



Computational Linguistics and Language Technology

Master Major 90

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
06M-7521w01	Other Curricular Modules
	Abschlussarbeit

Übersicht über die Module in den Modulgruppen

Modul-ID	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
06M-7521w01	Other Curricular Modules	Modultyp	ECTS
04SM22MAS01	Mantelstudium: Gesundheitserfahrungen interprofessionell	Wahlpflicht	4
06SM271-528	Categories of Linguistic Analysis	Wahlpflicht	6
06SM523-524	Speech perception and the brain	Wahlpflicht	6
06SM523-526	Experiments with speech	Wahlpflicht	6
06SM523-527	Voice Analysis	Wahlpflicht	6
06SM523-531	Our voice: Between linguistic and idiosyncratic information	Wahlpflicht	6
10SMSTS-103	Mit Bürger*innen Wissen schaffen? Wie Citizen Science gelingt!	Wahl	1
10SMSTS-105	Studienwoche: Nachhaltige Entwicklung und Transformation	Wahl	3
10SMSTS-106	UZH Innovathon: The Digitalization of Mobility	Wahl	3
10SMSTS-110	Moralisch handeln?! Ethische Kompetenzen in Theorie und Praxis	Wahl	3
10SMSTS-112	Entrepreneurship Bootcamp - Get Inspired to Get Started	Wahl	1
10SMSTS-118	Digital Security: What Everyone Should Know	Wahl	3
10SMSTS-200	Interdisciplinary Introduction to Machine Learning - Exercises	Wahl	2
10SMSTS-201	Interdisciplinary Introduction to Machine Learning - Theory	Wahl	3
10SMSTS-202	Teamwork on Digital Transformation Challenges I	Wahl	3
10SMSTS-203	Teamwork on Digital Transformation Challenges II	Wahl	6
10SMSTS-204	Digital Transformation - a Scientific Overview	Wahl	3
10SMSTS-500	Start! Teaching Essentials	Wahl	1
10SMSTS-501	Start! Practice your Teaching	Wahl	1
10SMSTS-503	Start! Coaching Accessibility	Wahl	1



10SMSTS-504	Start! AI Competences (for Teaching & Learning)	Wahl	1
10SMSTS-505	Mentoring für die nächste Generation	Wahl	6
10SMSTS-506	Get R_ready: Introduction to Data Analysis for Empirical Research	Wahl	1
10SMSTS-507	Get R_ready: Dynamic Reporting & Reproducibility in Research	Wahl	1
10SMSTS-508	Get R_ready: Prognostic & Prediction Modeling in Research	Wahl	1
10SMSTS-510	Raumanalysen interdisziplinär: GIS als digitale Methode	Wahl	3
10SMSTS-515	Open Access Basics	Wahl	1
10SMSTS-516	Introduction to Research Data Management	Wahl	1
10SMSTS-517	Making your data FAIR	Wahl	1
10SMSTS-518	Cyber Law – Data protection, AI, and Cybersecurity	Wahl	3
10SMSTS-602	Open Source Intelligence (OSINT)	Wahl	3
10SMSTS-604	ChatGPT and Beyond: Interdisciplinary Approaches to AI Literacy	Wahl	2
10SMSTS-605	Storytelling for Digital Transformation	Wahl	3
	Abschlussarbeit		Modultyp ECTS
06SM523-MA	Master's Thesis	Pflicht	30



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	03SM22MI0004
Modulgruppe	Computer Science
Modultyp	Wahlpflicht
Organisation	Wirtschaftswissenschaftliche Fakultät

Advanced Topics in Artificial Intelligence (AI) (L+E)

ECTS	6
Lehrformen	Vorlesung mit integrierter Übung
Allg. Beschreibung	<p>Artificial Intelligence (AI) techniques have become ubiquitous: we all repeatedly interact with artefacts that are driven by some AI technology.</p> <p>The goal of this course is to go beyond the foundational approaches (which are covered in other classes) and explore advanced topics in artificial intelligence such as large-scale knowledge processing, encoding mechanisms for unstructured and structured data, the combination of various AI approaches to provide intelligent systems, as well as notions of human-AI collaboration and coordination spanning from collective intelligence to ensuring notions of fairness, accountability, transparency and diversity.</p>
Lernziel	<p>The students can</p> <ul style="list-style-type: none">- apply the theory and practice of advanced AI methods to realistic scenarios- develop novel AI methods & applications based on existing cutting-edge research- reason about the impact of AI applications on society and devise methods that exploit the technology's advantages whilst mitigating the risks
Unterrichtssprache	English
Voraussetzungen	<p>This course assumes that you have taken an introductory AI course such as Introduction to Artificial Intelligence (offered in the spring term) or the previously offered Practical AI. This is roughly equivalent to covering Chapters 1 - 18 in the Book Artificial Intelligence: A Modern Approach 4th Ed.</p>
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 parallel 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-semesterig (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	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.

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)



Modulkürzel	04SM22MAS012
Modulgruppe	Other Curricular Modules
Modultyp	Wahlpflicht
Organisation	Medizinische Fakultät

Mantelstudium: Gesundheitserfahrungen interprofessionell

ECTS	4
Lehrformen	Vorlesung
Allg. Beschreibung	In interdisziplinär zusammengesetzten Kleingruppen planen und führen die Studierenden ein narratives Interview mit einer Patient:in zu deren Gesundheitserfahrungen durch. Das Gespräch wird aufgezeichnet und im Anschluss transkribiert und analysiert. Hierfür werden Methoden anderer Disziplinen eingeführt und angewandt (quantitative/automatische und qualitative Inhaltsanalyse, Gesprächsanalyse), was interdisziplinäres Lernen ermöglicht. Die Gruppen führen ein Lerntagebuch, das systematisch reflektiert wird.
Lernziel	"Die Studierenden... verstehen die kommunikativen und ethischen Herausforderungen an Gespräche mit Patient:innen zu deren Gesundheitserfahrungen, kennen wesentliche Methoden der Gesprächsführung und qualitativen Auswertung, sind in der Lage, in interdisziplinären Kleingruppen zusammen zu arbeiten, erarbeiten eine Gesprächstranskription und analysieren diese nach wissenschaftlichen Methoden."
Unterrichtssprache	Deutsch
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	keine Wiederholungsmöglichkeit
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	06SM271-528
Modulgruppe	Other Curricular Modules
Modultyp	Wahlpflicht
Organisation	Linguistik Zentrum Zürich

Categories of Linguistic Analysis

ECTS	6
Lehrformen	Übung
Allg. Beschreibung	This interactive, exercise-based module provides an overview of the most important categories in linguistic structural analysis. Participants learn which types of data are necessary to identify specific categories and structures, and how these can be detected within such data sets.
Lernziel	Knowledge of the most important linguistic analysis categories and their practical application to various languages/in cross-linguistic comparison.
Unterrichtssprache	Englisch
Voraussetzungen	Foundational knowledge of the main concepts and terms related to the structural levels of language
Leistungsnachweis	Portfolio (20% exercises, 80% written exam)
Notenskala	1-6, in Halbschritten
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	06SM523-524
Modulgruppe	Other Curricular Modules
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Speech perception and the brain

ECTS	6
Lehrformen	Vorlesung
Allg. Beschreibung	Human listeners can retrieve abstract linguistic messages from speech signals despite of the fact that there is strong variability in acoustic realisations of speech between individuals or between situations. Acquiring a language, listeners have to learn about how sounds group to syllables and syllables group to words and they can perform such decisions on speech despite of highly ambiguous cues to sounds, syllables or words. For this reason different theories of speech perception propose various solutions as to how speech can be perceived apparently effortlessly given its highly variable nature.
Lernziel	The objectives of this lecture series are to (1) understand the fundamental complexity of speech perception (2) understand a variety of different theories explaining speech perception (3) understand about a variety of different physical cues that contribute to the perception of speech
Unterrichtssprache	Englisch
Voraussetzungen	The participation in "Fundamentals of Speech Sciences and Signal Processing" is highly recommended. 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	Portfolio: (a) written assignments throughout term (50%), (b) written exam (50%).
Notenskala	1-6, in Halbschritten
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes 2. Herbstsemester)



Modulkürzel	06SM523-526
Modulgruppe	Other Curricular Modules
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Experiments with speech

ECTS	6
Lehrformen	Seminar
Allg. Beschreibung	The media often reports that speech played backwards contains secret messages. Is that true? What does it sound like? Scientists showed that babies can extract information from the speech signal without even knowing anything about the linguistic system. In backward speech, such abilities may be lost. Other research showed that non-native speakers can be identified in speech even when it is played backwards. Why playing speech backwards? How is this done? In this seminar we will learn how to study speech communication using experimental techniques. Students will run their own experiments in which they will address a variety of questions, for example how we segment a continuous speech stream into words or syllables, how we identify different languages or different speakers or how we communicate in strong background noise. There are many fascinating things to discover about speech communication but most likely not that speech played backwards contains secret messages.
Lernziel	The course has the objectives to learn how to (a) design and execute experiments in speech; (b) formulate testable experimental hypotheses based on theoretical knowledge; (c) process and manipulate speech for experiments; (d) analyse quantitative data obtained from experiments; (e) interpret results; (f) compare and discuss the results with related research; (g) write up findings in a state-of-the-art experimental report.
Unterrichtssprache	Englisch
Voraussetzungen	The participation in «Fundamentals of Speech Sciences and Signal Processing» is highly recommended. 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	Portfolio: (a) written assignments throughout term (20%), (b) oral presentation in class (20%), (c) written report (60%).
Notenskala	1-6, in Halbschritten
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	06SM523-527
Modulgruppe	Other Curricular Modules
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Voice Analysis

ECTS	6
Lehrformen	Seminar
Allg. Beschreibung	<p>The human voice is a highly complex instrument that produces intricate communicative signals (vocalising). Vocalising involves approximately 200 muscles working together within the vocal apparatus. Understanding how these signals are produced requires knowledge of both the anatomy and physiology of the vocal tract and larynx, as well as the role of articulatory muscles. In this course, you will explore various methods used to study voice production, including laryngography and laryngoscopy (examining vocal fold movement), electromagnetic articulography and ultrasound (tracking articulator movements), pharyngometry (analyzing vocal tract dimensions), myography (measuring muscle activity during vocalization), and respiratory tracing (monitoring breathing patterns while speaking). You will also examine how voice production relates to the acoustic signal and the communicative information it conveys and we will look at some use cases such as voice recognition. All these methods are available through the Linguistic Research Infrastructure (LiRI), with which we will collaborate closely.</p>
Lernziel	<p>Main objectives of this cross-disciplinary seminar are to understand (1) methods for measuring voice production (2) how different communicative information is encoded in voice (3) how the knowledge about information in voice can be applied in voice technology or forensic voice analysis, for example.</p>
Unterrichtssprache	Englisch
Voraussetzungen	<p>The participation in "Fundamentals of Speech Sciences and Signal Processing" and "Experiments with speech" is highly recommended.</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	<p>Portfolio: (a) written assignments throughout the term (20%), (b) oral presentation (20%) and (c) written report (60%).</p>
Notenskala	1-6, in Halbschritten
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	06SM523-531
Modulgruppe	Other Curricular Modules
Modultyp	Wahlpflicht
Organisation	Institut für Computerlinguistik

Our voice: Between linguistic and idiosyncratic information

ECTS	6
Lehrformen	Vorlesung
Allg. Beschreibung	Next to containing a linguistic message, voices play an essential role in human social interaction. Humans can recognize other individuals by their voice, rely on being recognized and recognition failure is a social misconduct that can lead to high embarrassment. Voices signal the emotional state, the fertility in females and help selecting the right mating partner. Voices are a key part of our personality and shape the trust we have in others. In this lecture series we will study the complexity of the human voice by applying a variety of technologies such as laryngography, electromagnetic articulography, ultrasound, endoscopy and myography.
Lernziel	(1) Theoretical understanding of the role of voice in speech communication (2) Acquisition of articulatory procedures for measuring voice production (3) Signal processing skills for the acoustic analysis of voices
Unterrichtssprache	Englisch
Voraussetzungen	- Lecture: Fundamentals of Speech Sciences and Signal Processing - Seminar: Experiments with Speech 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	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 2. Herbstsemester)



Modulkürzel	10SMSTS-103
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Mit Bürger*innen Wissen schaffen? Wie Citizen Science gelingt!

ECTS	1
Lehrformen	Seminar
Allg. Beschreibung	«Citizen Science» (CS) ermöglicht den Einbezug von Bürger*innen in wissenschaftliche Forschungsprojekte. Die Spannbreite von CS Projekten ist dabei gross und reicht von punktuelltem Einbezug zur Datenerhebung bis hin zur partizipativen Ko-Kreation von Projekten und Ko-Produktion von Wissen. Das Modul bietet eine Einführung ins Thema CS mittels konkreter Projektbeispiele aus unterschiedlichen Disziplinen. Dabei ergänzen sich E-Learning, Blockveranstaltungen vor Ort und der Austausch mit Projektverantwortlichen. Interaktiv diskutieren wir Ziele und Funktionen, Art und Intensität sowie Herausforderungen der praktischen Umsetzung im Feld. Darüber hinaus setzen wir CS in Bezug zu Kommunikation im Allgemeinen sowie Wissenschaftskommunikation im Besonderen, Diversität, Open Science und TD Forschung. Das Modul soll zur Reflexion darüber anregen, wie eine Wissensproduktion aussehen könnte, die sich durch grössere Offenheit und Teilhabemöglichkeiten von Bürger*innen auszeichnet.
Lernziel	Die Teilnehmenden können grundlegenden Konzepte und Fragen im Bereich CS nennen, erkennen CS Projekte und können sie in Bezug auf ihren Grad an Partizipation charakterisieren. Sie kennen Chancen und Herausforderungen von CS Projekten und können verschiedene Typen von CS Projekten in Bezug auf ihren Nutzen für Forschende und Bürger*innen reflektieren. Sie haben eine erste Vorstellung davon, wie Forschung und die Lösung gesellschaftlicher Probleme miteinander verbunden werden können. Zudem können sie die Zusammenhänge zu Wissenschaftskommunikation, Open Science und TD Forschung herstellen und können Theorie und Praxis von CS einem weiteren Umfeld erklären. Die Teilnehmenden können unter Einbezug der erlernten Prinzipien von CS Forschung bestehende Projektbeschreibungen kritisch analysieren und eine eigene, zielgruppengerechte Projektbeschreibung formulieren.
Unterrichtssprache	Deutsch
Voraussetzungen	Deutschkenntnisse. Das Modul wird auf Deutsch durchgeführt.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	10SMSTS-105
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Studienwoche: Nachhaltige Entwicklung und Transformation

ECTS	3
Lehrformen	Seminar
Allg. Beschreibung	Die Studienwoche Nachhaltigkeit vermittelt grundlegende sowie neueste Erkenntnisse der Nachhaltigen Entwicklung (NE). Im Vordergrund steht der Erwerb von Wissen und Kompetenzen für die Gestaltung gesellschaftlicher Veränderungsprozesse für eine NE. Ausgangspunkt ist ein Überblick über die Entstehung und Interpretationen der NE, bevor in disziplinär ausgerichteten Modulen ausgewählte Problemlagen thematisiert werden, wie z.B. Mensch-Umwelt-Beziehungen, die ethische Dimension oder Zielkonflikte der Nachhaltigen Entwicklung. U.a. wird es eine wissenschaftliche Einführung in die Zieldimension der gesellschaftlichen Transformation gegeben. Neben dem klassischen Erwerb von Wissen ist das Ziel, praxisorientierte Fragestellungen in einer transdisziplinären Herangehensweise zu bearbeiten. Unterstützt wird die Praxisorientierung durch eine Exkursion. Hierdurch werden Gestaltungs- und Managementfähigkeiten erlernt, die für zukünftige Verantwortungsträger:innen zentral sind. Die persönliche Präsenz und aktive Mitarbeit in der Studienwoche ist zwingender Bestandteil des Leistungsnachweises.
Lernziel	Die Studierenden kennen und reflektieren die Fundamente des Leitbildes Nachhaltiger Entwicklung (NE) als normatives und globales Leitbild, seine Entwicklungsgeschichte und die 17 Nachhaltigkeitsziele der Vereinten Nationen als derzeitigem dominantem Legitimationsrahmen. Sie verfügen über interdisziplinäre Analysekompetenz gesellschaftlicher Anwendungsfelder und Analysemethoden, die die Interdependenz gesellschaftlicher, wirtschaftlicher und ökologischer Entwicklungen aufzeigen. Sie kennen die zentralen Konflikte der NE in der Schweiz und im internationalen Kontext. Sie kennen wichtige Methoden der Sozialforschung sowie der inter- und transdisziplinären Forschung und verstehen deren Bedeutung und Anwendung im Kontext einer NE. Das Wissen über sozial-ökologische Transformationsprozesse und die erlernten Gestaltungskompetenzen werden die Studierenden dazu befähigen, konkrete Problemstellungen im Bereich NE ethisch und wissenschaftlich fundiert und kompetent lösen zu können.
Unterrichtssprache	Deutsch
Voraussetzungen	Grundlegende Kenntnisse über das Konzept oder zur Umsetzung Nachhaltiger Entwicklung sind wünschenswert, jedoch keine Voraussetzung. Erwartet wird ein grosses Interesse an Nachhaltiger Entwicklung und den unterschiedlichen, damit zusammenhängenden interdisziplinären Themenfeldern und Perspektiven. Sprachlich wird ein Deutschniveau von mindestens B2 vorausgesetzt. Die Studienwoche findet in deutscher Sprache statt, Englischkenntnisse sind für das Lektürestudium und einzelne Vorträge notwendig. Das Modul ist auch für (fortgeschrittene) Bachelorstudierende offen, d. h. ab dem fünften Semester.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	keine Wiederholungsmöglichkeit
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	10SMSTS-106
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

UZH Innovathon: The Digitalization of Mobility

ECTS	3
Lehrformen	Seminar
Allg. Beschreibung	<p>This transdisciplinary course equips students with innovation skills through structured, hands-on problem-solving techniques. Innovation is essential for developed economies like Switzerland to sustain their international standing and economic wellbeing.</p> <p>Students learn how to approach problems creatively, collaborate across disciplines, and develop impactful solutions. Working with practice partners, students tackle real-world challenges, contributing directly to solving these.</p> <p>The area of focus is the digitalization of mobility - an area where innovation e.g., clean, autonomous systems or seamless public transport can address societal needs and sustainability goals e.g., by reducing environmental impacts or enhancing inclusivity. The course begins with input from lecturers across various disciplines, offering diverse perspectives to build a strong foundation for understanding and innovation. Then, students engage in doing: developing actionable solutions which eventually may be implemented by industry partners.</p>
Lernziel	<p>See more on our course homepage: https://www.digitalinnovathon.uzh.ch/en.html</p> <p>Innovation Skills: Learn techniques to ideate, prototype, and refine solutions.</p> <p>Communication and Presentation Skills: Learn professional pitching, persuasive storytelling, and clear, impactful communication.</p> <p>Interdisciplinary Collaboration: Experience working with diverse teams, integrating multiple perspectives, and co-creating meaningful outcomes.</p> <p>Professional Interaction: Build skills in engaging with industry partners.</p> <p>Interdisciplinary Knowledge: Explore the digitalization of mobility from diverse disciplinary perspectives, including informatics, law, geography, remote sensing, health sciences, or business administration.</p>
Unterrichtssprache	<p>This course entails interactive collaboration and real-time teamwork. The activities thrive on the energy of being fully present - working together, exchanging ideas, and creating solutions in a vibrant environment. Thus, full on-site participation in all sessions is essential. We understand that English</p>
Voraussetzungen	<p>The number of participants is limited.</p> <p>This is an application module. Please register for the module within the specified deadlines via the UZH module booking tool and include with your application a short description of your personal motivation in a few sentences (max. half a page).</p>



UZH students register via the UZH course catalogue within the specified deadlines.
Non-UZH students who wish to complete the module as mobility students must first observe the application deadlines at UZH (<https://www.uzh.ch/en/studies/application/deadlines.html>) and, after the successful registration at UZH, book the module through the UZH course catalogue.

Leistungsnachweis	The course requires an English level of B1/B2. Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	keine Wiederholungsmöglichkeit
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	10SMSTS-110
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Moralisch handeln?! Ethische Kompetenzen in Theorie und Praxis

ECTS	3
Lehrformen	Seminar
Allg. Beschreibung	Politische, ökonomische, technische und klimatische Entwicklungen verändern globale, gesellschaftliche, berufliche und private Handlungsanforderungen. Der Bedarf an moralischer Orientierung und ethischer Entscheidungsfindung ist in zahlreichen beruflichen Praxisfeldern und im Alltag gestiegen und gefragt. Innerhalb des Rahmens legaler Möglichkeiten bleibt die Spanne der Wahlmöglichkeiten mit jeweiligem moralischem Gehalt groß; und erfordert weitsichtiges und verantwortliches Handeln auf Grundlage ethischer Reflexion. In diesem Kurs lernen Sie die eigene moralische Involvierung zu erkennen und erwerben durch die Verknüpfung von Theorie und Praxis die Kompetenz, sich verantwortlich ein ethisches Urteil zu bilden. Das Modul zielt zwar auf die Vermittlung ethischen Grundlagenwissens, fokussiert dabei aber auf die Anwendung in verschiedenen Praxisfeldern, aus denen Berufstätige anschaulich berichten.
Lernziel	Die Teilnehmenden werden für moralische Fragestellungen in ihren jeweiligen Fächern und angestrebten Berufsfeldern sensibilisiert und befähigt, eigenständig eine verantwortbare ethische Position zu entwickeln und zu vertreten. Ein Fokus liegt auf der Darstellung der Alltäglichkeit von moralischen Phänomenen, den persönlichen Einflussmöglichkeiten und der Tragweite des eigenen Handelns. Hierfür erwerben die Teilnehmenden Kenntnis über die jeweiligen fachspezifischen ethischen Themen und üben Strukturen ethischer Entscheidungsfindung praktisch ein.
Unterrichtssprache	Deutsch
Voraussetzungen	Für die Teilnahme gibt es keine Voraussetzungen.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Halbschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	10SMSTS-112
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Entrepreneurship Bootcamp - Get Inspired to Get Started

ECTS	1
Lehrformen	Seminar
Allg. Beschreibung	"Entrepreneurship Bootcamp - Get Inspired to Get Started" is designed for students across all disciplines who are curious about entrepreneurship and want to explore its potential as a career path. This hands-on course introduces you to entrepreneurial thinking, ideation techniques, and the skills necessary to thrive in interdisciplinary teams. Over three interactive sessions, you'll reflect on your personal career aspirations, learn from real-world entrepreneurs, and develop a resilient mindset for tackling challenges. No prior experience is required - just bring your curiosity and willingness to explore new possibilities. Join us to ignite your entrepreneurial journey!
Lernziel	The Bootcamp enables students to: - develop an entrepreneurial mindset, - establish a positive failure culture and learn from failure, - learn and apply ideation techniques, - build a comprehensive network and learn community building, - work effectively in interdisciplinary teams, - question whether a career as an entrepreneur appeals to them and plan their studies and career accordingly. The key outcome is to answer the question: "Is Entrepreneurship a career option for myself?"
Unterrichtssprache	Englisch
Voraussetzungen	none
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Semester)



Modulkürzel	10SMSTS-118
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Digital Security: What Everyone Should Know

ECTS	3
Lehrformen	Seminar
Allg. Beschreibung	<p>Cybersecurity affects everyone - not just IT professionals. This interdisciplinary introductory course provides fundamental knowledge of the technical, legal, ethical, psychological, and societal aspects of digital security.</p> <p>Using real-life case studies, scenario-based learning, and escape room elements, students work in interdisciplinary teams to analyze common cybersecurity incidents. The course empowers participants to assess risks, understand different perspectives, and apply practical security measures in everyday digital life.</p>
Lernziel	<p>Students will be able to...</p> <ul style="list-style-type: none"> - ... learn and explain fundamental cybersecurity concepts (Learning Objective 1 - Knowledge) - ... identify , understand, and apply the technical, social, psychological, legal, and ethical components of cybersecurity (Learning Objective 2 - Interdisciplinary Collaboration) - ... assess general societal threat scenarios realistically and weigh potential benefits and drawbacks of cybersecurity measures, including their own behavior (Learning Objective 3 - Risk Awareness) - ... develop recommendations and alternative solutions for simple cases (Learning Objective 4 - Solution Orientation) - ... accept the residual risk inherent in chosen cybersecurity measures (Learning Objective 5 - Responsibility and Accountability)
Unterrichtssprache	English
Voraussetzungen	None.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	10SMSTS-200
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Interdisciplinary Introduction to Machine Learning - Exercises

ECTS	2
Lehrformen	Übung
Allg. Beschreibung	<p>In this module, students have the opportunity to engage in exercises that address real-world problems in various disciplines, providing a hands-on experience with machine learning methodology.</p> <p>This module is designed in combination with the corresponding module: "Interdisciplinary Introduction to Machine Learning - Theory (10SMSTS-201)" and should only be booked together with it. Students will be assigned exercises (Python programming and/or non-programming exercises) for each lecture of the course 10SMSTS-201.</p>
Lernziel	After passing the module, the students are able to solve programming and non-programming exercises according to the content of 10SMSTS-201.
Unterrichtssprache	English
Voraussetzungen	Introduction to concepts of data analysis, Python programming, and statistics.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Semester)



Modulkürzel	10SMSTS-201
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Interdisciplinary Introduction to Machine Learning - Theory

ECTS	3
Lehrformen	Vorlesung
Allg. Beschreibung	This course on machine learning is designed to provide a comprehensive understanding from a multi-disciplinary perspective. Throughout the course, we will delve into the algorithms and techniques that constitute machine learning, while also considering its applications and limitations across various fields - Medicine, Law, Linguistics, Physical Sciences, and Robotics, to name a few. The aim is to equip students with the knowledge to critically assess the suitability of machine learning solutions for different types of challenges. By the end of this course, students should have a nuanced understanding of machine learning's capabilities and restrictions, informed by examples across multiple sectors.
Lernziel	After passing the module, the students are able to: <ul style="list-style-type: none">- name fundamentals about functionality and limitations of both supervised and unsupervised machine learning algorithms- list different data types and problem types, such as classification and regression, and match them to the appropriate algorithms- discuss about the vulnerability of and adversarial attacks on machine learning algorithms- give an overview about the wide variety of applications of ML across many disciplines as well as discipline-specific challenges- reflect on machine learning, the promise of artificial intelligence, and big data from a legal, ethical, as well as philosophical perspective
Unterrichtssprache	English
Voraussetzungen	Introduction to concepts of data analysis and statistics.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Semester)



Modulkürzel	10SMSTS-202
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Teamwork on Digital Transformation Challenges I

ECTS	3
Lehrformen	Seminar
Allg. Beschreibung	<p>In this module, students work on interdisciplinary projects that address challenges related to digital transformation. Under the guidance of a researcher from the Digital Society Initiative (DSI), students collaborate in interdisciplinary teams of 3-5 members. Each team member takes on defined responsibilities and contributes specific digital skills to the project.</p> <p>After an initial innovation phase, each team engages in an exchange with experts from the DSI network. Depending on the project's focus, teams receive guidance on appropriate digital methods and approaches, as well as input on ethical, legal, social and other relevant considerations.</p> <p>In a follow-up module (6 ECTS) in the spring semester, students have the opportunity to further develop and implement their project ideas in practice.</p>
Lernziel	<p>The students ...</p> <ul style="list-style-type: none">- work effectively in interdisciplinary teams on innovative digital transformation challenges.- understand both traditional disciplinary research and new approaches enabled by digitalization.- develop a cross-disciplinary understanding of diverse research questions, methods, and perspectives.- learn to value and integrate different disciplinary approaches.- evaluate project goals, processes, and results using ethical, legal and social criteria.- consider additional project-specific aspects, such as reproducibility and data protection.- apply relevant digital skills in a meaningful and practical way.- prepare and present project results using digital media.- present and discuss project concepts in a World-Café format.
Unterrichtssprache	Englisch
Voraussetzungen	For students enrolled in the Minor / LAO "Digital Skills", passing this compulsory course is a prerequisite for enrolling in the compulsory course "Teamwork on Digital Transformation Challenges II" in the following semester.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	10SMSTS-203
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Teamwork on Digital Transformation Challenges II

ECTS	6
Lehrformen	Seminar
Allg. Beschreibung	<p>In this module, interdisciplinary questions on challenges in the field of digital transformation are addressed in various projects.</p> <p>Under the guidance of a researcher from the Digital Society Initiative (DSI) network, students work in an interdisciplinary team of around 4 people, with each team member taking on defined tasks and also contributing specific digital skills.</p> <p>The challenges run over two semesters, starting in the fall semester to develop a project concept, followed by this module in the spring semester to realize the projects. It is aimed at Master's students from all disciplines who either continue in the same challenge team or apply for a challenge to bring their specific skills to the team.</p>
Lernziel	<p>The students ...</p> <ul style="list-style-type: none"> - are able to work successfully in interdisciplinary groups with innovative approaches on interdisciplinary challenges in the field of digital transformation. - understand traditional research in individual disciplines and new approaches made possible by digitalization. - thereby also acquire a cross-disciplinary understanding of different questions, approaches and methods. - learn to appreciate the different approaches of those involved. - evaluate their goals, the process and the results of the projects according to ethical, legal and social principles. - consider specific additional aspects, such as reproducibility and data protection, depending on the project. - apply digital skills beneficially in the project. - are able to prepare and present their project results.
Unterrichtssprache	English
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	10SMSTS-204
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Digital Transformation - a Scientific Overview

ECTS	3
Lehrformen	Seminar
Allg. Beschreibung	<p>This module provides students with a scientific overview of the digital transformation of our society from a multidisciplinary perspective.</p> <p>Students receive academic input followed by an interactive session with various DSI professors and learn to engage with and reflect on the challenges, opportunities and consequences of digital transformation.</p> <p>Sessions are usually structured as follows (exceptions are possible): 15:00 to 15:45: Input lecture by expert 16:15 to 17:00: Group work related to the input lecture</p>
Lernziel	<p>The students ...</p> <ul style="list-style-type: none">- obtain a structured overview of research fields that deal with the digital transformation- reflect on the digital transformation of our society both in group discussions and on the individual level- critically consider the social implications of the Digital Society.
Unterrichtssprache	Englisch
Voraussetzungen	None
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	1-6, in Viertelschritten
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	10SMSTS-500
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Start! Teaching Essentials

ECTS	1
Lehrformen	Seminar
Allg. Beschreibung	<p>In diesem Modul werden didaktische Grundlagen vermittelt. Sie lernen, wie Sie Wissen vermitteln und andere bei ihrem Lernprozess unterstützen können. Das Modul eignet sich ideal als Vorbereitung auf eine Tätigkeit als Tutor:in. Es besteht aus einem OLAT Online-Kurs, der selbstständig bearbeitet wird, und einem 3-stündigen synchronen Workshop (wahlweise online oder in Präsenz).</p> <p>Der OLAT-Kurs besteht aus 5 Bereichen:</p> <ol style="list-style-type: none">1. Standort- und Rollenbestimmung2. Feedback und Bewerten3. Präsentieren und Auftreten4. Unterrichtsplanung5. Online Lehre <p>English: This module imparts essential didactic principles. You will learn how to convey knowledge and support others on their learning journey. It is an ideal preparation for a tutor role. The module includes a self-paced OLAT online course and a 3-hour workshop (online or in-person).</p> <p>The OLAT course consists of 5 sections:</p> <ol style="list-style-type: none">1. Defining roles2. Feedback and evaluation3. Presentation skills4. Lesson planning5. Online teaching
Lernziel	<p>Studierende setzen sich mit der Bedeutung verschiedener Erfolgsfaktoren guter Lehre auseinander und reflektieren ihren Kompetenzerwerb in den folgenden Bereichen:</p> <ul style="list-style-type: none">- Grundverständnis akademischer Lehrtätigkeit- Standortbestimmung bez. Lehr- und Auftrittskompetenz- Rollenverständnis- Umgang mit Konflikten- Feedback geben und bewerten- Auftrittskompetenzen analysieren und stärken- Unterrichtsplanung und Aktivierung- Einsatz digitaler Technologie für den Lehr- und Lernprozess <p>English: Students engage with the significance of various success factors in effective teaching and reflect on their competencies in the following areas:</p> <ul style="list-style-type: none">- Basic understanding of academic teaching- Assessing own teaching and presentation skills
Unterrichtssprache	Deutsch oder Englisch: siehe Sprache der Lehrveranstaltung



Voraussetzungen	Keine Vorkenntnisse notwendig. Dieses Modul ist insbesondere geeignet für (angehende) Tutor:innen mit keiner oder wenig Lehrerfahrung, sowie für Studierende, die sich didaktische Kompetenzen aneignen möchten.
	English: No prior knowledge required. This module is especially suitable for (aspiring) teaching assistants with no or little teaching experience, as well as for students who wish to develop didactic skills.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Semester)



Modulkürzel	10SMSTS-501
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Start! Practice your Teaching

ECTS	1
Lehrformen	Seminar
Allg. Beschreibung	Dieses Modul bietet die Möglichkeit zur Vertiefung und zum aktiven Üben spezifischer didaktischer Themen wie Gamification, Wissenschaftskommunikation, Auftrittskompetenz, oder das Erstellen von Lehrmaterialien. Die Vertiefungsthemen werden entweder als synchrone Workshops (eintägig vor Ort) oder als asynchrone Selbstlerneinheiten auf OLAT angeboten. Aus dem wechselnden Semesterangebot müssen zwei Workshops sowie eine asynchrone Selbstlerneinheit absolviert werden, um das Modul zu bestehen.
Lernziel	Studierende lernen verschiedene Kompetenzen und Methoden für die Lehre und Wissensvermittlung vertieft kennen und anwenden.
Unterrichtssprache	Deutsch
Voraussetzungen	Keine Vorkenntnisse notwendig.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Semester)



Modulkürzel	10SMSTS-503
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Start! Coaching Accessibility

ECTS	1
Lehrformen	Seminar
Allg. Beschreibung	<p>Menschen mit physischen, sinnesbezogenen, kognitiven oder psychischen Beeinträchtigungen sind im Alltag mit verschiedenen Barrieren konfrontiert. Auch im universitären Kontext bestehen Barrieren für Mitarbeitende und Studierende mit einer Behinderung oder chronischen Krankheit. Das Modul beschäftigt sich mit unterschiedlichen Formen von technologischen, kulturellen und organisatorischen Barrieren im Lehr- und Lernkontext (z.B. erschwerte Zugänglichkeit von Lehrveranstaltungsunterlagen) und der Frage, wie solche Barrieren verhindert bzw. reduziert werden können sowie wie barrierefreies Lehren und Lernen möglich ist. Weiter sollen die Teilnehmenden dazu befähigt werden, um zukünftig als Accessibility Coaches für Dozierende tätig zu sein. Das Modul ist als Blending Learning-Veranstaltung konzipiert. Es besteht aus einem asynchronen E-Learning-Kurs mit Podcasts und weiteren Lernmaterialien. Daneben werden an einzelnen Terminen Kurse vor Ort und synchrone online-Kurse angeboten.</p>
Lernziel	<p>Das Modul setzt sich zum Ziel, (angehenden) studentischen Tutor:innen ein Bewusstsein für verschiedene Dimensionen der Barrierefreiheit in der Lehre und die Bedürfnisse von Studierenden mit Behinderung bezüglich barrierearmem Lernen und Inklusion zu vermitteln. Weiter sollen (angehende) studentische Tutor:innen dazu qualifiziert werden, um als Accessibility Coaches Dozierende der Universität Zürich bei der Implementierung barrierearmer Lehrmethoden und Materialien zu unterstützen. In diesem Zusammenhang erwerben die Teilnehmenden Kenntnisse in den folgenden Bereichen:</p> <ul style="list-style-type: none"> - Kulturelle und organisationale Aspekte der Inklusion und Umsetzung des Konzepts des "Designs for all" - Barrierefreiheit und Ziele barrierearmer Lehre - Technologische Unterstützung und e-Accessibility - Entwicklung bzw. Erstellung barrierefreier Lehr- und Lernmaterialien - Vermittlung der erworbenen Kenntnisse zur barrierearmen Lehre an Dozierende, zu deren Unterstützung
Unterrichtssprache	Deutsch
Voraussetzungen	Es sind keine Vorkenntnisse notwendig. Dieses Modul ist insbesondere geeignet für (angehende) Tutor:innen. Es steht aber allen Studierenden offen, die sich für die Themen Barrierefreiheit und Inklusion interessieren. Die Unterlagen zum E-Learning-Kurs werden auch in englischer Sprache bzw. mit englischen Untertiteln zur Verfügung gestellt. Die vor-Ort- bzw. online-Kurse finden jedoch in deutscher Sprache statt. Der Leistungsnachweis kann in deutscher oder englischer Sprache verfasst werden.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	10SMSTS-504
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Start! AI Competences (for Teaching & Learning)

ECTS	1
Lehrformen	Seminar
Allg. Beschreibung	<p>Interessierst du dich für die Potenziale, Herausforderungen und ethischen Aspekte von KI im Bildungsbereich? Denkst du gerne mit, wie eine Lehrveranstaltung innovativ mit KI gestaltet werden kann? Dann ist dieses Modul genau das Richtige für dich. Es richtet sich an alle BA- und MA-Studierenden, die neugierig auf KI in der Hochschullehre sind. Nach erfolgreichem Abschluss besteht die Möglichkeit, als AI-Coach angestellt zu werden.</p> <p>English Version Are you interested in the potential, challenges, and ethical aspects of AI in education? Do you enjoy thinking creatively about how a course can be innovatively designed with AI? Then this module is exactly right for you. It is aimed at all BA and MA students who are curious about AI in higher education teaching. Upon successful completion, there is the opportunity to be employed as an AI coach.</p>
Lernziel	<p>Die Studierenden werden in der Lage sein:</p> <ol style="list-style-type: none"> 1. Die KI-Grundlagen und ihre Anwendungen zu verstehen und Potenziale und Risiken für den Hochschullehrkontext abzuschätzen. 2. Ihr KI-Wissen kritisch anzuwenden, um effektive und innovative Lehr-Lernszenarien weiter zu entwickeln und praxisorientierte Lösungen zu gestalten. 3. Die ethischen Implikationen von KI-Technologien in der Bildung zu analysieren, insbesondere in Bezug auf ihre Auswirkungen auf die akademische Integrität und die Lehre. <p>English Version Students will be able to:</p> <ol style="list-style-type: none"> 1. understand AI fundamentals and their applications and assess potentials and risks for the university teaching context. 2. critically apply their AI knowledge to further develop effective and innovative teaching-learning scenarios and design practice-oriented solutions. 3. analyze the ethical implications of AI technologies in education, particularly in relation to their impact on academic integrity and teaching.
Unterrichtssprache	Deutsch und Englisch
Voraussetzungen	<p>Offenheit für neue Technologien und Freude, mit KI-Tools zu experimentieren. Erste Erfahrungen mit KI-Tools (z. B. Chatbots, Text- oder Bildgeneratoren) sind hilfreich, aber nicht zwingend erforderlich.</p> <p>English Version Openness to new technologies and enjoy experimenting with AI tools. Initial experience with AI tools (e.g. chatbots, text or image generators) is helpful, but not essential.</p>
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Herbstsemester)





Modulkürzel	10SMSTS-505
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Mentoring für die nächste Generation

ECTS	6
Lehrformen	Seminar
Allg. Beschreibung	Wollen Sie einen Beitrag zur Bildungsgerechtigkeit in der Schweiz leisten? Unterstützen Sie als Mentor:in ein Primarschulkind dabei, besser mit den Herausforderungen in Schule und Alltag umzugehen. Dieses Modul bietet Ihnen die Möglichkeit, sich im Rahmen Ihres Studiums sozial zu engagieren und sich dabei persönlich weiterzuentwickeln.

Das Modul umfasst einen praktischen und einen theoretischen Teil:

Theoretischer Teil

Zu Beginn des Semesters findet eine Blockveranstaltung statt, gefolgt von vier weiteren Lehrveranstaltungen, die sich über zwei Semester erstrecken. Abhängig vom Programm finden bis zu sechs Coaching-Treffen statt. Während des Moduls werden Sie durch die Praxispartner begleitet und gecoacht.

Praktischer Teil

Sie treffen sich mindestens 30 Mal (jeweils 1-2 Stunden) wöchentlich mit dem Ihnen zugeteilten Primarschulkind. Diese Treffen dokumentieren Sie in einem Online-Tagebuch.

Lernziel	Dieses Modul ist im Bereich des Service Learning anzusiedeln. Das bedeutet, dass gesellschaftliches Engagement mit fachlichem Lernen verbunden wird und ein Lernen durch Engagement stattfindet. Die vermittelten Kompetenzen werden durch das erbrachte soziale Engagement angewendet und vertieft. Das Modul und die Lernziele sind entsprechend praxisnah und handlungsorientiert:
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- Förderung der sozialen Kompetenzen: Verständnis und Empathie, Kommunikations- und Beratungskompetenz, interkulturelle Sensibilität, Problemlösestrategien, konstruktives Konfliktverhalten, Beziehungsgestaltung
- Steigerung des Bewusstseins für soziale Benachteiligung und Verständnis für soziale Mobilität
- Kenntnisse kindlicher Entwicklungsprozesse sowie Möglichkeiten, diese zu fördern
- Verständnis für die Wirkung und die Herausforderungen zivilgesellschaftlichen Engagements, sowohl auf gesellschaftlicher, persönlicher als auch ökonomischer Ebene

Unterrichtssprache	Deutsch
Voraussetzungen	Gute Deutschkenntnisse
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	keine Wiederholungsmöglichkeit
Angebotsmuster	2-semesterig (Beginn im Herbstsemester)



Modulkürzel	10SMSTS-506
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Get R_eady: Introduction to Data Analysis for Empirical Research

ECTS	1
Lehrformen	Seminar
Allg. Beschreibung	<p>The course offers an introduction to data analysis in the transdisciplinary field of empirical research in the programming language R. The R system of statistical computing is openly available from https://www.r-project.org and provides a simple and flexible software environment for statistical analyses and graphics. Tailored to the application of empirical research the course covers basics of functions and data formats in R, as well as the essential steps of a data analysis including data manipulation, descriptive statistics, statistical tests and graphical representations. Reflections on research methodology and transdisciplinarity will take place and critical thinking will be enhanced.</p>
Lernziel	<p>Aims of the course</p> <ul style="list-style-type: none">- to equip participants with the essential tools to address their research questions in R,- participants are able to perform plausibility checks, descriptive analysis, statistical tests and visualization of their research data in R,- participants are able to critically engage with and reflect on methodological aspects of data analysis and presentation and can adapt contemporary examples for critical appraisal to their disciplinary background.
Unterrichtssprache	Englisch
Voraussetzungen	Participants should have basic knowledge in statistics and should be beginners with the software R.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Semester)



Modulkürzel	10SMSTS-507
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Get R_eady: Dynamic Reporting & Reproducibility in Research

ECTS	1
Lehrformen	Seminar
Allg. Beschreibung	<p>Larger collections of data are becoming increasingly available. To exploit their potential, statistical analysis skills are needed.</p> <p>The direct link between data and visualization/reporting of results in all empirical research disciplines is highly relevant as several scientific fields have been criticized for lacking reproducibility.</p> <p>Dynamic reporting tools can be used to directly link data and analysis output, enabling fast adaptation of changes in the dataset following e.g. after data preparation, validation or in the context of manuscript revisions.</p> <p>Tailored to the application of empirical research, the course covers the basics of dynamic report compilation in RMarkdown, including examples of dynamic reports for presentations, manuscripts, and html websites. Reflections on research methodology, especially reproducibility, open science and transdisciplinarity will take place. Exemplary reports from different disciplines will be compiled and presented by the students.</p>
Lernziel	<p>Aims of the course</p> <ul style="list-style-type: none">- to equip participants with the essential tools to document their research with dynamic reporting tools,- to enable participants to generate presentations, manuscripts, and html websites directly from the underlying data sets,- to empower participants to critically engage with and reflect on methodological aspects of dynamic reporting and adapt the techniques to their own data sets and problems.
Unterrichtssprache	English
Voraussetzungen	Participants should have basic knowledge in statistical methods and in the programming language R, equivalent to completion of the course "Get R_eady: Introduction to Data Analysis for Empirical Research". Students should be beginners with software Quarto, R Markdown, R Notebook and R Sweave.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Semester)



Modulkürzel	10SMSTS-508
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Get R_eady: Prognostic & Prediction Modeling in Research

ECTS	1
Lehrformen	Seminar
Allg. Beschreibung	<p>Prognostic models to predict future events have increasingly been used across different fields, e.g. in the medical sciences (clinical prediction models, personalized medicine, prognostic models), in legal data science (predictive analytics), political sciences (scientific prediction), or related.</p> <p>The derivation and validation of such models poses specific challenges, that require knowledge of distinct methodological aspects in order to develop models that are internally valid and can be generalized out-of-sample. This course covers traditional statistical as well as machine learning approaches for model development, sample size calculation, variable selection, methodological outcomes for the assessment of model performance, as well as model validation. The course encourages critical thinking regarding published prognostic models' validity across different fields of research.</p>
Lernziel	<p>Aims of the course</p> <ul style="list-style-type: none">- to equip participants with the essential tools to derive a prediction model,- to enable participants to apply and interpret suitable model diagnostics for different types of prediction models,- to empower participants to critically engage with and reflect on published prediction models
Unterrichtssprache	Englisch
Voraussetzungen	Participants should have basic knowledge in the programming language R, equivalent to completion of the course "Get R_eady: Introduction to Data Analysis for Empirical Research". Additionally they should be familiar with statistical methods including statistical modeling methodology for binary outcomes.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Semester)



Modulkürzel	10SMSTS-510
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Raumanalysen interdisziplinär: GIS als digitale Methode

ECTS	3
Lehrformen	Übung
Allg. Beschreibung	<p>Der Kurs bietet eine interdisziplinäre Einführung in die Arbeit mit Geographischen Informationssystemen (GIS) als vielfältig einsetzbarer Methode.</p> <p>Räumliche Daten sind in fast jeder Disziplin wichtig. Sie eröffnen ein breites Spektrum an Einsatzmöglichkeiten, um räumliche Zusammenhänge zu erkennen. Welchen Nutzen hat die Arbeit mit GIS für verschiedene Fachbereiche? Welche Art von Erkenntnissen oder innovativen Fragestellungen sind mit GIS möglich? Welche Besonderheiten ergeben sich bei der Arbeit mit räumlichen Daten, und welche digitalen Werkzeuge stehen dafür zur Verfügung? Wie gelingt der Transfer von der wissenschaftlichen Fragestellung zur technischen Umsetzung, und welche grundlegenden Punkte gilt es dabei zu beachten?</p> <p>Diese Aspekte werden theoretisch beleuchtet, anhand von Fallbeispielen erläutert und in selbstständigen Übungen während des Semesters vertieft. Dabei werden sowohl theoretische Konzepte als auch praktische Umsetzungskompetenzen vermittelt.</p>
Lernziel	<p>Die Teilnehmer:innen kennen verschiedene Einsatzszenarien von GIS und können eigene Beispiele aus ihrer Disziplin skizzieren. Sie sind in der Lage, räumliche Daten selbst zu erheben oder bestehende Daten kritisch zu bewerten und wissen, worauf dabei jeweils zu achten ist.</p> <p>Sie können einfache GIS-Projekte konzipieren, verschiedene Visualisierungsmethoden anwenden und deren jeweilige Vor- und Nachteile benennen. Ausserdem verstehen sie, was ein Geoinformationssystem (GIS) ist und wie es fachspezifische Methoden sinnvoll ergänzen kann.</p>
Unterrichtssprache	Deutsch
Voraussetzungen	Keine besonderen Voraussetzungen.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	10SMSTS-515
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Open Access Basics

ECTS	1
Lehrformen	Seminar
Allg. Beschreibung	The introductory course "Open Access Basics" introduces students to the field of Open Science with a specific focus on Open Access - the online availability of articles and books. They learn about the newest developments in the publication landscape, how to access materials behind a paywall, explore the characteristics of Open Access and the difference to publications in traditional subscription-based journals. Manuscript versions and legal aspects of publishing (licenses) will also be discussed, as well as the impact that Open Access can have on society. The introductory course is intended for bachelor and master students who have little or no prior knowledge of Open Access. The course takes place as a half-day on-site event with online learning components before and after the event.
Lernziel	After this course, students are able to 1) name different versions of manuscripts, 2) differentiate between Open Access publications (diamond, gold, green) and traditional publications in subscription journals, 3) name various possibilities how and where to publish OA using online research tools such as the DOAJ, 4) access material that is behind a paywall and 5) distinguish between different creative commons licenses
Unterrichtssprache	English
Voraussetzungen	None
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Semester)



Modulkürzel	10SMSTS-516
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Introduction to Research Data Management

ECTS	1
Lehrformen	Seminar
Allg. Beschreibung	This introductory course on research data management (RDM) familiarizes students with important aspects and components of RDM and the data lifecycle. The course will also teach about data repositories, including how to find and cite existing data from such repositories, and about some of the legal aspects of data reuse and sharing, e.g. data licenses. After the end of this course, students are able to plan their own research data management. The introductory course is intended for bachelor students, master students and also PhD students who have little or no prior knowledge of research data management. The course takes place as a half-day on-site event with online learning components before and after the event. The online preparatory tasks need to be completed before the on-site event.
Lernziel	After this course, students are able to <ol style="list-style-type: none">1. recognize and describe important components of the data life cycle and Research Data Management (RDM),2. name data repositories for their research data,3. correctly cite existing datasets,4. recognize, interpret and use correctly licenses for research data, and5. write down important aspects of their research data management in a data management plan.
Unterrichtssprache	English
Voraussetzungen	None
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Semester)



Modulkürzel	10SMSTS-517
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Making your data FAIR

ECTS	1
Lehrformen	Seminar
Allg. Beschreibung	In the course "Making your data FAIR" students are familiarized with important aspects of FAIR (findable, accessible, interoperable, reusable) data as an essential prerequisite for publishing and sharing their data and for increased reproducibility and replicability of scientific research. They learn how to make their own data FAIR following existing standards (e.g. metadata) and how to assess the FAIRness of existing datasets. The course is intended for interested bachelor students, master students and PhDs who have some prior knowledge in data management and who would like to share their data with the scientific community and to increase its reusability. The course takes place as a half-day on-site event with online learning components before and after the on-site event.
Lernziel	After this course, students are able to <ol style="list-style-type: none">1. assess their own data (or other researchers' data) according to the FAIR principles, highlight deficiencies according to the FAIR principles and improve them,2. prepare their own data according to existing standards (following the FAIR principles), e.g. use non-proprietary data formats, use controlled vocabulary, follow metadata standards, and3. find FAIR-compatible repositories to store and share their data.
Unterrichtssprache	English
Voraussetzungen	None
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	10SMSTS-518
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Cyber Law – Data protection, AI, and Cybersecurity

ECTS	3
Lehrformen	Seminar
Allg. Beschreibung	<p>Digital technologies have revolutionized industries, driving transformative change while also presenting critical challenges in cybersecurity and data protection. This course explores the intersection of law, emerging technologies like AI, and cybersecurity to equip students from all fields with the foundational knowledge needed to navigate the legal landscape of this rapidly evolving field.</p> <p>By combining introductory legal instruction with hands-on workshops, students will gain an interdisciplinary understanding of the laws, regulations, their societal impact and ethical considerations that govern cybersecurity and data protection practices. By the end of this course, students will be prepared to assess compliance risks within their respective professional fields, cultivating a risk-aware mindset highly valued in today's job market.</p>
Lernziel	<p>After successfully completing this course, students can...</p> <ul style="list-style-type: none">-... explain a systematic overview of Swiss and European legal frameworks, regulations, law in the area of data, data protection, AI and cybersecurity (knowledge).-... assess advantages and disadvantages of their organizations data handling and AI use (risk awareness).-... distinguish and appreciate the technical, social, psychological, legal and ethical components of law in a digitalized society (interdisciplinary cooperation).-... assist their working environment in navigating a highly complex field (be a first point of contact, an ambassador).-... assist in developing training materials for their working environment (communication and educational skills).
Unterrichtssprache	Englisch
Voraussetzungen	None.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (einmalig)



Modulkürzel	10SMSTS-602
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Open Source Intelligence (OSINT)

ECTS	3
Lehrformen	Seminar
Allg. Beschreibung	OSINT, short for Open-Source Intelligence, enables you to gather crucial information from a variety of publicly available sources, including social media, news articles, government websites, and much more. The capacity to gather, examine, and validate open-source information has never been more crucial - particularly as powerful LLMs both amplify the speed of data processing and raise new challenges around disinformation that must be rigorously detected and mitigated. Throughout this course, students will learn how to (a) use OSINT tools and techniques to gather information, (b) apply Operational Security measures to minimize their own digital footprint, (c) adopt best practices to document, assess, and effectively report findings, and (d) recognize and navigate legal and ethical considerations to ensure proper conduct within the permitted scope.
Lernziel	<ol style="list-style-type: none">1. Understanding the concept and scope of OSINT;2. Developing awareness of ethical and legal considerations when using OSINT methods;3. Understanding the limitations and challenges of OSINT;4. Using OSINT techniques on a practical project.
Unterrichtssprache	Englisch
Voraussetzungen	—
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	1-semesterig (jedes Herbstsemester)



Modulkürzel	10SMSTS-604
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

ChatGPT and Beyond: Interdisciplinary Approaches to AI Literacy

ECTS	2
Lehrformen	Seminar
Allg. Beschreibung	This course addresses the rapidly evolving field of generative AI and its applications. Students will learn the essential principles of how generative AI models function and explore the opportunities of various tools and techniques. It also encourages critical discussion of the technology's limitations-legal, technical, and ethical-alongside potential dangers such as bias and information loss. Through examples from different disciplines, students will gain a purposeful understanding of generative AI, emphasizing transparency and responsible use. The course features lecturers from various UZH departments, each providing unique insights and use cases from their fields. By the end of the course, students will have acquired the knowledge and skills to critically and effectively apply AI tools, preparing them to navigate and innovate responsibly in the complex landscape of generative AI.
Lernziel	After the course, students will be able to <ol style="list-style-type: none">1. Understand the fundamental principles of how generative AI tools work.2. Recognize the possibilities and chances offered by generative AI tools in various contexts.3. Identify and critically assess the limitations and dangers, including legal, technical, cost, and ethical considerations, of using generative AI.4. Successfully and responsibly apply generative AI tools in their studies.
Unterrichtssprache	English
Voraussetzungen	The course is not suitable for Bachelor students in their first semester.
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	einmal wiederholbar
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	10SMSTS-605
Modulgruppe	Other Curricular Modules
Modultyp	Wahl
Organisation	School for Transdisciplinary Studies

Storytelling for Digital Transformation

ECTS	3
Lehrformen	Seminar
Allg. Beschreibung	Communicating complex, abstract concepts is a major challenge of the digital era, yet essential for enabling meaningful participation in the digital economy, democracy, and society. Storytelling offers a powerful way to translate complex ideas into relatable, engaging narratives, helping to address the widespread lack of digital literacy. In this course, we will equip students with communication skills to enable others to make informed decisions. Drawing on examples from tech journalism, digital literacy campaigns, and science communication, we show how these fields play a crucial role in enabling the public to critically evaluate the opportunities and risks of emerging technologies such as artificial intelligence, cryptocurrencies, and social media. Using cybersecurity-often perceived as a technical and intimidating field-as a case study, students will learn how to craft their own compelling stories around a digital topic of their choice.
Lernziel	(1) Understanding how complex digital facts can be conveyed by engaging stories; (2) Understanding and applying storytelling in the fields of digital transformation; (3) evaluating the benefits and limitations of storytelling for specific formats or topics, and (4) creating relatable and comprehensible narratives.
Unterrichtssprache	English
Voraussetzungen	None
Leistungsnachweis	Siehe Vorlesungsverzeichnis
Notenskala	bestanden/nicht bestanden
Repetierbarkeit	keine Wiederholungsmöglichkeit
Angebotsmuster	1-semesterig (jedes Frühjahrssemester)



Modulkürzel	06SM523-MA
Modultyp	Pflicht
Organisation	Institut für Computerlinguistik

Master's Thesis

ECTS	30
Lehrformen	Master Paper / MA-Arbeit
Allg. Beschreibung	The "state of the art" is to be reprocessed in relation to the chosen question and the formal rules of the discipline (e.g. regarding references) must be taken into account. For more information please consult the home page of the Institute of Computational Linguistics.
Lernziel	The students (1) are able to cope with a research question in a scientific concise way (2) are able to deal with the relevant research literature (3) use existing language technology or improve existing methods (4) specify und implement their own problem specific algorithm (5) evaluate their systems according to the standards of our discipline (6) concisely describe their work in their Master's thesis
Unterrichtssprache	Englisch
Voraussetzungen	Successful completion of 30% of the required modules. 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
Notenskala	1-6, in Halbschritten
Repetierbarkeit	einmal wiederholbar, erneut buchen
Angebotsmuster	2-semesterig (jedes Semester)