implemented. Thus, respective protocol details and system aspects for will be covered, showing potentials as well as problems.
Unterrichtssprache	English
Voraussetzungen	Content of the lecture on "Computer Networks and Distributed (CNDS)" is essential. The knowledge of "Computer Engineering and Systems Software (CNSS)" is recommended, but not necessary.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes 2. Frühjahrssemester)



Modulkürzel	03SMMINF4227
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Data Warehousing (L)

ECTS	3
Lehrformen	Vorlesung
Allg. Beschreibung	Data Warehousing bezeichnet die Tätigkeit des Sammelns, Integrierens, Aggregierens und Analysierens grosser Datenmengen zum Zweck der Entscheidungsunterstützung in Unternehmen. Die in diesem Kontext relevanten Architekturen, Aufgaben und Lösungsansätze werden vorgestellt. Insbesondere werden die Themen Data Warehouse-Systeme, Entwurf von Data Warehouses, Extraktion, Transformation, Laden (ETL) von Daten aus Datenquellen, Datenqualität, Metadaten, Business-Intelligence- Anwendungen und Performance-Optimierung von Data Warehouses behandelt.
Lernziel	Allgemeines Verständnis des Anwendungspotentials der Data-Warehouse- Technologie. Verständnis von DWH-Architekturen und -Prozessen. Kenntnis der Basistechnologien und Methoden des Data-Warehousing.
Unterrichtssprache	Deutsch
Voraussetzungen	Module «Database Systems»
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes 2. Frühjahrssemester)



Modulkürzel	03SMMINF4529
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Practical Artificial Intelligence (L+E)

ECTS	6
Lehrformen	Übung, Vorlesung
Allg. Beschreibung	<p>Over the past years, the appearance of applications requiring or benefiting from (classical) artificial intelligence has accelerated. For example, electronic markets for the buying and selling of goods and services over the Web is a fast-growing, multi-billion-dollar segment of the world economy. Knowledge-based techniques for product recommendation, auctions, need identification, vendor selection, negotiation, agent communication, ontologies, business rules, and information integration are of rising interest and have started having practical impact on real Web e-markets. This class covers the foundational theories (mostly) from the field of (classical) artificial intelligence that have made it possible to evolve to more «intelligent» applications. It will cover areas such as knowledge representation and reasoning (increasingly important through the semantic web effort of the w3c), learning, problem solving, planning, and reasoning under uncertainty. For each of the subjects it will cover the underlying theories and provide an insight into practical applications using those techniques.</p>
Lernziel	Theory and practice of AI methods in business and science applications.
Unterrichtssprache	English
Voraussetzungen	Finished Bachelor studies
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SMMINF4532
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Human Aspects of Software Engineering (L)

ECTS	6
Lehrformen	Vorlesung
Allg. Beschreibung	<p>Producing great software as fast as the market demands requires great, productive developers. Yet, what does it mean for an individual developer to be productive, and how can we best help developers to be productive? To answer these questions, researchers in software engineering have been, and are still predominantly looking at the output that software developers create, such as the applications, the source code, or the test cases. This output-oriented focus misses one of the most essential parts in the process of software development: the individual developer who creates the software.</p>

Recent advances in technology afford the opportunity to collect a wide variety of detailed information on a software developer and her work, ranging from the number of resolved work items all the way to the cognitive load the developer experiences while working. The availability and accessibility of data on each developer is enabling us to explore questions about developer productivity in powerful new ways.

In this course, we investigate how we can ensure the human ingenuity and smarts are being amplified by the processes and tools used to create systems, rather than the humans spending precious cognitive effort dealing with mundane or unnecessary problems.

The course will be adjusted according to your feedback, interests, and experience. This is an overview of the kinds of topics we could cover:

- * quantitative & qualitative evaluation of software engineering
- (biometric) sensing in software development
- * developer retrospection and productivity
- * work fragmentation and interruptions
- * code navigation & exploration
- * program comprehension
- * software development tools and environments.

Lernziel	
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	03SMMINF4534
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Advanced Software Engineering (L+E)

ECTS	4
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	This course covers the following specific topics in software engineering: software architecture and design, architectural patterns and styles, aspect-oriented programming, domain-specific languages, engineering elastic applications, software quality metrics, problem frames, software processes including agile methods, and further selected topics.
Lernziel	Learn advanced techniques, methods, and processes in software engineering.
Unterrichtssprache	English
Voraussetzungen	MSc Informatik: Master-Basismodul
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SMMINF4538
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Big-Data Analytics (L+E)

ECTS	3
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	Data-driven decisions are changing the way organizations (and science) operate. Relying on increasingly available large amounts of data organizations leverage quantitative analytics for their operations. Data, however, is growing in volume, velocity (time sensitivity), variety, and veracity requiring novel approaches for analytics and new capabilities for decisions makers to master this avalanche of data. This course is divided into two parts. In the first part, you will learn about general principles and best practices of data science by investigating the different stages of the data science process. This is not just done on a theoretical level, but also enhanced by practical exercises. In the second part, you will learn about architectures and programming models of massive parallel data processing systems used in industry and science today. This course will enable you to leverage massive parallel computing systems to write basic big data analysis applications using a system APIs and high level libraries and prepare you for other, more technically-oriented resources that you may encounter when working with these systems. During the course you will also implement a data analytics task in the context of a small (group- based) project.
Lernziel	Learn the general principles of data analysis. Learn to process large amounts of data with massive parallel computation systems and understand their architecture and programming models. Learn the basics of data processing and data modeling with statistical and machine learning methods on these systems.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SMMINF4547
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Quantitative Methods in Human-Computer Interaction (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>When you design a new user interface or adopt a new software for your company, how do you evaluate whether these changes improve your or your company's performance? By how much will the performance be improved? Will the changes be worth the cost? How certain are you in the answers to these questions? How can you convince your colleagues or supervisors to believe in your findings?</p> <p>To address these questions, researchers and practitioners in the field of Human-Computer Interaction (HCI) use quantitative research methods to collect data, design experiments, and analyze the results. This course introduces students to the following key methods of quantitative research:</p> <ul style="list-style-type: none">- Conduct literature research, formulate, and refine research questions.- Choosing measurements for user experience, both objective (e.g., speed and accuracy) and subjective (e.g., perceived workload and stress)- Designing and conducting controlled experiments with proper internal and external validity- Analyzing data both exploratory and inferential statistical analysis- Extracting, and evaluating knowledge from the scientific literature as basis or additional evidence for your findings- Writing up your methodology and findings accurately with adequate detail for future replications <p>Students will learn these methods hands-on through assignments and project work. This course is an ideal preparation for a thesis and future research work in the field of human-computer interaction. Knowledge in this course is also essential for practitioners such as user experience specialists.</p>
Lernziel	<ul style="list-style-type: none">- Students understand definitions of user experience measurements and can choose appropriate measurements for their research.- Students understand types of validity in quantitative research.- Students can design and conduct controlled experiments.- Students can visualize data from their experiments for exploratory analysis.- Students know how to perform inferential statistics by choosing correct procedures and check statistical assumptions.- Students can identify essential information for their reports and can write up their study and findings with adequate details.
Unterrichtssprache	English
Voraussetzungen	As all course materials will be in English; students should have a good command of spoken and written English.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)





Modulkürzel	03SMMINF4552
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Advanced Software Engineering (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	This course has the goal of deepening the knowledge about advanced software engineering practices. The lectures will be complemented by a software project developed in teams. The teams will work by applying most of the software engineering processes presented within the lectures. At the end of the course, the teams will present their project.
Lernziel	Learn advanced techniques, methods, and processes in software engineering and apply them in practice.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Semester)



Modulkürzel	03SMMINF4564
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Web and mobile accessibility (L+E)

ECTS	3
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>This course gives an overview of assistive technologies used by people with disabilities and elderly persons, provides the fundamentals (including exercises) on how to make the web accessible for these target groups. This lecture is a block lecture, consisting of 4 parts. Parts I and IV consist of virtual classroom components, whereas Part III is independent work (at home or remotely). Parts I and II could occur on subsequent days or on separate days in the semester.</p> <p>Part I: Assistive technologies (1 Day, online via Zoom). Students get to know different so-called assistive technologies for persons with various disabilities, including visual, hearing, mobility, and cognitive disabilities.</p> <p>Part II: Web and mobile accessibility implementation (1 Day, self-study). Students learn techniques and tools to make web applications accessible for persons with disabilities, according to the International Web Content Accessibility Guidelines (WCAG 2.1). During this day, the lecturer will be available via Zoom throughout the day to answer any questions. At the end of the second part, students receive the source code of an inaccessible website.</p> <p>Part III: Student work (independent work). Working in small groups of 2-3 people, students should re-implement the received source code of the inaccessible website, adjusting it into an accessible website that aligns with WCAG 2.1. If there are few students in the lecture, the student work should be carried out individually rather than in groups.</p> <p>Part IV: Presentation of the results (1 Day, online via Zoom). Student groups present the results of their work in a 15- to 20-minute presentation.</p>
Lernziel	Understanding the needs of users with disabilities and elderly persons in interactions with digital systems, skills in web accessibility, familiarity with different types of assistive technologies
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (unregelmässig)



Modulkürzel	03SMMINF4568
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Deep Learning (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	This lecture provides a mathematical understanding on how artificial neural networks and, particularly, deep learning works. In the exercise, we will use a deep learning framework, PyTorch, to employ the theoretical knowledge in practical deep learning examples.
Lernziel	Students know the mathematical background of deep learning, which types of problems could be solved and what are the current issues with deep learning systems. They are able to solve problems at hand by deep learning using the PyTorch framework
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	03SMMINF4570
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Introduction to Interactive-Visual Data Analysis (V)

ECTS	3
Lehrformen	Vorlesung
Allg. Beschreibung	This module introduces fundamental concepts and techniques of interactive-visual data analysis. The main focus is on the combination of automatic data analysis methods with interactive visual interfaces as well as on their interplay to facilitate data analysis goals. Associated research fields are Information Visualization, Visual Analytics, and Interactive Machine Learning.
Lernziel	Students will learn basic characteristics of data and data (pre-) processing/analysis methods. Further, students will learn skills about how data can be transformed into visual structures and which types of visualization techniques are meaningful design choices for given data types at hand. Finally, students will learn fundamental user interaction techniques and the benefits of interaction for visual data analysis.
Unterrichtssprache	English
Voraussetzungen	Willingness to participate actively in class is recommended.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (einmalig)



Modulkürzel	03SMMINF4576
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Systems for Data Science (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	Data-driven decisions are changing the way organizations and science operate. Many methods which were infeasible a couple of decades ago, can now be leveraged due to increasingly available large amounts of data. Processing this kind of data, though, is not just difficult because of its sheer size, but also because it is generated ever more rapidly, exhibits a more complex structure, and is often noisy. In this course, we look at the backend part of data science, i.e., what kind of technology and systems do we need to process and store huge amounts of data efficiently and in a scalable way. On the one hand, we look at principles underlying distributed systems in general; on the other hand, we also investigate the functionality of concrete systems. The latter part is enhanced by practical (programming) exercises, in which we take a closer look at the architecture of these systems and the programming models they employ.
Lernziel	Learn the general principles underlying distributed systems. Learn to process large amounts of data with massive parallel computations systems and understand their architecture and programming models. Learn about data processing and storage in these systems. Learn how to apply this knowledge in practical exercises using well-known systems (e.g. Apache Spark).
Unterrichtssprache	English
Voraussetzungen	An (introductory) module on database systems, such as BINF2160 Database Systems.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	siehe Reglemente WWF
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	06SM523-510
Modulgruppe	Computational Linguistics and Language Technology in Practice
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Practical Training In-House

ECTS	6
Lehrformen	Praktikum
Allg. Beschreibung	In this module, the students get in touch with scientific project work, that is, they learn how to do basic research. In order to accomplish these kind of skills, they read scientific literature, prepare and annotate data, apply statistical and machine learning methods to solve particular problems. They are also involved in the preparation of articles for workshops and conferences. The students work on a particular (partial) problem in a scientific context or even running project. This module can be booked to credit work done in a scientific project at the UZH. This module can be booked with 6 or 9 ECTS points. The amount of points will be decided in consultation with the module coordinator.
Lernziel	The students (1) get in touch with research (2) read scientific literature (3) are involved in evaluation processes (4) take over particular tasks in the context of a project (5) are involved in the preparation of articles (6) get insights into practical work (7) deepen their knowledge and skills with respect to a particular topic
Unterrichtssprache	Deutsch und/oder Englisch
Voraussetzungen	This module cannot be booked by the students themselves, the booking has to be authorized by the module coordinator. There is no entitlement to this module, the module will only be offered if a suitable position is available in a project. The requirements will be defined according to the topic. This module is open only to Master's students. It may not be booked by Bachelor's students as a pre-Master's module.
Leistungsnachweis	dokumentierte praktische Arbeit
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Semester)



Modulkürzel	06SM523-511
Modulgruppe	Computational Linguistics and Language Technology in Practice
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Practical Training Off-Site

ECTS	6
Lehrformen	Praktikum
Allg. Beschreibung	The students gain experience in the application of computational linguistics. They get in touch with the structures and procedures of companies and are involved into the realisation of software in order to solve particular problems of these companies. The students apply what they have learned and adapt it to the needs of a specific commercial sector. Practical Trainings Off-Site are usually stays at companies or public organizations that are involved with Natural Language Processing. The training has to have a relation to Natural Language Processing and they have to be organized autonomously. This module can be booked with 3 or 6 ECTS points. The amount of points will be decided in consultation with the module coordinator.
Lernziel	The students (1) get in touch with language technology companies (2) learn to connect theory and practical work (3) get to know the structures and processes of companies (4) apply what they have learned (5) broaden their knowledge of practical issues
Unterrichtssprache	Deutsch und/oder Englisch
Voraussetzungen	This module cannot be booked by the students themselves, the booking has to be authorized by the module coordinator. A prior application must be approved by the module coordinator in order for the Practical Training Off-Site to be credited. This module is open only to Master's students. It may not be booked by Bachelor's students as a pre-Master's module.
Leistungsnachweis	dokumentierte praktische Arbeit
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Semester)



Modulkürzel	06SM523-512
Modulgruppe	Computational Linguistics and Language Technology in Practice
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Programming Project 1

ECTS	6
Lehrformen	Sonstiges
Allg. Beschreibung	Programming projects aim at the consolidation of programming and the acquisition of software engineering skills. Starting with a particular research question and relevant literature, they work on a solution, define milestones, acquire and/or annotate data, implement a program and evaluate it using appropriate data. This module can be booked to credit work done in a programming project. This module can be booked with 3, 6 or 9 ECTS points. The amount of points will be decided in consultation with the module coordinator.
Lernziel	The students (1) autonomously design a project (2) realize the project plan (3) use existing tools (4) do software engineering (5) document their work according to standards (6) evaluate the results (7) use software repositories
Unterrichtssprache	Deutsch und/oder Englisch
Voraussetzungen	In the duration of a study level a maximum of two programming projects can be booked. This module can be booked to credit work done in a programming project. It cannot be booked by the students themselves, the booking has to be authorized by the module coordinator. Before a programming project is started, it is essential to get the permission of the module coordinator (per Email). The prerequisites will be set according to the topic. This module is open only to Master's students. It may not be booked by Bachelor's students as a pre-Master's module.
Leistungsnachweis	dokumentierte praktische Arbeit
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Semester)



Modulkürzel	06SM523-513
Modulgruppe	Computational Linguistics and Language Technology in Practice
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Student Teaching Assistant 1

ECTS	6
Lehrformen	Sonstiges
Allg. Beschreibung	A student teaching assistance serves the acquisition of basic teaching skills. This requires a deeper insight of the contents of the associated lecture and the ability to prepare teaching material in order to help the students to better understand it. The task also involves the preparation and correction of exercises. This module can be booked to credit the conducting of exercises/tutorials. This module can be booked with 3 or 6 ECTS points. The amount of points will be decided in consultation with the module coordinator.
Lernziel	The students (1) cope with computational linguistics content from a teaching perspective (2) learn to prepare computational linguistics content in a way tailored to a student's audience (3) learn to correct exercises and give appropriate feedback
Unterrichtssprache	Deutsch und/oder Englisch
Voraussetzungen	In the duration of a study level a maximum of two modules «Student Teaching Assistant» can be booked, whereby the two modules must differ in content (also to any previously completed student teaching assistant modules). This module is booked in order to receive credit for a first job as a student teaching assistant at master's level. This module is an application module, the application has to be authorized by the module coordinator (per Email). The lecturers have to be included in the communication. The open positions for student teaching assistants are usually posted on the mailing list of the Institute of Computational Linguistics (cclist@lists.ifi.uzh.ch) a few weeks before the semester starts. Students interested in conducting exercises/tutorials of a specific course can apply anytime for the position directly with the lecturer and the module coordinator. The module in question must have been passed successfully beforehand.
Leistungsnachweis	This module is open only to Master's students. It may not be booked by Bachelor's students as a dokumentierte praktische Arbeit
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Semester)



Modulkürzel	06SM523-516
Modulgruppe	Computational Linguistics and Language Technology in Practice
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Student Teaching Assistant 2

ECTS	6
Lehrformen	Sonstiges
Allg. Beschreibung	A student teaching assistance serves the acquisition of basic teaching skills. This requires a deeper insight of the contents of the associated lecture and the ability to prepare teaching material in order to help the students to better understand it. The task also involves the preparation and correction of exercises. This module can be booked to credit the conducting of exercises/tutorials. This module can be booked with 3 or 6 ECTS points. The amount of points will be decided in consultation with the module coordinator.
Lernziel	The students: - cope with computational linguistics content from a teaching perspective; - learn to prepare computational linguistics content in a way tailored to a student's audience; - learn to correct exercises and give appropriate feedback.
Unterrichtssprache	Deutsch und/oder Englisch
Voraussetzungen	In the duration of a study level a maximum of two modules «Student Teaching Assistant» can be booked, whereby the two modules must differ in content (also to any previously completed student teaching assistant modules). This module is booked in order to receive credit for a second job as a student teaching assistant at master's level. This module is an application module, the application has to be authorized by the module coordinator (per Email). The lecturers have to be included in the communication. The open positions for student teaching assistants are usually posted on the mailing list of the Institute of Computational Linguistics (cclist@lists.ifi.uzh.ch) a few weeks before the semester starts. Students interested in conducting exercises/tutorials of a specific course can apply anytime for the position directly with the lecturer and the module coordinator. The module in question must have been passed successfully beforehand.
Leistungsnachweis	This module is open only to Master's students. It may not be booked by Bachelor's students as a dokumentierte praktische Arbeit
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Semester)



Modulkürzel	06SM523-517
Modulgruppe	Computational Linguistics and Language Technology in Practice
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Programming Project 2

ECTS	6
Lehrformen	Sonstiges
Allg. Beschreibung	Programming projects aim at the consolidation of programming skills and the acquisition of software engineering skills. Starting with a particular research question and relevant literature, they work on a solution, define milestones, acquire and/or annotate data, implement a program and evaluate it using appropriate data. This module can be booked with 3, 6 or 9 ECTS points. The amount of points will be decided in consultation with the module coordinator.
Lernziel	The students: - autonomously design a project; - realise the project plan; - use existing tools; - do software engineering; - document their work according to standards; - evaluate the results; - use software repositories.
Unterrichtssprache	Deutsch und/oder Englisch
Voraussetzungen	In the duration of a study level a maximum of two programming projects can be booked. This module can be booked to credit work done in a second programming project. It cannot be booked by the students themselves, the booking has to be authorized by the module coordinator. Before a programming project is started, it is essential to get the permission of the module coordinator (per Email). The prerequisites will be set according to the topic. This module is open only to Master's students. It may not be booked by Bachelor's students as a pre-Master's module.
Leistungsnachweis	dokumentierte praktische Arbeit
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Semester)