

Module Catalogue

Exchange Studies Faculty of Applied Computer Science

Faculty of Applied Computer Science

You can see the other use cases of the modules in Digicampus.

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* = At least one course for this module is offered in the current semester

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Version 5 (since SoSe24)

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* = At least one course for this module is offered in the current semester

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* = At least one course for this module is offered in the current semester

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* = At least one course for this module is offered in the current semester

Module GEO-1023: Practical I Praktische Arbeitsmethoden 1	Methods 1	5 ECTS/LP
Version 3.0.0 (since WS22/23) Person responsible for module: Dr.	Cecile Remy	
Contents:	·	
The range of exercises includes, ar computer-aided data analysis and it	nong other things, empirical surveys, qua modelling, measurement methods, field p geodata analysis and visualization with g	racticals, laboratory analyses, applications
students are able to describe a spe	equire basic geographical working method recific working method in geography (dependent) context and to evaluate the results and cla	nding on the course chosen), to use this
Workload: Total: 150 h		
may be necessary. In principle, the	urse, special technical requirements contents of all basic modules are students. None for exchange students.	Credit Requirements: Pass the module exam
Frequency: each semester	Recommended Semester:	Minimal Duration of the Module: 1 semester[s]
Contact Hours:	Repeat Exams Permitted:	
2	according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Praktische A		
Mode of Instruction: exercise cou Language: German / English Contact Hours: 2	rse	
Assigned Courses:		
Fernerkundung der Polarregione	n für die Klimaforschung (exercise cou	rse)
Fundamentals of catchment ana	ysis with GIS (exercise course)	
Globale Wasserspeicher im Klim	awandel (exercise course)	
ImpACTup! Innovation and Entre	preneurship for Better Futures (lecture)
Innenstadtentwicklung in Augsb	urg (exercise course)	
Paläobotanische Geländeübung	(exercise course)	
Praxis Klimaresilienz von Kultur	ökosystemen (exercise course)	

Stadtklimamodellierung mit EnviMet (exercise course) **

Examination

**

GEO-1023 Praktische Arbeitsmethoden (5 LP)

practical exam, Protokoll, kurze Hausarbeit, not graded

Test Frequency:

each semester

Description:

protocol, short scientific term

Module GEO-2026: Advance Aufbaumodul 1 - Humangeograph	d Module 1 - Human Geography ^{ie}	6 ECTS/LP
Version 3.0.0 (since WS22/23) Person responsible for module: D	r. Niklas Völkening	
• • •	of a human-geographical topics, e.g. glob al geography, renewable energies, natura evelopment research.	-
research. The students can analys on the respective topic. In additior		ed topics and propose possible solutions.
Total: 180 h		-
Conditions: none		Credit Requirements: Pass the module exam
Frequency: each semester	Recommended Semester:	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 4	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		

Part of the Module: Spezialvorlesung Humangeographie GEO-2026

Language: German / English

Contact Hours: 2

ECTS Credits: 3.0

Assigned Courses:

LfU Ringvorlesung UmweltStudium: Schutz der Natur: Erfolge, Konflikte, Perspektiven (lecture)

Spezialvorlesung Geographie des ländlichen Raums (lecture)

Spezialvorlesung Klimaresilienz von Kulturökosystemen (lecture)

**

**

Part of the Module: Begleitseminar zur Spezialvorlesung Humangeographie GEO-2026

Language: German / English Contact Hours: 2 ECTS Credits: 3.0

Assigned Courses:

Begleitseminar 1 zu Geographie des ländlichen Raums (seminar)

Begleitseminar 1 zur LfU-VL UmweltStudium: Schutz der Natur: Erfolge, Konflikte, Perspektiven (seminar)

Begleitseminar 2 zu Geographie des ländlichen Raums (seminar)

**

Begleitseminar 2 zur LfU-VL UmweltStudium: Schutz der Natur: Erfolge, Konflikte, Perspektiven (seminar) **

Begleitseminar zu Klimaresilienz von Kulturökosystemen (seminar)

Examination

Aufbaumodul 1 - Humangeographie

lecture + accompanying seminar, mündl. Prüfung (15 Min.) oder Klausur oder Portfolioprüfung, graded **Description:**

Module exam, Oral exam 15 minutes, written exam or portfolio

Module GEO-2027: Advanced Aufbaumodul 1 - Physische Geogr	I Module 1 - Physical Geography aphie	6 ECTS/LP
Version 3.0.0 (since WS22/23) Person responsible for module: Dr.	Cecile Remy	
	of a physical-geographical topic, e.g. globa , vegetation history, biochemical cycles, ex	-
state of research. The students can and methods on the respective top	ces: knowledge on a specific topic of physical g n analyse, assess and critically assess the ic. In addition, the students can set up the an organize and moderate a scientific disc	most important principles, theories ses on selected topics and propose
Workload: Total: 180 h		
Conditions: none		Credit Requirements: Pass the module exam
Frequency: each semester	Recommended Semester:	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 4	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Spezialvories Mode of Instruction: lecture Language: German / English Contact Hours: 2	sung Physische Geographie GEO-2027	
Assigned Courses: LfU Ringvorlesung UmweltStudi	um: Schutz der Natur: Erfolge, Konflikt	e, Perspektiven (lecture)
Spezialvorlesung Biosphäre im I	Klimasystem (lecture)	
Spezialvorlesung Klimaresilienz	von Kulturökosystemen (lecture)	
Part of the Module: Begleitsemir Mode of Instruction: seminar Language: German / English Frequency: annually Contact Hours: 2	nar zur Spezialvorlesung Physische Geo	ographie GEO-2027
Assigned Courses:		
Begleitseminar 1 zur LfU-VL Um	weltStudium: Schutz der Natur: Erfolge	, Konflikte, Perspektiven (seminar)

Begleitseminar 2 zur LfU-VL UmweltStudium: Schutz der Natur: Erfolge, Konflikte, Perspektiven (seminar)
**

Begleitseminar zu Biosphäre im Klimasystem (seminar)

**

Begleitseminar zu Klimaresilienz von Kulturökosystemen (seminar)

**

Examination

Aufbaumodul 1 - Physische Geographie

module exam, mündl. Prüfung (15 Min.) oder Klausur oder Portfolioprüfung, graded

Description:

Oral exam (15 min.) or written exam

Module GEO-2065: Practical Me Praktische Arbeitsmethoden 2	ethods 2	5 ECTS/LP
Version 3.0.0 (since WS22/23)		
Person responsible for module: Dr. C	ecile Remy	
computer-aided data analysis and mo	ong other things, empirical surveys, qua odelling, measurement methods, field p eodata analysis and visualization with g	practicals, laboratory analyses, applications
students are able to describe a speci	uire basic geographical working method fic working method in geography (depe ntext and to evaluate the results and cla	nding on the course chosen), to use this
Workload: Total: 150 h		
Conditions: Depending on the content of the cour may be necessary. In principle, the c recommended.		Credit Requirements: Pass the module exam
Frequency: each semester	Recommended Semester: 3 6.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Praktische Arb Mode of Instruction: exercise cours Language: German / English Contact Hours: 2		
Assigned Courses: Fernerkundung der Polarregionen	für die Klimaforschung (exercise cou	ırse)
Fundamentals of catchment analys	sis with GIS (exercise course)	
Globale Wasserspeicher im Klimav	vandel (exercise course)	
ImpACTup! Innovation and Entrep	reneurship for Better Futures (lecture	9)
Innenstadtentwicklung in Augsbur	g (exercise course)	
Paläobotanische Geländeübung (e **	xercise course)	
Praxis Klimaresilienz von Kulturök	osystemen (exercise course)	
Python für Geographen (exercise c	ourse)	

**

Stadtklimamodellierung mit EnviMet (exercise course)

**

Examination

GEO-2065 Praktische Arbeitsmethoden 2

practical exam, Protokoll, kurze Hausarbeit, not graded

Test Frequency:

each semester

of. Christoph Beck f results of specific qualitative and quan ny. unoff measurement, site climate recordir e, analysis of water components, pollen umerical climate modelling, statistical ar	ng, vegetation mapping. Laboratory analysis. IT-supported data analysis
ny. unoff measurement, site climate recordir e, analysis of water components, pollen umerical climate modelling, statistical ar	ng, vegetation mapping. Laboratory analysis. IT-supported data analysis
e, analysis of water components, pollen umerical climate modelling, statistical ar	analysis. IT-supported data analysis
ts know important methods of investigat are able to select and apply appropriate results.	
provided materials (self-study)	
	Credit Requirements: Pass the module exam
Recommended Semester: 3 5.	Minimal Duration of the Module: 1 semester[s]
Repeat Exams Permitted: according to the examination regulations of the study program	
elle Methoden der Physischen Geogr	aphie
	ts know important methods of investigat are able to select and apply appropriate results. brovided materials (self-study) Recommended Semester: 3 5. Repeat Exams Permitted: according to the examination regulations of the study program

Examination

Spezielle Methoden der Physischen Geographie

written exam / length of examination: 90 minutes, graded

Test Frequency:

only in the winter semester

Description:

short scientific term paper, practical exercise or short report

Module GEO-3082: Advance Aufbaumodul 2 - Humangeograph	d Module 2 - Human Geography iie	6 ECTS/LP
Version 3.0.0 (since WS22/23) Person responsible for module: D	r. Niklas Völkening	· · · · · · · · · · · · · · · · · · ·
	of a human-geographical topic, e.g. globa al geography, renewable energies, natura evelopment research.	-
research. The students can analys on the respective topic. In addition	knowledge on a specific topic of human g se, assess and critically assess the most i	geography and present the current state of mportant principles, theories and methods ted topics and propose possible solutions. p and defend their own arguments.
Workload: Total: 180 h		
Conditions: none		Credit Requirements: Pass the module exam
Frequency: each semester	Recommended Semester: 5 8.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 4	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Spezialvorlesung Humangeographie GEO-3082

Mode of Instruction: lecture

Language: German / English Contact Hours: 2

ECTS Credits: 3.0

Assigned Courses:

**

LfU Ringvorlesung UmweltStudium: Schutz der Natur: Erfolge, Konflikte, Perspektiven (lecture)

Spezialvorlesung Geographie des ländlichen Raums (lecture)

Spezialvorlesung Klimaresilienz von Kulturökosystemen (lecture) **

Part of the Module: Begleitseminar zur Spezialvorlesung Humangeographie GEO-3082

Mode of Instruction: seminar Language: German / English Contact Hours: 2

ECTS Credits: 3.0

Assigned Courses:

Begleitseminar 1 zu Geographie des ländlichen Raums (seminar)

Begleitseminar 1 zur LfU-VL UmweltStudium: Schutz der Natur: Erfolge, Konflikte, Perspektiven (seminar)
**

Begleitseminar 2 zu Geographie des ländlichen Raums (seminar)

**

**

Begleitseminar 2 zur LfU-VL UmweltStudium: Schutz der Natur: Erfolge, Konflikte, Perspektiven (seminar)

Begleitseminar zu Klimaresilienz von Kulturökosystemen (seminar)

Examination

Aufbaumodul 2 - Humangeographie

lecture + accompanying seminar, mündliche Prüfung (15 Min.), Klausur oder Portfolio, graded

Description:

Module exam, Oral exam 15 minutes, written exam or portfolio

Module GEO-3083: Advanced M Aufbaumodul 2 - Physische Geograph		6 ECTS/LP
Version 3.0.0 (since WS22/23) Person responsible for module: Dr. Ce	ecile Remy	
	physical-geographical topic, e.g. globa getation history, biochemical cycles, ex	-
state of research. The students can ar and methods on the respective topic. I	wledge on a specific topic of physical g nalyse, assess and critically assess the n addition, the students can set up the	most important principles, theories
Workload: Total: 180 h		
Conditions: none		Credit Requirements: Pass the module exam
Frequency: each semester	Recommended Semester: 5 8.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 4	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Spezialvorlesun Mode of Instruction: lecture Language: German / English Contact Hours: 2	g Physische Geographie GEO-3083	
Assigned Courses: LfU Ringvorlesung UmweltStudium ** Spezialvorlesung Biosphäre im Klin	: Schutz der Natur: Erfolge, Konflikte nasystem (lecture)	e, Perspektiven (lecture)
** Spezialvorlesung Klimaresilienz vol **	n Kulturökosystemen (lecture)	
Part of the Module: Begleitseminar Mode of Instruction: seminar Language: German / English Contact Hours: 2	zur Spezialvorlesung Physische Geo	ographie GEO-3083
Assigned Courses:		
**	tStudium: Schutz der Natur: Erfolge tStudium: Schutz der Natur: Erfolge	

Begleitseminar zu Biosphäre im Klimasystem (seminar)

**

Begleitseminar zu Klimaresilienz von Kulturökosystemen (seminar)

**

Examination

Aufbaumodul 2 - Physische Geographie

module exam, mündl. Prüfung (15 Min.) oder Klausur oder Portfolioprüfung, graded

Description:

Oral exam (15 min.) or written exam

Module GEO-3098: Advanced Hauptseminar	d Seminar	5 ECTS/LP
Version 2.1.0 (since WS22/23) Person responsible for module: Dr	. Stephan Bosch	
dealt with. Advanced seminars are	asic courses is deepened and new developm e offered on sub-areas of geography, regiona al change, cultural landscapes, etc.).	
written work and an oral presentat	ces: students are able to present an in-depth topi ion. For this purpose, the relevant specialist Ily examined. In addition, the moderation an	content from the scientific literature is
Workload: Total: 150 h 100 h preparation of written term p 20 h preparation of presentations (30 h (attendance)		
Conditions: Basic knowledge of scientific work specialist literature is expected.	is required. Confident handling of English	Credit Requirements: Pass the module exam
Frequency: each semester	Recommended Semester: 5 8.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Hauptsemin Mode of Instruction: advanced so Language: German / English Contact Hours: 2 ECTS Credits: 5.0		
Assigned Courses:		
Biogeographie (advanced semina	ar)	
Climate, agriculture and adaptat	ion in sub-Saharan Africa (advanced sem	inar)
Digitale Geographien (advanced	seminar)	
Food Environments (advanced s	eminar)	
Klimawandel und Gesundheit in	Europa (advanced seminar)	

Klimawandel – Extremereignisse und Zukunftsprojektionen von Klimavariablen (advanced seminar)

Urbane Resilienz (advanced seminar)

**

Examination

Hauptseminar

/ work period for assignment: 6 weeks, graded

Test Frequency:

each semester

Description:

Das in der Hausarbeit erarbeitete Thema wird im Hauptseminar präsentiert.

Module INF-0332: Artificial Intelli Artificial Intelligence	gence	5 ECTS/LP
Version 1.1.0 (since SoSe20) Person responsible for module: Prof. D	r. Björn Schuller	
Learning, Knowledge representation, P Creativity, Reasoning, Problem Solving Upon completing the course, students wand for specific tasks in artificial intellig respective application context. They will and systems. During the course, the participants will is gain the ability to make scientifically me methods. They will get used to the way Moreover, students will gain the ability is to apply their new knowledge to practic of machine learning. They will also dev Key qualifications: analytical skills, da practical systems, ability to present and	the broad research area of artificial inter- erception, Natural Language Processing Planning, and General intelligence. will have the skills and knowledge to be ence and know the pros and cons of de libe able to apply and implement the dis- improve their skills in logical, analytical, eaningful assessments in the field of arti- of thinking and the language of relevan- to, convincingly, present their developed al tasks and solve many real-life proble- elop the competence to identify significa- ata science cross-disciplinary knowledge d document results in a comprehensible lity awareness, meticulousness, teamwore	g, Socio-Emotional Intelligence, Artificia able to choose suitable approaches sign alternatives, as assessed in the scussed technical concepts in programs and conceptual thinking. Students will ificial intelligence using appropriate t disciplines. d ideas and concepts. They will be able ms through the appropriate application ant technical developments in the field. e, procedures and processes in creating way, skill to solve problems under
Workload: Total: 150 h 15 h studying of course content using li 15 h studying of course content using p 30 h lecture (attendance) 60 h studying of course content through 30 h exercise course (attendance)	provided materials (self-study)	
Conditions: Knowledge of basic mathematic lecture	es should be present.	Credit Requirements: Bestehen der Modulprüfung
Frequency: irregular	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 4	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Artificial Intellige Mode of Instruction: lecture Language: German Contact Hours: 2	ence (Vorlesung)	

Contents:

Learning, Knowledge representation, Perception, Natural Language Processing, Socio-Emotional Intelligence, Artificial Creativity, Reasoning, Problem Solving, Planning, and General intelligence.

Literature:

Literature will be anounced during the lecture.

Part of the Module: Artificial Intelligence (Übung)

Mode of Instruction: exercise course Language: English Frequency: irregular (usu. summer semester) Contact Hours: 2

Examination

Artificial Intelligence

written exam / length of examination: 90 minutes, graded

Test Frequency:

when a course is offered

Module INF-0426: Wearable Tech Healthcare Wearable Technology Applications in F		8 ECTS/LP
Version 1.0.0 (since WS22/23)		
Person responsible for module: Prof. D	0r. Elisabeth André	
After successful participation, they will to the guidelines of the user-centered of They are able to translate current inter- interaction devices, as well as to indep they are able to apply practice-relevant They are able to plan larger project tas discuss the results appropriately in plen Key qualifications: Skill in confident a and language of application-relevant di skill in leading teams; skill in presenting	I techniques of interaction design and er have the necessary knowledge to analyst design process and to design software se action paradigms and design guidelines endently familiarize themselves with the t evaluation methods to assess the quali sks in small teams, solve them according nary sessions and present them as a tea and persuasive presentation of ideas and isciplines; understanding of team proces g and documenting results in a compreh- ity to contribute to science; competence	ze application scenarios according olutions tailored to the target group. into models and programs for novel necessary technologies. Furthermore, ty of the created software prototype. to a self-developed project plan and am. I concepts; knowledge of the mindset ses; skill in collaborating in teams; ensible manner; ability to expand
Workload: Total: 240 h 15 h studying of course content using p 15 h studying of course content using l 120 h studying of course content throug 30 h lecture (attendance) 60 h exercise course (attendance)		
Conditions: Programming experience		
Frequency: each winter semester	Recommended Semester: from 4.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 6	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Practical Module Interaction Design and Engineering for Health Care Applications

Mode of Instruction: lecture

Language: English

Frequency: each summer semester

Contact Hours: 2

Contents:

The specific assignment for student projects is designed each year.

Literature:

Literature references will be announced at the beginning of the semester depending on the topic.

Part of the Module: Wearable Technology Applications in Healthcare (Exercise Course)

Mode of Instruction: exercise course Language: English Contact Hours: 4

Examination

Practical Module Interaction Design and Engineering for Health Care Applications

portfolio exam, graded

Test Frequency:

when a course is offered

Module INF-0457: Introduction to Introduction to Natural Language Proce		5 ECTS/LP
Version 1.1.0 (since SoSe23) Person responsible for module: Prof. D	Pr. Annemarie Friedrich	
language and is thus an interdisciplinal	ms to enable computers to understand, ry field at the intersection of linguistics, on nave been driven by the availability of la	computer science, and artificial
and choose suitable approaches for so	will have the skills and knowledge to ide lving the task with state-of-the-art methe , and potential ethical considerations of	ods. They will be able to discuss the
	improve their skills in logical, analytical, y meaningful assessments in the field o n NLP.	
Systematical advancement of design to	ge of advantages and disadvantages of pols; Ability to work in teams; Understan find solutions for practical problems; Abi	ding of team management; Knowledge
Workload: Total: 150 h 30 h lecture (attendance) 30 h exercise course (attendance) 15 h studying of course content using p 15 h studying of course content using l 60 h studying of course content througl	iterarture (self-study)	
Conditions: Experience in Python Programming		Credit Requirements: Passing the module exam
Frequency: each summer semester	Recommended Semester: from 4.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 4	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module	·	

Part of the Module: Introduction to Natural Language Processing (Vorlesung)

Mode of Instruction: lecture

Language: German / English

Contact Hours: 2

Contents:

This course covers the core concepts of state-of-the-art deep-learning-based natural language processing (NLP) including basic machine learning concepts, word embeddings, neural networks, transformers, language models, text classification, sequence labeling, machine translation, parsing, and ethics in NLP. The practical part of the course will introduce Python-based NLP and deep learning toolkits (prior knowledge of Python is highly recommended).

Literature:

- Dan Jurafsky and James Martin: Speech and Language Processing, 3rd edition. (Draft: https:// web.stanford.edu/~jurafsky/slp3/)
- Additional literature will be announced at the beginning of the course.

Part of the Module: Introduction to Natural Language Processing (Übung)

Mode of Instruction: exercise course Language: English Contact Hours: 2

Examination

Introduction to Natural Language Processing portfolio exam, graded Test Frequency: when a course is offered

Module INF-0487: Introduction to Introduction to Python Programming	Python Programming	4 ECTS/LF
Version 1.1.0 (since WS23/24) Person responsible for module: Prof. D	r. Annemarie Friedrich	
Learning Outcomes / Competences: Participants understand the concepts a depth design techniques and methods problems of medium size and complex independently in program libraries, inco	of structured programming and can a ity. Participants will know how to use	
Key skills: Ability to think abstractly, lo team collaboration skills.	gically, analytically and conceptually;	independent work with program libraries;
Remarks: The course will be taught in English. D	uring exercises, German will also be u	used.
Workload: Total: 120 h 30 h lecture (attendance) 15 h exercise course (attendance) 5 h studying of course content using lite 60 h studying of course content through 10 h studying of course content using p	n exercises / case studies (self-study)	
Conditions: Basic programming skills in C or Java		Credit Requirements: Passing the module exam
Module Computer Science 1 (INF-0097 Module Computer Science 2 (INF-0098	-	
Frequency: usu. at least once per acad. year	Recommended Semester: from 3.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 3	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Introduction to Python Programming (Lecture)

Mode of Instruction: lecture

Language: English

Contact Hours: 2

Contents:

The Python programming language is highly relevant in today's technology landscape due to its versatility and ease of use. It serves as a powerful language for tasks ranging from web development and data analysis to artificial intelligence and automation, making it an essential tool for both beginners and experienced developers in a wide range of industries and research areas.

The course assumes familiarity with either C or Java programming, and goes from data types and control structures to object orientation and algorithms with a focus on the peculiarities of the Python programming language.

The number of participants of this course is limited.

Literature:

Mark Lutz. Learning Python. O'Reilly 2013.

Assigned Courses:

Introduction to Python Programming (Lecture) (lecture)

**

Part of the Module: Introduction to Python Programming (Exercise)

Mode of Instruction: exercise course

Language: English / German

Contact Hours: 1

Assigned Courses:

Exercise to Introduction to Python Programming (exercise course)

Introduction to Python Programming (Lecture) (lecture)

Examination

**

**

Introduction to Python Programming

written exam / length of examination: 60 minutes, graded

Test Frequency:

when a course is offered

Module INF-0089: Seminar M Vision (BA) Seminar Multimediale Datenverar	lultimedia Computing & Computer	4 ECTS/LP
Version 1.0.0 (since SoSe14) Person responsible for module: Pl		
Learning Outcomes / Competer After attending the seminar, the st methods, procedures, techniques, image and video processing, mac individual seminar topic. Participants possess scientific me comprehensibly in speech and wr field critically and argumentatively Furthermore, they learn to recogn oriented manner. The participants They understand how to structure focus on essential messages and apply chains of argumentation and confidently deal with common pre- target group, apply various moder Key qualifications: Presentation	tuces: audents can independently work out and ana , and technologies from the field of multimed hine learning, and image and video search) thodology, communication skills, and the ab iting and to discuss and evaluate scientifica	dia computing and computer vision (e.g. and evaluate them in relation to the bility to present a special topic clearly and lly challenging topics from the named entation and use them in a goal- and present subject content freely. ionally, the students know how to an with complex content. They skilfully ons. The students understand how to They manage to gear a talk to a specific engaged even over a longer period. f good scientific practice; evaluating
Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term pa	apers (self-study)	
Conditions: none		
Frequency: each semester	Recommended Semester: from 3.	Minimal Duration of the Module: 1 semester[s]

Parts of the Module

Part of the Module: Seminar Multimediale Datenverarbeitung

Mode of Instruction: seminar

Language: German

Frequency: each winter semester

Contact Hours: 2

Contents:

The topics of the seminar from the wide-ranging field of multimedia and machine vision are determined each year and adapted to current trends.

Literature:

Current research literature

Assigned Courses:

Seminar über Multimediale Datenverarbeitung (Bachelor) (seminar)

**

Examination

Presentation and written paper

seminar, graded

Test Frequency:

when a course is offered

	otics	4 ECTS/LF
Version 1.1.0 (since SoSe14) Person responsible for module: Prof. [Dr. Wolfgang Reif	
Learning Outcomes / Competences After successful completion of the sem methods, procedures, techniques and	ninar, the students are able to understa	nd and solve basic problems, concepts,
special topic clearly and comprehensit	· · · · ·	e appropriate media in order to present a discuss topics from the aforementioned and arguing and use them in a goal-
	comprehensibly and present subject c prehensible way and to focus on the co	
-	ent themselves and how to deal confide ecific target group and to motivate the	
Soft-skills:		
 Analytical competence Working methodical Principles of good scientific praction Ability to present (in writing and 	al literature, including English-languag tice orally) ideas,concepts and results (pra	
 them Ability to think logically, abstract Awareness for quality aspects Communication skills Time management 	ly, analytically and conceptually, and to	
 Ability to think logically, abstract Awareness for quality aspects Communication skills Time management 	ly, analytically and conceptually, and to	
 Ability to think logically, abstract Awareness for quality aspects Communication skills Time management Workload: Total: 120 h	ly, analytically and conceptually, and to	
 Ability to think logically, abstract Awareness for quality aspects Communication skills Time management 		
 Ability to think logically, abstract Awareness for quality aspects Communication skills Time management Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term papers Conditions:		
 Ability to think logically, abstract Awareness for quality aspects Communication skills Time management Workload: Total: 120 h 30 h seminar (attendance)		

Part of the Module: Seminar Robotik

Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

Contents:

The concrete topics of the seminar deal with the use and programming of robots of all kinds and are determined annually and adapted to current developments.

Literature:

Depends on the concrete topics of the seminar.

Assigned Courses:

Seminar zu Robotik (seminar)

**

Examination

Seminar Robotik

written/oral exam / length of examination: 45 minutes

work period for assignment: 3 months, graded

Test Frequency:

when a course is offered

Seminar Internetsicherheit	net Security	4 ECTS/LP
Version 2.0.0 (since SoSe17) Person responsible for module: Prof. D	or. Wolfgang Reif	J
	nts are able to understand basic problem d of Internet security and independently	
clearly and comprehensibly in speech a	nmunication skills and ability to use appr and writing and to discuss topics from the ructures of reasoning and argumentation	e mentioned field critically. They will
	clearly and understandably and to preser ation in a clear and comprehensible way n a comprehensible way.	
-	nt themselves and how to work with com becific target group and to motivate the a	
Soft Skills:		
 to document them Ability to think logically, abstractly Awareness for quality aspects Communication skills Time management 		
Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term papers	s (self-study)	
Conditions: none		
	Recommended Semester:	Minimal Duration of the Module:
Frequency: irregular (usu. summer semester)	from 4.	1 semester[s]

Part of the Module: Seminar Internet Security

Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

Contents:

The specific topics of the seminar deal with the security of computer systems on the Internet and they change from year to year to adapt to current developments.

Literature:

Depends on the concrete topic.

Examination

Seminar Internet Security

written/oral exam / length of examination: 45 minutes

work period for assignment: 3 months, graded

Test Frequency:

when a course is offered

(Bachelor)	ware- and Systems Engineering	4 ECTS/LF
Seminar Software- und Systems Eng	neering (Bachelor)	
Version 1.1.0 (since SoSe14) Person responsible for module: Prof.	Dr. Wolfgang Reif	
Learning Outcomes / Competences		
After successful completion of the ser	ninar, students are able to understand b gies in the field of software and systems	
specific topic clearly and comprehens	ommunication skills and the ability to use ibly in speech and writing and to discuss ognize the logical structures of reasoning	s topics from the aforementioned field
	clearly and understandably and to prese tation in a clear and comprehensible way in a comprehensible way.	
	ent themselves and how to deal confider to a specific target group and to motivat	
Soft Skills:		
to document them		
Workload: Fotal: 120 h 90 h preparation of written term paper 80 h seminar (attendance)	rs (self-study)	
Conditions: none		
Frequency: each winter semester	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Seminar Softwa Mode of Instruction: seminar Language: German / English	are- und Systems Engineering (Bache	lor)

Contents:

The topics of the seminar deal with current trends in Software and Systems Engineering on the level of undergraduate students. The topics change from year to year and are regulary adapted to reflect new developments.

Literature:

Depends on the concrete topic.

Examination

Seminar Software- und Systems Engineering (Bachelor)

written/oral exam / length of examination: 45 minutes work period for assignment: 3 months, graded

Test Frequency:

Module INF-0226: Seminar Da Seminar Datenbanksysteme für Ba		4 ECTS/LP
Version 1.0.0 (since SoSe16) Person responsible for module: Pre	of. Dr. Peter Michael Fischer	
methods, procedures, techniques a They have the working techniques clearly and comprehensibly, both v and argumentatively. They will also a goal-oriented manner. The participants are able to formula understand how to structure a lectur messages and convey them in a co The students understand how to put They manage to gear a lecture to a techniques. Key qualifications: Literature reseat methodical competence; Scientific confident and convincing (written a for their documentation; Skill in log	nts are able to independently work out an and technologies in the field of databases , communication skills and ability to use a rerbally and in writing, and to discuss topi o be able to recognize and use logical stru- ate clearly and understandably and to pre- ure in a clear and comprehensible way ar omprehensible way. resent themselves and how to deal confic a specific target group and to motivate the rch; Independent work with English-langu- methodology; Principles of good scientifi- ind oral) presentation of (practical or theo	systems. appropriate media to present a special topic ics from the aforementioned field critically uctures of reasoning and argumentation in esent specialist content freely. They nd how to focus the lecture on essential dently with common presentation media. e listener and to apply various moderation uage specialist literature; Analytical- c practice; Skill in the comprehensible,
Workload: Total: 120 h 90 h preparation of written term pa 30 h seminar (attendance)	pers (self-study)	
Conditions: Module Database Systems (INF-00	073) - recommended	
Frequency: each semester	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours:	Repeat Exams Permitted:	

Parts of the Module

Part of the Module: Seminar Datenbanksysteme für Bachel	P	Part	of	the	Module:	Seminar	Datenbanks	vsteme	für	Bachelo
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Mode of Instruction: seminar

Language: German / English

Frequency: irregular (usu. summer semester)

Contact Hours: 2

Contents:

Current research contributions from the field of "Databases and Information Systems".

Literature:

Current research contributions

Assigned Courses:

Seminar Datenbanksysteme für Bachelor (seminar)

**

Presentation and written elaboration

seminar, graded

Test Frequency:

Module INF-0269: Seminar Embe and Wellbeing (Bachelor) Seminar Embedded Intelligence for He	edded Intelligence for Health Care	4 ECTS/LP
Version 1.0.0 (since WS17/18) Person responsible for module: Prof. D		<u> </u>
concepts, methods, procedures, techni working techniques, communication sk and written form in a clear and underst	its are able to independently develop and iques and technologies in the field of e-h ills and ability to use the appropriate me andable way and to discuss topics from ze the logical structures of thinking and a	ealth and m-health. You have the dia to present a specific topic in spoken the area mentioned critically and
	and understandably and present speciali to focus the presentation on essential mo	-
	and how to handle common presentation o and to motivate the listener and to use	
literature research; Independent work w	scientific practice; Analytical-methodica with English-language specialist literature in an understandable, secure and convir age; quality awareness.	e; communication skills; Ability to
Workload: Total: 120 h 90 h preparation of written term papers 30 h seminar (attendance)	s (self-study)	
Conditions: none		Credit Requirements: Bestehen der Modulprüfung
Frequency: irregular	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Seminar Embedded Intelligence for Health Care and Wellbeing (Bachelor)

Mode of Instruction: seminar

Language: German

Contact Hours: 2

Contents:

The seminar deals with current relevant topics in the context of embedded intelligence in the health sector. These include u.a. Sensor technologies for knowledge-based monitoring of health-related activities, vital signs and context factors, multi-sensory acquisition, analysis and interpretation of biological parameters (e.g. metabolic, cardiological and neurological signals), but also user modeling and user interfaces for health and fitness applications.

The students work on the given topic based on scientific literature and give a presentation and prepare a written summary.

Literature:

Will be announced by the lecturer

Seminar Embedded Intelligence for Health Care and Wellbeing (Bachelor)

written/oral exam, graded

Test Frequency:

Module INF-0313: Seminar IT Infrastructure in Medical Information Systems for Bachelor Students Seminar IT-Infrastrukturen in der Medizin für Bachelor	4 ECTS/LF
Version 1.0.0 (since SoSe19)	
Person responsible for module: Prof. Dr. Frank Kramer	
Learning Outcomes / Competences:	
After attending the seminar, students are able to independently work out an	d understand basic problems, concepts,
methods, procedures, techniques and technologies in the field of IT infrastru	actures for translational medical research.
They have the working techniques, communication skills and ability to use a	ppropriate media to present a specific
topic clearly and comprehensibly, both verbally and in writing, and to discus	s topics from the aforementioned field
critically and argumentatively. They will also be able to recognize and use lo	gical structures of reasoning and
argumentation in a goal-oriented manner. The participants are able to form	late clearly and understandably and to
present specialist content freely. They understand how to structure a lecture	in a clear and comprehensible way and
how to focus the lecture on essential messages and convey them in a comp	rehensible way. The students understand
how to present themselves and how to deal confidently with common prese	ntation media. They manage to gear a
lecture to a specific target group and to motivate the listener and to apply va	arious moderation techniques.
Key qualifications: Literature research; Independent work with English-lan	guage specialist literature; Analytical-
methodical competence; Scientific methodology; Principles of good scientifi	c practice; Skill in the comprehensible,
confident and convincing (written and oral) presentation of (practical or theo	retical) ideas, concepts and results and
in documenting them; Skill in logical, abstract, analytical and conceptual thi	nking and formal argumentation; Quality
awareness, meticulousness; Communication skills; Time management.	
Workload:	
Total: 120 h	
30 h seminar (attendance)	

Credit Requirements:

1 semester[s]

Passing the module examination

Minimal Duration of the Module:

Parts of the Module

Contact Hours:

Conditions:

none

2

Part of the Module: Seminar IT Infrastructure in Medical Information Systems for Bachelor Students

Recommended Semester:

Repeat Exams Permitted:

according to the examination regulations of the study program

from 4.

Mode of Instruction: seminar

Frequency: each semester

Language: German / English Contact Hours: 2

Contents:

Current topics of IT infrastructures in medicine

90 h preparation of written term papers (self-study)

Literature:

will be presented in the respective kickoff event.

Assigned Courses:

Seminar IT-Infrastrukturen in der Medizin für Bachelor (seminar)

**

Seminar IT Infrastructure in Medical Information Systems for Bachelor Students

written/oral exam, graded

Test Frequency:

Module INF-0330: Seminar Seminar Computational Intellig	r Computational Intelligence (Bachelor) gence (Bachelor)	4 ECTS/LP
Version 1.0.0 (since SoSe20) Person responsible for module	e: Prof. Dr. Björn Schuller	
statements, concepts, method They possess the scientific tec understandingly a special topic from the field in a critical way. them constructively. Participants can express them how to structure a talk, to focu them in a suitable way. The lin Students know how to perform	udents will be able to autonomously acquire and s, approaches, techniques, and technologies in t chniques, communication skills, and the ability to c in spoken and written, and to discuss and evalu Furthermore, they can recognise logical structur selves in a clear and understandable way and p s it - also given a complex content - on the essen tes of arguments and strategies in case of disturb energetically, to cope with the presentation med a certain audience, to motivate the listeners als	the field of Computational Intelligence. employ suitable media, to present uate scientifically challenging themes es of thinking and debating and employ resent scientific topics. They understand ntial messages, and to communicate bances are applied by the students. dia and to use them interactively. They
	ЛІ.	
Key qualifications: Fundame management; Literature resea to present (in written and spok Writing a report in the markup	entals of good scientific practice; Analytical-meth rch; Self-contained work with English technical li en) practical and theoretical ideas in an understa language LaTeX; Evaluation of methods, techno	iterature; Communication skills; Ability andable, confident, and convincing way
Key qualifications: Fundame management; Literature resea to present (in written and spok	entals of good scientific practice; Analytical-meth rch; Self-contained work with English technical li en) practical and theoretical ideas in an understa language LaTeX; Evaluation of methods, techno	iterature; Communication skills; Ability andable, confident, and convincing way
Key qualifications: Fundame management; Literature resea to present (in written and spok Writing a report in the markup aspects; Quality awareness. Workload: Total: 120 h 30 h seminar (attendance)	entals of good scientific practice; Analytical-meth rch; Self-contained work with English technical li en) practical and theoretical ideas in an understa language LaTeX; Evaluation of methods, techno	iterature; Communication skills; Ability andable, confident, and convincing way
Key qualifications: Fundame management; Literature resea to present (in written and spok Writing a report in the markup aspects; Quality awareness. Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written terr Conditions: none	entals of good scientific practice; Analytical-meth rch; Self-contained work with English technical li en) practical and theoretical ideas in an understa language LaTeX; Evaluation of methods, techno	iterature; Communication skills; Ability andable, confident, and convincing way blogies, and solutions w.r.t. different Credit Requirements:
Key qualifications: Fundame management; Literature resea to present (in written and spok Writing a report in the markup aspects; Quality awareness. Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written terr Conditions:	entals of good scientific practice; Analytical-meth rch; Self-contained work with English technical li en) practical and theoretical ideas in an understa language LaTeX; Evaluation of methods, techno n papers (self-study)	terature; Communication skills; Ability andable, confident, and convincing way blogies, and solutions w.r.t. different Credit Requirements: Bestehen der Modulprüfung Minimal Duration of the Module:

Part of the Module: Seminar Computational Intelligence (Bachelor)

Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

Contents:

Fuzzy Logic, Neural Networks, Evolutionary Computation, Learning Theory, Probabilistic Methods

Literature:

To be announced by the lecturers.

Seminar Computational Intelligence (Bachelor)

written/oral exam, graded

Test Frequency:

Seminar Embedded Systems (Ba	Embedded Systems (Bachelor) achelor)	4 ECTS/LP
Version 1.0.0 (since SoSe20) Person responsible for module: F	Prof. Dr. Sebastian Altmeyer	
-	nces: ents are able to independently work out an s and technologies in the field of embedded	
clearly and comprehensibly, both and argumentatively. They will al in a goal-oriented manner. The p freely. They understand how to s	es, communication skills and ability to use a n verbally and in writing, and to discuss topi so be able to recognize and use logical stru- articipants can formulate clearly and comp tructure a scientific presentation in a clear ssages and convey them in a comprehensi	cs from the aforementioned field critically uctures of reasoning and argumentation rehensibly and present specialist content and comprehensible way and how to focus
	present themselves and how to deal confic tion to a specific target group and to motiva	
	search; Independent work with English-lan	
confident and convincing (written for their documentation; Skill in lo	ic methodology; Principles of good scientific and oral) presentation of (practical or theo ogical, abstract, analytical and conceptual to nmunication skills; Time management.	retical) ideas, concepts and results and
confident and convincing (written for their documentation; Skill in lo	and oral) presentation of (practical or theo ogical, abstract, analytical and conceptual to nmunication skills; Time management.	retical) ideas, concepts and results and
confident and convincing (written for their documentation; Skill in lo awareness, meticulousness; Cor Workload: Total: 120 h 90 h preparation of written term p	and oral) presentation of (practical or theo ogical, abstract, analytical and conceptual to nmunication skills; Time management.	retical) ideas, concepts and results and
confident and convincing (written for their documentation; Skill in lo awareness, meticulousness; Cor Workload: Total: 120 h 90 h preparation of written term p 30 h seminar (attendance) Conditions:	and oral) presentation of (practical or theo ogical, abstract, analytical and conceptual to nmunication skills; Time management.	retical) ideas, concepts and results and

arts of the Module

Part of the Module: Seminar Embedded Systems (Bachelor)

Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

Contents:

In the seminar, topics from the field of embedded systems will be covered. Each seminar participant receives individual literature references, which are then to be supplemented in the course of the seminar by further independently compiled references. The seminar will end with a written paper and a presentation on the topic covered.

Literature:

given individually and self research

Assigned Courses:

Seminar Embedded Systems (Bachelor) (seminar)

**

Examination

Seminar Embedded Systems (Bachelor) written/oral exam, graded Test Frequency: when a course is offered

Module INF-0341: Seminar I Seminar Digital Health (Bachelor	4 ECTS/LP	
Version 1.0.0 (since SoSe20)		
Person responsible for module: F	Prof. Dr. Björn Schuller	
statements, concepts, methods, a M-Health. They possess the scie present understandingly a specia	ents will be able to autonomously acquire approaches, techniques, and technologie ntific techniques, communication skills, a Il topic in spoken and written, and to discu	e and understand advanced problem s in the field of Digital Health, E-Health and nd the ability to employ suitable media, to uss and evaluate scientifically challenging gical structures of thinking and debating and
how to structure a talk, to focus it them in a suitable way. The lines Students know how to perform er	- also given a complex content - on the e of arguments and strategies in case of d nergetically, to cope with the presentation	nd present scientific topics. They understand essential messages, and to communicate isturbances are applied by the students. In media and to use them interactively. They is also over a longer duration, and to employ
management; Literature research to present (in written and spoken	-	cal literature; Communication skills; Ability lerstandable, confident, and convincing way;
Workload: Total: 120 h 90 h preparation of written term p	papers (self-study)	
30 h seminar (attendance)		
30 h seminar (attendance) Conditions:	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]

Parts of the Module

Part of the Module: Seminar Digital Health (Bachelor)

Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

Contents:

In the seminar Digital Health, recent research works in this field are going to be discussed. This comprises both the acquisition of data through sensors and (e.g., microphones or electrodes) and the analysis and the modelling of the data. One important aspect is also the practicability of modern deep learning methods. Digital Health applications reach from tracking of health states (e.g., epilepsy or depression) to personal assistance services. The participating students will work on a certain aspect, supervised by a research associate of the chair. They will summarise their results in a written report and an oral presentation.

Topics: E-Health, M-Health, Sensor Signal Analysis, Vital Signs, Big Data.

Literature:

Depends on the chosen topic

Examination

Seminar Digital Health (Bachelor)

written/oral exam, graded

Test Frequency:

Module INF-0343: Seminar So Systems (BA) Seminar Software Engineering ver	oftware Engineering of Distributed teilter Systeme (BA)	4 ECTS/LP	
Version 1.0.0 (since SoSe20) Person responsible for module: Pro	of. Dr. Bernhard Bauer		
methods, procedures, techniques, seminar topic from the named field appropriate media to present a spe evaluate scientifically challenging to recognize the logical structures of to formulate clearly and comprehensi clearly and understandably, focus to complex content. They skillfully app students understand how to present interactively. They manage to gear durations, and apply various mode	the study on essential messages, and under the subject content freely. They are provide the scientific methodology, content the science of the sciencific methodology, content the study and argumentation and use them g the study on essential messages, and under the science of argumentation and solution structure the themselves and confidently deal with joint the a lecture to a specific target group, motivative	tware engineering about the particular immunication skills, and ability to use eech and writing and to discuss and umentatively. Furthermore, they can oal-oriented. The participants can y understand how to structure a lecture rstandably convey them, even with ategies in the event of disruptions. The presentation media and use them e the listener even during longer lecture	
confident, and convincing (written a in documenting them; skills in logic	methodology; principles of good scientific pl and oral) presentation of (practical or theore al, abstract, analytical and conceptual think nunication skills; time management. Transla	tical) ideas, concepts, and results and ing and formal argumentation; quality	
90 h preparation of written term pa 30 h seminar (attendance)	pers (self-study)		
-	Software Engineering of Distributed the to overlaps.		
Frequency: irregular	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]	
Contact Hours: Repeat Exams Permitted: 2 according to the examination regulations of the study program			
Parts of the Module			
Part of the Module: Seminar Soft Mode of Instruction: seminar Language: German Contact Hours: 2	tware Engineering verteilter Systeme (BA	()	
Contents: Current software engineering to	ppics from industry and research.		
Literature:			

Literature:

Will be presented at the respective kick-off event.

Assigned Courses:

Seminar Software Engineering verteilter Systeme (Bachelor) (seminar)

**

Examination

Seminar Software Engineering verteilter Systeme (BA)

written/oral exam, graded

Test Frequency:

Module INF-0345: Seminar / Engineering (BA)	Automotive Software and Systems	4 ECTS/LF
Seminar Automotive Software an	d Systems Engineering (BA)	
Version 1.0.0 (since SoSe20)		
Person responsible for module: F	Prof. Dr. Bernhard Bauer	
methods, procedures, techniques working techniques, communicat and comprehensibly in speech ar Furthermore, they can recognize The participants can formulate cli to structure a lecture clearly and	ents can independently work out and underst s, and technologies in automotive software & ion skills, and ability to use appropriate media and writing and discuss issues from the name the logical structures of thinking and argume early and comprehensibly and present subject understandably, focus the study on important ts understand how to present themselves an	systems engineering. They have the a to present a particular topic clearly d field critically and argumentatively. ntation and use them goal-oriented. ct content freely. They understand how t messages, and convey them in a d deal confidently with joint presentation
nedia. They manage to gear a le echniques.	cture to a specific target group, motivate the earch: Independent work with English-langua	
media. They manage to gear a le techniques. Key qualifications: Literature rese methodical competence; Scientifi confident, and convincing (writter in documenting them; Skill in logi awareness, meticulousness; Con Workload: Total: 120 h	cture to a specific target group, motivate the earch; Independent work with English-languag c methodology; Principles of good scientific p and oral) presentation of (practical or theore cal, abstract, analytical and conceptual thinki munication skills; Time management.	ge specialist literature; Analytical- practice; Skill in the understandable, etical) ideas, concepts, and results and
media. They manage to gear a le techniques. Key qualifications: Literature rese methodical competence; Scientifi confident, and convincing (writter in documenting them; Skill in logi	earch; Independent work with English-language c methodology; Principles of good scientific p and oral) presentation of (practical or theore cal, abstract, analytical and conceptual thinkin munication skills; Time management.	ge specialist literature; Analytical- practice; Skill in the understandable, etical) ideas, concepts, and results and
media. They manage to gear a lettechniques. Key qualifications: Literature reser methodical competence; Scientific confident, and convincing (writter in documenting them; Skill in logi awareness, meticulousness; Con Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term p Conditions: The previous course "Seminar Fu	earch; Independent work with English-language c methodology; Principles of good scientific p and oral) presentation of (practical or theore cal, abstract, analytical and conceptual thinkin munication skills; Time management.	ge specialist literature; Analytical- practice; Skill in the understandable, etical) ideas, concepts, and results and
media. They manage to gear a leachniques. Key qualifications: Literature reser- methodical competence; Scientific confident, and convincing (writter n documenting them; Skill in logi awareness, meticulousness; Con Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term p Conditions: The previous course "Seminar Fu Automotive Systems (BA)" (INF-0	earch; Independent work with English-language c methodology; Principles of good scientific p and oral) presentation of (practical or theore cal, abstract, analytical and conceptual thinking munication skills; Time management.	ge specialist literature; Analytical- practice; Skill in the understandable, etical) ideas, concepts, and results and

Part of the Module: Seminar Automotive Software and Systems Engineering (BA)

Mode of Instruction: seminar

Language: German

Contact Hours: 2

Contents:

Current software engineering topics from industry and research.

Literature:

Will be presented in the respective kick-off event.

Seminar Automotive Software and Systems Engineering (BA)

written/oral exam, graded

Test Frequency:

Module INF-0347: Seminar Avid Engineering (BA)		4 ECTS/LI
Seminar Avionic Software and Syste	ms Engineering (BA)	
Version 1.0.0 (since SoSe20) Person responsible for module: Prof.	Dr. Bernhard Bauer	
methods, procedures, techniques, an seminar topic from the named field. T appropriate media to present a speci evaluate scientifically challenging top recognize the logical structures of thi formulate clearly and comprehensibly clearly and understandably focus the in the case of complex content. They disruptions. The students understand	can independently analyze and evaluate ad technologies in Avionic Software & Syst They have the scientific methodology, com fic case clearly and comprehensibly in spe pics from the named field critically and argu- nking and argumentation and use them go y and present subject content freely. They study on essential messages and convey skillfully apply chains of argumentation ar how to present themselves and confident hage to gear a lecture to a specific target g	ems Engineering about the particular munication skills, and ability to use eech and writing and to discuss and umentatively. Furthermore, they can bal-oriented. The participants can understand how to structure a lecture them in a comprehensible way, even ad solution strategies in the event of thy deal with joint presentation media
Key qualifications: Literature researc	h: independent work with English-languag	
methodical competence; scientific me confident, and convincing (written an in documenting them; skills in logical awareness, meticulousness; commu	ethodology; principles of good scientific pra- d oral) presentation of (practical or theored , abstract, analytical and conceptual thinki nication skills; time management. Translat	actice; skills in the understandable, ical) ideas, concepts, and results and ng and formal argumentation; quality
methodical competence; scientific me confident, and convincing (written an in documenting them; skills in logical awareness, meticulousness; commu (free version) Workload: Total: 120 h 90 h preparation of written term pape	ethodology; principles of good scientific pra d oral) presentation of (practical or theoret , abstract, analytical and conceptual thinki nication skills; time management. Translat	actice; skills in the understandable, ical) ideas, concepts, and results and ng and formal argumentation; quality
methodical competence; scientific me confident, and convincing (written an in documenting them; skills in logical awareness, meticulousness; commun (free version) Workload: Total: 120 h 90 h preparation of written term pape 30 h seminar (attendance) Conditions: The previous course "Seminar Grund	ethodology; principles of good scientific pra d oral) presentation of (practical or theoret , abstract, analytical and conceptual thinki nication skills; time management. Translat	actice; skills in the understandable, ical) ideas, concepts, and results and ng and formal argumentation; quality
methodical competence; scientific me confident, and convincing (written an in documenting them; skills in logical awareness, meticulousness; commun (free version) Workload: Total: 120 h 90 h preparation of written term pape 30 h seminar (attendance) Conditions: The previous course "Seminar Grund Avionic Systems (BA)" (INF-0028) m	ethodology; principles of good scientific pra d oral) presentation of (practical or theoret , abstract, analytical and conceptual thinki nication skills; time management. Translat ers (self-study)	actice; skills in the understandable, ical) ideas, concepts, and results and ng and formal argumentation; quality
methodical competence; scientific me confident, and convincing (written an in documenting them; skills in logical awareness, meticulousness; commun (free version) Workload: Total: 120 h 90 h preparation of written term pape 30 h seminar (attendance) Conditions: The previous course "Seminar Grund	ethodology; principles of good scientific pra d oral) presentation of (practical or theoret , abstract, analytical and conceptual thinkin nication skills; time management. Translat ers (self-study) dlagen des Software Engineering für ust not have been taken due to overlaps. Recommended Semester:	Actice; skills in the understandable, ical) ideas, concepts, and results and ng and formal argumentation; quality ed with www.DeepL.com/Translator
methodical competence; scientific me confident, and convincing (written an in documenting them; skills in logical awareness, meticulousness; commun (free version) Workload: Total: 120 h 90 h preparation of written term pape 30 h seminar (attendance) Conditions: The previous course "Seminar Grund Avionic Systems (BA)" (INF-0028) m Frequency: irregular Contact Hours:	ethodology; principles of good scientific pradiction of (practical or theoret, abstract, analytical and conceptual thinkinication skills; time management. Translate ers (self-study) duagen des Software Engineering für ust not have been taken due to overlaps. Recommended Semester: from 5. Repeat Exams Permitted: according to the examination	Actice; skills in the understandable, ical) ideas, concepts, and results and ng and formal argumentation; quality ed with www.DeepL.com/Translator

Current software engineering topics from industry and research.

Literature:

Will be presented in the respective kick-off event.

Seminar Avionic Software and Systems Engineering (BA)

written/oral exam, graded

Test Frequency:

Module INF-0363: Seminar Software Engineering in Safety- and Security-Critical Systems (BA)	4 ECTS/LP			
Seminar Software Engineering in sicherheitskritischen Systemen (BA)				
Version 1.0.0 (since WS20/21)				
Person responsible for module: Prof. Dr. Bernhard Bauer				
Learning Outcomes / Competences:				
After attending the seminar, students can independently develop, analyze and	evaluate advanced problems,			
concepts, methods, procedures, techniques, and technologies in software eng	ineering in safety-critical systems and			
their related disciplines about the particular seminar topic from the named field	. They have the scientific methodology,			
communication skills, and ability to use appropriate media to present a specific	case clearly and comprehensibly			
in speech and writing and to discuss and evaluate scientifically challenging top	ics from the named field critically			
and argumentatively. Furthermore, they can recognize the logical structures of	thinking and argumentation and use			
them goal-oriented. The participants can formulate clearly and comprehensibly	and present subject content freely.			
They understand how to structure a lecture clearly and understandably focus the	ne study on important messages and			
understandably convey them, even in the case of complex content. They skillfu	Illy apply chains of argumentation and			
solution strategies in the event of disruptions. The students understand how to	present themselves and confidently			
deal with joint presentation media and use them interactively. They manage to	gear a lecture to a specific target			
group, motivate the listener even during longer lecture durations, and apply various moderation techniques.				
Key qualifications: Literature research; independent work with English-languag	e specialist literature; analytical-			
methodical competence; scientific methodology; principles of good scientific practice; skills in the understandable,				
confident, and convincing (written and oral) presentation of (practical or theore	tical) ideas, concepts, and results and			
in documenting them; skills in logical, abstract, analytical and conceptual thinki	ng and formal argumentation; quality			
awareness, meticulousness; communication skills; time management. Translat	ed with www.DeepL.com/Translator			
(free version)				

Workload:

Total: 120 h 30 h seminar (attendance)

90 h preparation of written term papers (self-study)

Conditions:		
none		
Frequency: irregular	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Seminar Software Engineering in Safety- and Security-Critical Systems (BA) Mode of Instruction: seminar Language: German Contact Hours: 2

Contents:

Current software engineering topics from industry and research.

Literature:

Will be presented in the respective kick-off event.

Assigned Courses:

Seminar Software Engineering in sicherheitskritischen Systemen (Bachelor) (seminar)

**

Examination

Seminar Software Engineering in Safety- and Security-Critical Systems (BA)

written/oral exam, graded

Test Frequency:

(Bachelor) Seminar Resource Aware Algorithmics	urce Aware Algorithmics	4 ECTS/LP
Version 1.0.0 (since SoSe21) Person responsible for module: Prof. D	Dr. Tobias Mömke	
Learning Outcomes / Competences: After attending the seminar, the studen techniques in a self-sufficient manner.		nmic concepts, methods, tools and
They have acquired communication sk scientific topic both as a talk and in wri		and the use of media to present a specific
The participants have learned to expre have learned to confidently stand in fro are able to tailor the talk to the respect	ont of the audience, using state of the a	derstandable and inspiring manner. They rt presentation tools and media. They
Key Qualifications: Literature researce clean scientific practice; ability to prese in written and spoken form); abstract, lo communication skills; time management	ent techincal content in confident, unde ogical and analytical thinking; ability to	rstandable and structured manner (both
Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term papers	s (self-study)	
Conditions: Good knowledge of content taught in m as "Mathematik für Informatiker 1" and Knowledge about algorithms and data	d "Diskrete Strukturen und Logik."	Credit Requirements: Passing of Module exam
Frequency: irregular	Recommended Semester: from 4.	Minimal Duration of the Module: 1 semester[s]
Contact Hours:	Repeat Exams Permitted:	
2	according to the examination regulations of the study program	
2 Parts of the Module	-	
	regulations of the study program	

Depending on the topic of the seminar.

Assigned Courses:

Seminar Resource Aware Algorithmics (Bachelor) (seminar)

*(online/digital) *

Seminar Resource Aware Algorithmics (Bachelor)

written/oral exam, graded

Test Frequency:

Seminar Digitale Ethik (Bachelo	Digital Ethics (Bachelor)	4 ECTS/LP
Versier 4.0.0 (sizes) (004 (00)	(") 	
Version 1.0.0 (since WS21/22) Person responsible for module:	Prof. Dr. Robert Lorenz	
Learning Outcomes / Compete		
After attending the seminar, the	students can independently work out and an es, and technologies from the field of digital e	
	nethodology, communication skills, and the a writing and to discuss and evaluate scientificatly.	
oriented manner. The participan They understand how to structu focus on essential messages an apply chains of argumentation a confidently deal with common p	gnise logical structures of thinking and argum its can formulate clearly and comprehensibly re a talk that is clear and easy to follow. Addi ad convey them in a comprehensible way, ev- and solution strategies in the event of disrupti resentation media and use them interactively eration techniques, and keep their audience	and present subject content freely. tionally, the students know how to en with complex content. They skilfully ons. The students understand how to . They manage to gear a talk to a specific
	on techniques; literature research; principles on techniques, and technologies from differer	
Workload: Total: 120 h 90 h preparation of presentation 30 h seminar (attendance)	is (self-study)	
Conditions:		Credit Requirements:
Module Database Systems (INF-0073) - recommended		Passing the module examination
•	IF-0097) - recommended	
Module Computer Science 1 (IN	· ·· ····	
Module Computer Science 1 (IN Module Computer Science 2 (IN	-	
Module Computer Science 1 (IN Module Computer Science 2 (IN Module Computer Science 3 (IN	-	Minimal Duration of the Module: 1 semester[s]
Module Computer Science 1 (IN Module Computer Science 2 (IN Module Computer Science 3 (IN Frequency: irregular	IF-0111) - recommended Recommended Semester:	
Module Computer Science 1 (IN Module Computer Science 2 (IN Module Computer Science 3 (IN Frequency: irregular Contact Hours: 2	IF-0111) - recommended Recommended Semester: from 5. Repeat Exams Permitted: according to the examination	
Module Computer Science 1 (IN Module Computer Science 2 (IN Module Computer Science 3 (IN Frequency: irregular Contact Hours:	IF-0111) - recommended Recommended Semester: from 5. Repeat Exams Permitted: according to the examination regulations of the study program	

Literature depends on the chosen topic

Seminar Digital Ethics (Bachelor)

presentation / length of examination: 45 minutes, graded

Test Frequency:

Module INF-0421: Seminar Or Seminar Organic Computing (Bach		4 ECTS/LP
Version 1.0.0 (since WS22/23) Person responsible for module: Pro	f. Dr. Jörg Hähner	
•	es: ts are able to independently work out and nd technologies in the field of ad-hoc and	• • • • •
topic clearly and comprehensibly in	speech and writing and to discuss topics	e appropriate media to present a special from the named field critically and ninking and argumentation and use them ir
		t content freely. They understand how to presentation on essential messages and
	esent themselves and how to deal confid ecific target group and to motivate the list	
Key qualifications: Literature rese	arch; independent work with English-lang	guage specialist literature;
Analytical-methodical competence;	scientific methodology; principles of good	d scientific practice;
and convincing manner (written and	ractical and theoretical) ideas, concepts d oral); ability to think logically, abstractly meticulousness; communication skills; tir	
Workload: Total: 120 h 90 h preparation of written term pap 30 h seminar (attendance)	pers (self-study)	
Conditions: none		
Frequency: each semester	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Seminar Orga Mode of Instruction: seminar Language: German / English	anic Computing (Bachelor)	
Contact Hours: 2 ECTS Credits: 4.0		
ECTS Credits: 4.0 Contents:	etermined each year and adapted to curr	ent trends.
ECTS Credits: 4.0 Contents: The topics of the seminar are de Literature:	etermined each year and adapted to curr rent topics: scientific papers or books.	ent trends.

Seminar Organic Computing (Bachelor) (seminar)

**

Examination

Presentation and written paper. written/oral exam, graded

Test Frequency:

Module INF-0423: Seminar Machine Learning (BA) Seminar Machine Learning (BA)	4 ECTS/LP
Version 1.0.0 (since WS22/23)	

Person responsible for module: Prof. Dr. Bernhard Bauer

Learning Outcomes / Competences:

After attending the seminar, students are able to work out and understand fundamental problems, concepts, methods, procedures, techniques, and technologies in the field of Medical Information Sciences independently. They have the working techniques, communication skills, and the ability to use appropriate media to present a particular topic clearly and comprehensibly in speech and writing and discuss issues from the mentioned field critically and argumentatively. Furthermore, they can recognize the logical structures of thinking and argumentation and use them goal-oriented. The participants can formulate clearly and comprehensibly and present subject content freely. They understand how to structure a lecture clearly and understandably, focus the study on important messages, and convey them in a comprehensible way. The students understand how to present themselves and deal confidently with joint presentation media. They manage to gear a lecture to a specific target group, motivate the listener, and apply various moderation techniques.

Key qualifications: Literature research; independent work with English-language specialist literature; analyticalmethodical competence; scientific methodology; principles of good scientific practice; skills in the understandable, confident, and convincing (written and oral) presentation of (practical or theoretical) ideas, concepts, and results and in documenting them; skills in logical, abstract, analytical and conceptual thinking and formal argumentation; quality awareness, meticulousness; communication skills; time management.

Workload:

Total: 120 h

90 h preparation of written term papers (self-study)30 h seminar (attendance)

Conditions: none		
Frequency: irregular	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Machine Learning (Seminar)

Mode of Instruction: seminar

Language: German

Contact Hours: 2

Contents:

This seminar will cover the basics of Medical Information Sciences. Various topics are to be worked on which are to serve as a basis for a subsequent practical course.

Literature:

Will be presented in the respective kick-off event.

Assigned Courses:

Seminar Machine Learning (Bachelor) (seminar)

**

Presentation and written paper

written/oral exam, graded

Test Frequency:

Module INF-0438: Seminar Quan Seminar Quantenalgorithmen (Bachel		4 ECTS/LP
Version 1.0.0 (since SoSe23) Person responsible for module: Prof. [Dr. Jakob Siegfried Kottmann	
parallele Besuch der Vorlesung wird e werden in der Vorlesung aufgegriffene	r Vorlesung "Grundlagen der Quanteninf mpfohlen. Spezifische Themen orientiere Anwendungsbeispiele und Themenfelde als Vorbereitung einer Abschlussarbeit i	en sich an aktueller Forschung. Hierbei er vertieft oder neue Themenfelder
Methoden, Verfahren, Techniken und erarbeiten und zu verstehen. Sie verfügen über die Arbeitstechniker um ein spezielles Thema in Wort und S genannten Gebiet kritisch und argume Denkens und Argumentierens erkenne Die Teilnehmenden können klar und v Vortrag klar und nachvollziehbar zu str verständlich zu vermitteln. Die Studierenden verstehen es, präser Sie schaffen es, einen Vortrag auf eine verschiedene Moderationstechniken ar Schlüsselqualifikationen: Literaturre	die Studierenden in der Lage, grundlege Technologien auf dem Gebiet der Quante n, Kommunikationsfähigkeit und Fähigkei Schrift klar und verständlich zu präsentie entativ zu diskutieren. Außerdem können en und zielführend einsetzen. erständlich formulieren und Fachinhalte f rukturieren und den Vortrag auf wesentlic nt aufzutreten und souverän mit gängiger e bestimmte Zielgruppe auszurichten und nzuwenden. cherche; Eigenständiges Arbeiten mit en	enalgorithmen selbstständig zu it zum Einsatz entsprechender Medien, ren und Themenstellungen aus dem sie die logischen Strukturen des frei vortragen. Sie verstehen es, einen che Botschaften auszurichten und diese n Präsentationsmedien umzugehen. d den Zuhörer zu motivieren und
Fertigkeit der verständlichen, sicheren (praktischen oder theoretischen) Ideer	Vissenschaftliche Methodik; Grundsätze und überzeugenden (schriftlichen und m n, Konzepten und Ergebnissen und zu de d konzeptionellen Denken und formaler <i>i</i> management	nündlichen) Darstellung von eren Dokumentation; Fertigkeit zum
Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term papers	s (self-study)	
Conditions: Grundkenntnissen Quantenmechanik (die Quanteninformationsveranstaltung	oder Inhalt der Vorlesung "Einführung in " (kann parallel besucht werden)	Credit Requirements: Bestehen der Modulprüfung
Frequency: each semester	Recommended Semester:	Minimal Duration of the Module: 1 semester[s]

Parts of the Module

Part of the Module: Seminar Quantenalgorithmen (Bachelor)

Mode of Instruction: seminar

Language: English / German

Frequency: nach Bedarf WS und SoSe

Contact Hours: 2

Contents:

Die Themen des Seminars werden jedes Mal neu festgelegt und aktuellen Entwicklungen angepasst.

Literature:

Abhängig vom gewählten Thema

Assigned Courses:

Seminar Quantenalgorithmen (Bachelor) (seminar)

**

Examination

Seminar Quantenalgorithmen (Bachelor) written/oral exam, graded

Test Frequency:

Module INF-0442: Seminar on Th Systems (Bachelor) Seminar Theorie verteilter und parallel		4 ECTS/LP
Version 1.0.0 (since SoSe23) Person responsible for module: Prof. D		<u> </u>
Methoden, Verfahren, Techniken und ² selbstständig zu erarbeiten und zu vers Sie verfügen über die Arbeitstechniker um ein spezielles Thema in Wort und S genannten Gebiet kritisch und argume Denkens und Argumentierens erkenne Die Teilnehmenden können klar und ver Vortrag klar und nachvollziehbar zu str verständlich zu vermitteln. Die Studierenden verstehen es, präser Sie schaffen es, einen Vortrag auf eine	die Studierenden in der Lage, grundlege Fechnologien auf dem Gebiet der Theor stehen. A, Kommunikationsfähigkeit und Fähigke Schrift klar und verständlich zu präsentie ntativ zu diskutieren. Außerdem können en und zielführend einsetzen. erständlich formulieren und Fachinhalte ukturieren und den Vortrag auf wesentli ht aufzutreten und souverän mit gängige e bestimmte Zielgruppe auszurichten un	ie verteilter und paralller Systeme eit zum Einsatz entsprechender Medien, eren und Themenstellungen aus dem a sie die logischen Strukturen des frei vortragen. Sie verstehen es, einen iche Botschaften auszurichten und diese en Präsentationsmedien umzugehen.
Analytisch-methodische Kompetenz; V Fertigkeit der verständlichen, sicheren (praktischen oder theoretischen) Ideen	cherche; Eigenständiges Arbeiten mit er Vissenschaftliche Methodik; Grundsätze und überzeugenden (schriftlichen und r I, Konzepten und Ergebnissen und zu de d konzeptionellen Denken und formaler management	guter wissenschaftlicher Praxis; nündlichen) Darstellung von eren Dokumentation; Fertigkeit zum
30 h seminar (attendance)		
Conditions: Module Introduction to Theory of Comp	outation (INF-0110) - recommended	Credit Requirements: Bestehen der Modulprüfung
Frequency: each summer semester	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Seminar Theorie Mode of Instruction: seminar Language: German Contact Hours: 2	e verteilter und paralleler Systeme (Ba	achelor)
Contents: Die Themen des Seminars werden	jedes Mal neu festgelegt und aktuellen	Entwicklungen angepasst.
Literature: Abhängig vom gewählten Thema		

Seminar Theorie verteilter und paralleler Systeme (Bachelor)

written/oral exam, graded

Test Frequency:

	oftware and Artificial Intelligence for	4 ECTS/LF
Production Systems (Bachel	· ·	
	Intelligenz in der Produktion (Bachelor)	
Version 1.0.0 (since SoSe23) Person responsible for module: Pr	rof Dr. Wolfgang Reif	
Learning Outcomes / Competen		-
After completion of the seminar, s	tudents are able to understand basic problen e field of Internet security and independently	
clearly and comprehensibly in spe	communication skills and ability to use app ech and writing and to discuss topics from th al structures of reasoning and argumentation	ne mentioned field critically. They will
	late clearly and understandably and to prese sentation in a clear and comprehensible way em in a comprehensible way.	
	resent themselves and how to work with cor a specific target group and to motivate the a	
Soft Skills:		
to document them	ractice d oral) ideas, concepts and results in a comp tractly, analytically and conceptually and to a	
Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term pa	apers (self-study)	
Conditions: none		
Frequency: irregular	Recommended Semester: from 4.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination	

Part of the Module: Seminar Internet Security

Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

Contents:

The specific topics of the seminar deal with the security of computer systems on the Internet and they change from year to year to adapt to current developments.

Literature:

Depends on the concrete topic.

Assigned Courses:

Seminar zu Software und Künstliche Intelligenz in der Produktion (Bachelor) (seminar)

Examination

Seminar Internet Security

written/oral exam / length of examination: 45 minutes

work period for assignment: 3 months, graded

Test Frequency:

Seminar zu nebenläufigen Systemen	oncurrent Systems (Bachelor) (Bachelor)	4 ECTS/LP
Version 1.0.0 (since SoSe23)		
Person responsible for module: Prof.	Dr. Robert Lorenz	
-	nts can independently work out and ana	lyse advanced problems, concepts, hics and evaluate them in relation to the
	dology, communication skills, and the ab and to discuss and evaluate scientifical	ility to present a special topic clearly and ly challenging topics from the named
oriented manner. The participants car They understand how to structure a ta focus on essential messages and con apply chains of argumentation and so confidently deal with common present target group, apply various moderatio	n techniques, and keep their audience e	and present subject content freely. onally, the students know how to n with complex content. They skilfully ns. The students understand how to They manage to gear a talk to a specific
rey quantications. Presentation tech	aniguagu litaratura ragagrahu pringinlag a	f and anightific prosting, avaluating
	nniques; literature research; principles o nniques, and technologies from different	f good scientific practice; evaluating points of view.
solution approaches, procedures, tech Workload: Total: 120 h 30 h seminar (attendance)	nniques, and technologies from different	
	nniques, and technologies from different	
solution approaches, procedures, tech Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of presentations (sel	f-study) 97) - recommended 98) - recommended	points of view.
solution approaches, procedures, tech Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of presentations (sel Conditions: Module Computer Science 1 (INF-009 Module Computer Science 2 (INF-009	f-study) 97) - recommended 98) - recommended	points of view.
solution approaches, procedures, tech Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of presentations (sel Conditions: Module Computer Science 1 (INF-009 Module Computer Science 2 (INF-009 Module Discrete structures and logic (f-study) 97) - recommended 98) - recommended (INF-0266) - recommended Recommended Semester:	points of view. Credit Requirements: Passing the module examination Minimal Duration of the Module:

Part of the Module: Seminar Digital Ethics (Bachelor) Mode of Instruction: seminar Language: German / English Contact Hours: 2 ECTS Credits: 4.0 Contents: The topics change over time, in order to reflect up-to-date developments Literature: Literature depends on the chosen topic

Seminar Digital Ethics (Bachelor)

written/oral exam, graded

Test Frequency:

Seminar Diagnostische Sensol	r Diagnostic Sensing (Bachelor) rik (Bachelor)	4 ECTS/LP
Version 1.0.0 (since SoSe23) Person responsible for module	: Prof. Dr. Sebastian Zaunseder	
methods, procedures, technique They have the working technique specific topic clearly and comp field critically and argumentative argumentation in a goal-oriente The participants can formulate to structure a talk in a clear and them in a comprehensible way. The students understand how t	udents are able to independently work out ar les and technologies in the field of Diagnosti ues, communication skills and the ability to u rehensibly, both verbally and in writing, and rely. They will also be able to recognize and ed manner. clearly and comprehensibly and present spe d comprehensible way and how to focus the	c Sensing. use appropriate media to present a to discuss topics from the aforementioned use logical structures of reasoning and ecialist content freely. They understand how talk on essential messages and convey dently with common presentation media.
Key qualifications: Literature methodical competence; Scien	research; Independent work with English-lar tific methodology; Principles of good scientif en and oral) presentation of (practical or th	
methodical competence; Scien	tific methodology; Principles of good scientif en and oral) presentation of (practical or th	
Key qualifications: Literature methodical competence; Scien confident and convincing (writte Workload: Total: 120 h 30 h seminar (attendance)	tific methodology; Principles of good scientif en and oral) presentation of (practical or th	
Key qualifications: Literature methodical competence; Scien confident and convincing (writte Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term Conditions: none	tific methodology; Principles of good scientif en and oral) presentation of (practical or th	credit Requirements:
Key qualifications: Literature methodical competence; Scien confident and convincing (writte Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term Conditions:	tific methodology; Principles of good scientif en and oral) presentation of (practical or th n papers (self-study) Recommended Semester:	Credit Requirements: Passing the module examination Minimal Duration of the Module:

Part of the Module: Seminar Diagnostic Sensing (Bachelor)

Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

ECTS Credits: 4.0

Contents:

The topics of the seminar change over time, in order to reflect up-to-date developments

Literature:

Literature depends on the chosen topic

Assigned Courses:

Seminar Diagnostische Sensorik (Bachelor) (seminar)

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INF-8006 Seminar Diagnostic Sensing (Bachelor)

written/oral exam, graded

Test Frequency:

Module INF-0467: Seminar N (Bachelor) Seminar Natural Language Under	atural Language Understanding	4 ECTS/LP
Version 1.0.0 (since WS23/24) Person responsible for module: Pl		
Contents: The seminar on natural language linguistics, exploring how machine a subfield of natural language pro- algorithms, models, and systems that computers can process and n	understanding delves into the fascinating s can comprehend and process human la cessing (NLP) and computational linguisti for understanding and representing the m	anguage. Computational semantics is cs that focuses on the development of eaning of natural language text in a way o this seminar include: representing word,
The number of participants is limit	ed.	
-	nces: nts are able to independently work out ar and technologies in the field of embedde	
clearly and comprehensibly, both and argumentatively. They will als in a goal-oriented manner. The pa freely. They understand how to st	verbally and in writing, and to discuss top o be able to recognize and use logical str rticipants can formulate clearly and comp	rehensibly and present specialist content and comprehensible way and how to focus
	present themselves and how to deal confi- ion to a specific target group and to motiv	
methodical competence; Scientific confident and convincing (written for their documentation; Skill in log	earch; Independent work with English-lar methodology; Principles of good scientif and oral) presentation of (practical or the gical, abstract, analytical and conceptual munication skills; Time management.	c practice; Skill in the comprehensible,
Remarks:		
	akob Prange, who will join the departmen	t in October.
Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term pa	apers (self-study)	
Conditions:		Credit Requirements:
none		Presentation and term paper
Frequency: each semester	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination	

Part of the Module: Seminar Natural Language Understanding (Bachelor)

Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

Contents:

In the seminar, topics from the field of embedded systems will be covered. Each seminar participant receives individual literature references, which are then to be supplemented in the course of the seminar by further independently compiled references. The seminar will end with a written paper and a presentation on the topic covered.

Literature:

given individually and self research

Assigned Courses:

Seminar Natural Language Understanding (Bachelor) (seminar)

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Examination

Seminar Natural Language Understanding (Bachelor)

written/oral exam, graded

Test Frequency:

Module INF-0470: Seminar Networks (B Seminar Vernetzte Systeme und K	achelor)	4 ECTS/LP
Version 1.0.0 (since WS23/24) Person responsible for module: Prof. Dr. Michael Seufert		,
Konzepte, Methoden, Verfahren, T Kommunikationsnetzen selbststän Sie verfügen über die Arbeitstechn um ein spezielles Thema in Wort u genannten Gebiet kritisch und argu Denkens und Argumentierens erke Die Teilnehmenden können klar ur Vortrag klar und nachvollziehbar zu verständlich zu vermitteln. Die Studierenden verstehen es, pr Sie schaffen es, einen Vortrag auf verschiedene Moderationstechnike Schlüsselqualifikationen: Literat Analytisch-methodische Kompeter Fertigkeit der verständlichen, siche (praktischen oder theoretischen) Io	ind die Studierenden in der Lage, grundle echniken und Technologien auf dem Geb dig zu erarbeiten und zu verstehen. iken, Kommunikationsfähigkeit und Fähig und Schrift klar und verständlich zu präser umentativ zu diskutieren. Außerdem könn ennen und zielführend einsetzen. Ind verständlich formulieren und Fachinhal u strukturieren und den Vortrag auf weser äsent aufzutreten und souverän mit gäng eine bestimmte Zielgruppe auszurichten en anzuwenden. urrecherche; Eigenständiges Arbeiten mit az; Wissenschaftliche Methodik; Grundsät eren und überzeugenden (schriftlichen um deen, Konzepten und Ergebnissen und zu n und konzeptionellen Denken und formal	biet von vernetzten Systemen und gkeit zum Einsatz entsprechender Medien, ntieren und Themenstellungen aus dem en sie die logischen Strukturen des Ite frei vortragen. Sie verstehen es, einen ntliche Botschaften auszurichten und diese igen Präsentationsmedien umzugehen. und den Zuhörer zu motivieren und englischsprachiger Fachliteratur; ze guter wissenschaftlicher Praxis; d mündlichen) Darstellung von i deren Dokumentation; Fertigkeit zum
Workload: Total: 120 h 90 h preparation of written term pa 30 h seminar (attendance)	pers (self-study)	
Conditions: none		Credit Requirements: Bestehen der Modulprüfung
Frequency: irregular	Recommended Semester: from 4.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Seminar Ver Mode of Instruction: seminar Language: German Contact Hours: 2	netzte Systeme und Kommunikationsn	netze (Bachelor)

Contents:

Die Themen des Seminars werden jedes Jahr neu festgelegt und aktuellen Konzepten und Technologien im Bereich der vernetzten Systeme und Kommunikationsnetze angepasst.

Literature:

individuell gegeben und Selbstrecherche

Assigned Courses:

Seminar Vernetzte Systeme und Kommunikationsnetze (Bachelor) (seminar)

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Examination

Seminar Vernetzte Systeme und Kommunikationsnetze (Bachelor)

written/oral exam, graded

Test Frequency:

Module INF-0478: Seminar Embodied Artificial Intelligence and	4 ECTS/LP
Computer Vision	
Seminar Embodied Artificial Intelligence and Computer Vision	
Version 1.0.0 (since WS23/24)	

Person responsible for module: Prof. Dr. Jörg-Dieter Stückler

Learning Outcomes / Competences:

After attending the seminar, students are able to independently work out and understand basic problems, concepts, methods, procedures, techniques and technologies in the field of Embodied Artificial Intelligence and Computer Vision. They have the working techniques, communication skills and ability to use appropriate media to present a special topic clearly and comprehensibly, both verbally and in writing, and to discuss topics from the aforementioned field critically and argumentatively. They will also be able to recognize and use logical structures of reasoning and argumentation in a goal-oriented manner. The participants can formulate clearly and comprehensibly and present specialist content freely. They understand how to structure a lecture in a clear and comprehensible way and how to focus the lecture on essential messages and convey them in a comprehensible way. The students understand how to present themselves and how to deal confidently with common presentation media. They manage to gear a presentation to a specific target group and to motivate the listener and to apply various moderation techniques.

Key qualifications: Literature research; independent work with English-language literature; analytical-methodical competence; scientific methodology; principles of good scientific practice; ability to present (written and oral) ideas, concepts and results in a comprehensible, confident and convincing manner and to document them; ability to think logically, abstractly, analytically and conceptually and to argue formally; quality awareness, meticulousness; communication skills; time management.

Workload:

Total: 120 h

30 h seminar (attendance)

90 h preparation of written term papers (self-study)

Conditions: none		Credit Requirements: Passing the module exam
Frequency: irregular	Recommended Semester: from 4.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Seminar Embodied Artificial Intelligence and Computer Vision

Mode of Instruction: seminar

Language: English / German

Contact Hours: 2

Contents:

In the seminar, topics from the field of Embodied Artificial Intelligence and Computer Vision will be covered. Each seminar participant will be assigned individual literature references, which will then be supplemented in the course of the seminar by further independently compiled references. The seminar will end with a written report and a presentation on the topic covered.

Literature:

Scientific literature announced in the kick-off meeting and self research

Seminar Embodied Artificial Intelligence and Computer Vision

written/oral exam, graded

Test Frequency:

Distributed Systems	Module Software Methodologies for	6 ECTS/LP
Forschungsmodul Softwaremetho	odiken für verteilte Systeme	
Version 1.0.0 (since SoSe13)		
Person responsible for module: P	rof. Dr. Bernhard Bauer	
field and can actively participate i procedures, techniques, and tech students have the teamwork and	buted systems. They have detailed and up-to- n research projects. To this end, they unders nologies and can contribute this knowledge t communication skills, the ability to study litera n the field and critically evaluate, combine, an	tand advanced concepts, methods, o research projects. In addition, ature, and the learning and working
comprehensible, confident, and c	k logically, analytically, and conceptually; ind onvincing presentation of ideas, concepts, ar ork in teams and understand team processes	d results; quality awareness;
comprehensible, confident, and c communication skills; ability to we	onvincing presentation of ideas, concepts, ar	d results; quality awareness;
comprehensible, confident, and c communication skills; ability to wo	onvincing presentation of ideas, concepts, ar	d results; quality awareness;
comprehensible, confident, and c communication skills; ability to wo Workload: Total: 180 h 15 h seminar (attendance)	onvincing presentation of ideas, concepts, ar ork in teams and understand team processes	d results; quality awareness;
comprehensible, confident, and c communication skills; ability to wo Workload: Total: 180 h	onvincing presentation of ideas, concepts, ar ork in teams and understand team processes	d results; quality awareness;
comprehensible, confident, and c communication skills; ability to wo Workload: Total: 180 h 15 h seminar (attendance) 165 h internship / practical course	onvincing presentation of ideas, concepts, ar ork in teams and understand team processes	d results; quality awareness;
comprehensible, confident, and c communication skills; ability to wo Workload: Total: 180 h 15 h seminar (attendance) 165 h internship / practical course Conditions:	onvincing presentation of ideas, concepts, ar ork in teams and understand team processes	d results; quality awareness;
comprehensible, confident, and c communication skills; ability to wo Workload: Total: 180 h 15 h seminar (attendance) 165 h internship / practical course Conditions: none	onvincing presentation of ideas, concepts, ar ork in teams and understand team processes	d results; quality awareness;
comprehensible, confident, and c communication skills; ability to wo Workload: Total: 180 h 15 h seminar (attendance) 165 h internship / practical course Conditions:	onvincing presentation of ideas, concepts, ar ork in teams and understand team processes	d results; quality awareness; principles of good scientific practice;

Part of the Module: Forschungsmodul Softwaremethodiken für verteilte Systeme

according to the examination

regulations of the study program

Mode of Instruction: internship Language: German / English

Contact Hours: 1

Contents:

1

Current research topics at the DS-Lab.

Literature:

Provided for the respective topics.

Assigned Courses:

Oberseminar zu Softwaremethodik für verteilte Systeme

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Examination

Presentation and written paper

internship, graded

Test Frequency:

	Module Theoretical Computer	6 ECTS/LP
Science Forschungsmodul Theoretische I	nformatik	
Version 1.0.0 (since SoSe13)		
Person responsible for module: F	Prof. Dr. Torben Hagerup	
intermediate complexity in the fie to-date knowledge in the field, en techniques for their research proj literature research, and evaluate Key Qualifications: Logical, analytical, and conceptu present thoughts, concepts, and	The research module, the students will be in Id of Theoretical Computer Science. Furthe abling them to actively develop and apply it ects. The students will have team spirit and solutions and results in a critical manner. al comprehension; independent work with E conclusions in an understandable, confiden of fundamentals of good scientific practice.	Trmore, they will have detailed and up- ts concepts, methods, processes, and the ability to communicate, conduct English technical literature; capability to at, and convincing way; quality awareness
Workload: Total: 180 h 165 h internship / practical course 15 h seminar (attendance) Conditions:	e (self-study)	
none		
Frequency: each semester	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours:	Repeat Exams Permitted: according to the examination	
	regulations of the study program	
Parts of the Module	regulations of the study program	

Contact Hours: 1

Contents:

Collaboration on current research topics of the group.

Literature:

• Scientific papers, manuals.

Assigned Courses:

Oberseminar Theoretische Informatik

*(online/digital) *

Examination

Oral presentation and written paper.

internship, graded

Test Frequency:

Module INF-0064: Research I Forschungsmodul Organic Compu		6 ECTS/LP
Version 1.0.0 (since SoSe14) Person responsible for module: Pr	of. Dr. Jörg Hähner	
field of "Organic Computing". The participate in research projects. To and technologies and can contribu communication skills, the ability to	ces: module, students are able to understand p y have detailed and up-to-date knowledge o this end, they understand advanced cond ute this knowledge to research projects. In research literature and the learning and w aluate, combine and present interim results	in the mentioned field and can actively cepts, methods, procedures, techniques addition, students have the teamwork and vorking techniques to discuss problems in
in English; comprehensible, confic	< logically, analytically and conceptually; in lent and convincing presentation of ideas, rk in teams and understand team processe	concepts and results; quality awareness;
Workload: Total: 180 h 165 h internship / practical course 15 h seminar (attendance)	(self-study)	
Conditions: none		
Frequency: each semester	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 1	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Research M Mode of Instruction: internship Language: German / English	odule Organic Computing	

Contact Hours: 1

Contents:

Collaboration on current research topics.

Literature:

Depending on the topic to be worked on:

- Paper
- Book
- Handbook

Assigned Courses:

Oberseminar Organic Computing

*(online/digital) *

Examination

Presentation and final report.

internship, graded

Test Frequency:

Systems	dule Databases and Information	6 ECTS/LP
-		
Forschungsmodul Datenbanken und	Informationssysteme	
Version 1.2.0 (since SoSe14)		
Person responsible for module: Prof.	Dr. Peter Michael Fischer	
Learning Outcomes / Competences	5:	
After participating in the research more	dule, students can understand medium-c	omplexity problems in the field of
•	They have detailed and up-to-date knowl	•
•••••	ojects. To this end, they understand adv	• • • • • •
	his field and can apply this knowledge to	
v	unication, the ability to study research lit	
•	tically evaluate, combine and present inte	
	nceptual thinking; Independent work with	
	on of ideas, concepts, and results; Quality	
working in teams and understanding	team processes; Principles of good scien	
Workload:		
Total: 180 h		
15 h seminar (attendance)		
15 h seminar (attendance)	elf-study)	
	elf-study)	1
15 h seminar (attendance) 165 h internship / practical course (se Conditions:		
15 h seminar (attendance) 165 h internship / practical course (se Conditions: Module Database Systems (INF-0073		Minimal Duration of the Module:
15 h seminar (attendance) 165 h internship / practical course (se Conditions: Module Database Systems (INF-0073	3) - recommended	Minimal Duration of the Module: 1 semester[s]
15 h seminar (attendance) 165 h internship / practical course (se Conditions: Module Database Systems (INF-0073 Frequency: each semester	B) - recommended Recommended Semester:	
15 h seminar (attendance) 165 h internship / practical course (se	3) - recommended Recommended Semester: from 5.	
15 h seminar (attendance) 165 h internship / practical course (se Conditions: Module Database Systems (INF-0073 Frequency: each semester Contact Hours:	A) - recommended Recommended Semester: from 5. Repeat Exams Permitted:	

Part of the Module: Forschungsmodul Datenbanken und Informationssysteme

Mode of Instruction: internship

Language: German / English

Contact Hours: 1

Contents:

Current research topics in the field of database systems and Big Data

Literature:

- Current research articles with relation to "Big Data"
- · Manuals of the relevant products and frameworks

Assigned Courses:

Oberseminar Datenbanken und Informationssysteme

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Examination

Software acceptance, presentation, final report

internship, graded

Test Frequency:

Module INF-0090: Research Module Multimedia Computing & 6 ECTS/L Computer Vision (BA) 7000000000000000000000000000000000000
Forschungsmodul Multimedia Computing & Computer Vision Version 1.0.0 (since SoSe14)
Learning Outcomes / Competences: After participating in the research module, students can understand problems of medium complexity in the field of multimedia (image, video, and audio processing with machine learning). They have detailed and up-to-date knowled in the aforementioned field and can actively participate in research projects. To this end, they understand advanced concepts, methods, procedures, techniques and technologies and can apply this knowledge in research projects. In addition, students have teamwork and communication skills, the ability to research literature, and techniques to discuss problems in the field, as well as to critically evaluate, combine, and present interim results. Key qualifications: Ability to think logically, analytically and conceptually; independent work with specialist literature; comprehensible, confident and convincing presentation of ideas, concepts and results; quality awareness; communication skills; ability to work in teams and understand team processes; principles of good scientific practice. Workload: Total 400 b
Total: 180 h 15 h seminar (attendance) 165 h internship / practical course (self-study) Conditions:
none
Frequency: each semester Recommended Semester: Minimal Duration of the Module: from 5. 1 semester[s]
Contact Hours: Repeat Exams Permitted: 1 according to the examination regulations of the study program
Parts of the Module
Part of the Module: Research Module Multimedia Computing & Computer Vision Mode of Instruction: internship Language: German Frequency: as needed Contact Hours: 1
Contents: The specific task from the wide-ranging field of multimedia and machine vision (image, video and audio processing, object recognition, search of image, video and audio material) is designed individually for each stude every year. Literature:
scientific papers, manuals
Assigned Courses:
Oberseminar Multimedia Computing

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Presentation and written paper

internship, graded

Test Frequency:

Module INF-0105: Research Me Informatics Forschungsmodul Lehrprofessur für		6 ECTS/LP
Version 1.0.0 (since SoSe14) Person responsible for module: Prof	. Dr. Robert Lorenz	-
fields of <i>concurrent systems</i> , <i>petri ne</i> aforementioned field and can activel concepts, methods, procedures, tec In addition, students have teamwork	es: odule, students can understand problems ets or process mining. They have detailed y participate in research projects. To this hniques and technologies and can apply and communication skills, the ability to p I as to critically evaluate, combine, and p	d and up-to-date knowledge in the end, they understand advanced this knowledge in research projects. research literature, and techniques to
literature; comprehensible, confiden	ogically, analytically and conceptually; in t and convincing presentation of ideas, c in teams and understand team processe	oncepts and results; quality awareness;
Workload: Total: 180 h 165 h internship / practical course (s 15 h seminar (attendance)	elf-study)	
Conditions: Basic knowledge in research topics <i>mining</i>	concurrent systems, petri nets or proces	s
Frequency: each semester	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours:	Repeat Exams Permitted: according to the examination	

Part of the Module: Research Module Teaching Professorship Informatics

Mode of Instruction: internship

Language: German / English

Contact Hours: 1

Contents:

Collaboration on current research topics in the field of concurrent systems, petri nets or process mining.

Literature:

- J. Desel, W. Reisig, G. Rozenberg: Lectures on Concurrency and Petri Nets, Springer, Lecture Notes in Computer Science 3098, 2004
- Wil M. P. van der Aalst: Process Mining. Data Sciemce in Action. Springer, 2016.

Assigned Courses:

Oberseminar zu Lehrprofessur für Informatik

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Research Module Teaching Professorship Informatics

practical exam, graded

Test Frequency:

Module INF-0127: Research Me Engineering	odule Software- and Systems	6 ECTS/LP
Forschungsmodul Software- und Sy	rstems Engineering	
Version 1.1.0 (since SoSe14)		
Person responsible for module: Prof	. Dr. Wolfgang Reif	
the field of software and systems en field and can actively participate in r techniques and technologies and ca and communication skills, the ability	es: odule, students are able to understand pro igineering. They have detailed and up-to-da esearch projects. They understand advance in apply this knowledge in research project to do literature research and the learning a ritically evaluate, combine and present inte	ate knowledge in the aforementioned eed concepts, methods, procedures, s. In addition, students have teamwork and working techniques to discuss
Soft Skills:		
	with technical literature, including English ling presentation of ideas, concepts and resund nderstand team processes	
Workload: Total: 180 h 165 h internship / practical course (s 15 h seminar (attendance)	self-study)	
Conditions: none		
Frequency: each semester	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 1	Repeat Exams Permitted: according to the examination regulations of the study program	

Part of the Module: Research Module Software- and Systems Engineering

Mode of Instruction: internship

Language: German / English

Contact Hours: 1

Contents:

Contribution to current research projects of the chair for Software Engineering

Literature:

Depends on the project: Scientific papers, system documentation, books, ...

Assigned Courses:

Oberseminar Software- und Systems Engineering

*(online/digital) *

Research Module Software- and Systems Engineering Project Presentation

practical exam / work period for assignment: 6 weeks, graded

Test Frequency:

Module INF-0173: Research I Forschungsmodul Human-Centere	Module Human-Centered Multimedia ed Multimedia	6 ECTS/LP
Version 1.0.0 (since SoSe13) Person responsible for module: Pr	of. Dr. Elisabeth André	
field of "Human-Centered Multimer can actively participate in research techniques and technologies and o teamwork and communication skill discuss problems in the field, as w Key qualifications: Skill in logical literature; Understandable, confide	ces: module, students are able to understand prod dia". They have detailed and up-to-date know in projects. To this end, they understand adva can apply this knowledge in research project: ls, the ability to research literature and the le rell as to critically evaluate, combine and pres l, analytical, and conceptual thinking; Indeper ent, and persuasive presentation of ideas, co sing in teams and understanding team proces	vledge in the aforementioned field and inced concepts, methods, procedures, s. In addition, students have the arning and working techniques to sent intermediate results. Indent work with English-language incepts, and results; Quality awareness;
Workload: Total: 180 h 165 h internship / practical course 15 h seminar (attendance)	(self-study)	
		1
Conditions: none		
	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]

Part of the Module: Research Module Human-Centered Multimedia

Mode of Instruction: internship

Language: German

Contact Hours: 1

Contents:

Collaborate on current research topics in the area of Human-Centered Multimedia.

Literature:

Literature references will be given at the beginning of the module depending on the topic.

Assigned Courses:

Oberseminar Human-Centered Multimedia

*(online/digital) *

Examination

Research Module Human-Centered Multimedia

practical exam, graded

Test Frequency:

Module INF-0271: Research Module Embedded Intelligence for Health Care and Wellbeing Forschungsmodul Embedded Intelligence for Health Care and Wellbeing	6 ECTS/LP
Version 1.1.0 (since WS17/18)	

Person responsible for module: Prof. Dr. Björn Schuller

Learning Outcomes / Competences:

After participating in the research module, students are able to understand problems of medium complexity in the field of intelligent embedded systems, in particular signal analysis for e-health and m-health applications. They have detailed and up-to-date knowledge in the area mentioned and can actively participate in research projects. In addition, they understand advanced concepts, methods, procedures, techniques and technologies and can contribute this knowledge to research projects. In addition, the students have the team and communication skills, the ability to research scientific literature and the learning and working techniques to discuss problems in the field, as well as to critically evaluate, combine and present interim results.

Key Qualifications: Ability to think logically, analytically and conceptually; Independent work with English-language specialist literature; Understandable, safe and convincing presentation of ideas, concepts and results; quality awareness; communication skills; Team collaboration skills and understanding of team processes; principles of good scientific practice; project management skills; Scientific Method.

Workload:

Total: 180 h

165 h internship / practical course (self-study)

15 h seminar (attendance)

Conditions:		Credit Requirements:
none		Bestehen der Modulprüfung
Frequency: irregular	Recommended Semester:	Minimal Duration of the Module:
	5.	1 semester[s]
Contact Hours:	Repeat Exams Permitted:	
1	according to the examination	
	regulations of the study program	

Parts of the Module

Part of the Module: Research Module Embedded Intelligence for Health Care and Wellbeing

Mode of Instruction: internship

Language: German / English

Contact Hours: 1

Contents:

Participation in current research topics.

Literature:

Scientific publications; manuals; is provided by the chair.

Assigned Courses:

Oberseminar Embedded Intelligence for Health Care and Wellbeing

*(online/digital) *

Examination

Presentation and written paper

practical exam, graded

Test Frequency:

Module INF-0327: Research Module IT Infrastructure in Medical	6 ECTS/LP
Information Systems	
Forschungsmodul IT-Infrastrukturen in der Medizin	
Version 1.0.0 (since WS19/20)	

Person responsible for module: Prof. Dr. Frank Kramer

Learning Outcomes / Competences:

After participating in the research module, students are able to understand problems of medium complexity in the field of IT infrastructures in translational medical research. They have detailed and up-to-date knowledge in the aforementioned field and can actively participate in research projects. To this end, they understand advanced concepts, methods, procedures, techniques and technologies and can apply this knowledge in research projects. In addition, students have the teamwork and communication skills, the ability to research literature and the learning and working techniques to discuss problems in the field, as well as to critically evaluate, combine and present intermediate results.

Key Skills: Skill in logical, analytical, and conceptual thinking; Independent work with English-language literature; Understandable, confident, and persuasive presentation of ideas, concepts, and results; Quality awareness; Communication skills; Skill in working in teams and understanding team processes; Principles of good scientific practice.

Workload:

Total: 180 h

Conditions:		Credit Requirements: Passing the module examination
Frequency: each semester Recommended Semester: from 3.		Minimal Duration of the Module: 1 semester[s]
Contact Hours: 1	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Research Module IT Infrastructure in Medical Information Systems

Mode of Instruction: internship

Language: German / English

Contact Hours: 1

Contents:

Current research topics in the field of IT infrastructures in translational medical research.

Literature:

scientific essays, manuals

Assigned Courses:

Oberseminar IT-Infrastrukturen für die Translationale Medizinische Forschung

*(online/digital) *

Examination

Research Module IT Infrastructure in Medical Information Systems

practical exam, graded

Test Frequency:

Forschungsmodul Embedded Sy	Module Embedded Systems <i>ystems</i>	6 ECTS/LF
Version 1.0.0 (since SoSe20)		
Person responsible for module: I	Prof. Dr. Sebastian Altmeyer	
Learning Outcomes / Compete	ences:	
After participating in the research	h module, students are able to understand	problems of medium complexity in the field
of embedded systems. They hav	ve detailed and up-to-date knowledge in the	aforementioned field and can actively
participate in research projects.	To this end, they understand advanced con	cepts, methods, procedures, techniques
and technologies and can apply	this knowledge in research projects. In add	ition, students have the teamwork and
communication skills, the ability	to research literature and the learning and v	working techniques to discuss problems in
the field, as well as to critically e	valuate, combine and present intermediate	results.
literature; Intelligible, confident, a Communication skills; Skill in wo	al, analytical, and conceptual thinking; Inde and persuasive presentation of ideas, conce rking in teams and understanding team pro	epts, and results; Quality awareness;
literature; Intelligible, confident, a Communication skills; Skill in wo practice.	and persuasive presentation of ideas, conce	epts, and results; Quality awareness;
literature; Intelligible, confident, a Communication skills; Skill in wo practice. Workload: Total: 180 h	and persuasive presentation of ideas, conce orking in teams and understanding team pro	epts, and results; Quality awareness;
literature; Intelligible, confident, a Communication skills; Skill in wo practice. Workload: Total: 180 h 15 h seminar (attendance)	and persuasive presentation of ideas, conce orking in teams and understanding team pro	epts, and results; Quality awareness;
literature; Intelligible, confident, a Communication skills; Skill in wo practice. Workload: Total: 180 h 15 h seminar (attendance) 165 h internship / practical cours Conditions:	and persuasive presentation of ideas, conce orking in teams and understanding team pro	epts, and results; Quality awareness;
literature; Intelligible, confident, a Communication skills; Skill in wo practice. Workload: Total: 180 h 15 h seminar (attendance) 165 h internship / practical cours Conditions: none	and persuasive presentation of ideas, conce orking in teams and understanding team pro	epts, and results; Quality awareness;
literature; Intelligible, confident, a Communication skills; Skill in wo practice. Workload: Total: 180 h 15 h seminar (attendance) 165 h internship / practical cours Conditions: none	and persuasive presentation of ideas, conce orking in teams and understanding team pro	epts, and results; Quality awareness; cesses; Principles of good scientific
literature; Intelligible, confident, a Communication skills; Skill in wo practice. Workload: Total: 180 h 15 h seminar (attendance) 165 h internship / practical cours Conditions: none Frequency: each semester	and persuasive presentation of ideas, conce orking in teams and understanding team pro- se (self-study) Recommended Semester:	Appts, and results; Quality awareness; Accesses; Principles of good scientific
literature; Intelligible, confident, a Communication skills; Skill in wo practice. Workload: Total: 180 h 15 h seminar (attendance) 165 h internship / practical cours Conditions:	and persuasive presentation of ideas, conce orking in teams and understanding team pro- se (self-study) Recommended Semester: 5.	Appts, and results; Quality awareness; Accesses; Principles of good scientific

Part of the Module: Forschungsmodul Embedded Systems

Mode of Instruction: internship

Language: German / English

Contact Hours: 1

Contents:

Participation in current research topics.

Literature:

scientific papers, handbooks

Assigned Courses:

Oberseminar Embedded Systems

**

Examination

Forschungsmodul Embedded Systems

practical exam, graded

Test Frequency:

Version 1.0.0 (since WS20/21)

Person responsible for module: Prof. Dr. Tobias Mömke

Learning Outcomes / Competences:

After attending this research module, the students are able to understand algorithmic problems and solutions of medium difficulty in the area of resource aware algorithmics. They have acquired a detailed understanding of up-todate topics within the area and can actively participate in research projects. Furthermore, they understand some deep concepts, methods, tools and technologies and can apply the acquired knowledge in research projects. Besides the technical abilities, they train their team and communication skills, the ability to perform literature research and to discurss and present technical topics.

Key Qualifications: Ability to perform analytical and logic thinking; self-sufficient work with scientific literature in English language; ability to present results and ideas in form of understandable and inspiring presentations; aim for high-quality results; communication skills; ability to work with a team and to understand team processes; respect for clean scientific practices.

Workload:

Total: 180 h

165 h internship / practical course (self-study) 15 h seminar (attendance)

Conditions:		Credit Requirements:
none		Bestehen der Modulprüfung
Frequency: each semester	Recommended Semester: 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 1	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Forschungsmodul Resource Aware Algorithmics

Mode of Instruction: internship

Language: German / English

Contact Hours: 1

Contents:

Contribution to research on state of the art research topics.

Literature:

scientific papers, books

Assigned Courses:

Oberseminar Resource Aware Algorithmics

**

Examination

Reseach Module Resource Aware Algorithmics

portfolio exam, graded

Test Frequency:

Module INF-0435: Researce Forschungsmodul Quantenalge	h Module Quantum Algorithms Drithmen	6 ECTS/LF
Version 1.0.0 (since SoSe23)		
Person responsible for module	Prof. Dr. Jakob Siegfried Kottmann	
Learning Outcomes / Compe	tences:	
auf dem Gebiet der Quantenal dem genannten Gebiet und kör Konzepte, Methoden, Verfahre einbringen. Außerdem verfüge Literaturrecherche und die Lerr	nungsmodul sind die Studierenden in der Lag gorithmen verstehen. Sie verfügen über deta nnen in Forschungsprojekten aktiv mitarbeite n, Techniken und Technologien und können n die Studierenden über die Team- und Kom n- und Arbeitstechniken, um Problemstellung n bewerten, zu kombinieren und zu präsentie	illiertes und aktuelles Wissen auf en. Dazu verstehen sie weiterführende dieses Wissen in Forschungsprojekten munikationsfähigkeit, die Fähigkeit zur en auf dem Gebiet zu diskutieren, sowie
Schlüsselqualifikationen: Fe mit englischsprachiger Fachlite und Ergebnissen; Qualitätsbew	tigkeit zum logischen, analytischen und kon ratur; Verständliche, sichere und überzeuge rußtsein; Kommunikationsfähigkeit; Fertigkei	nde Präsentation von Ideen, Konzepten t der Zusammenarbeit in Teams und
Schlüsselqualifikationen: Fe mit englischsprachiger Fachlite und Ergebnissen; Qualitätsbew Verstehen von Teamprozesser	tigkeit zum logischen, analytischen und kon ratur; Verständliche, sichere und überzeuge	nde Präsentation von Ideen, Konzepten t der Zusammenarbeit in Teams und
Schlüsselqualifikationen: Fe mit englischsprachiger Fachlite und Ergebnissen; Qualitätsbew Verstehen von Teamprozesser Workload:	tigkeit zum logischen, analytischen und kon ratur; Verständliche, sichere und überzeuge rußtsein; Kommunikationsfähigkeit; Fertigkei	nde Präsentation von Ideen, Konzepten t der Zusammenarbeit in Teams und
Schlüsselqualifikationen: Fe mit englischsprachiger Fachlite und Ergebnissen; Qualitätsbew	tigkeit zum logischen, analytischen und kon ratur; Verständliche, sichere und überzeuge rußtsein; Kommunikationsfähigkeit; Fertigkei a; Grundsätze guter wissenschaftlicher Praxi	nde Präsentation von Ideen, Konzepten t der Zusammenarbeit in Teams und
Schlüsselqualifikationen: Fe mit englischsprachiger Fachlite und Ergebnissen; Qualitätsbew Verstehen von Teamprozesser Workload: Total: 180 h	tigkeit zum logischen, analytischen und kon ratur; Verständliche, sichere und überzeuge rußtsein; Kommunikationsfähigkeit; Fertigkei a; Grundsätze guter wissenschaftlicher Praxi	nde Präsentation von Ideen, Konzepten t der Zusammenarbeit in Teams und
Schlüsselqualifikationen: Fe mit englischsprachiger Fachlite und Ergebnissen; Qualitätsbew Verstehen von Teamprozesser Workload: Total: 180 h 165 h internship / practical cou	tigkeit zum logischen, analytischen und kon ratur; Verständliche, sichere und überzeuge rußtsein; Kommunikationsfähigkeit; Fertigkei a; Grundsätze guter wissenschaftlicher Praxi	nde Präsentation von Ideen, Konzepten t der Zusammenarbeit in Teams und
Schlüsselqualifikationen: Fe mit englischsprachiger Fachlite und Ergebnissen; Qualitätsbew Verstehen von Teamprozesser Workload: Total: 180 h 165 h internship / practical cou 1 h seminar (attendance) Conditions: none	tigkeit zum logischen, analytischen und kon ratur; Verständliche, sichere und überzeuge rußtsein; Kommunikationsfähigkeit; Fertigkei a; Grundsätze guter wissenschaftlicher Praxi	nde Präsentation von Ideen, Konzepten t der Zusammenarbeit in Teams und s Credit Requirements:
Schlüsselqualifikationen: Fe mit englischsprachiger Fachlite und Ergebnissen; Qualitätsbew Verstehen von Teamprozesser Workload: Total: 180 h 165 h internship / practical cou 1 h seminar (attendance) Conditions: none Frequency: as needed	tigkeit zum logischen, analytischen und kon ratur; Verständliche, sichere und überzeuge rußtsein; Kommunikationsfähigkeit; Fertigkei n; Grundsätze guter wissenschaftlicher Praxi	nde Präsentation von Ideen, Konzepten t der Zusammenarbeit in Teams und s Credit Requirements: Bestehen der Modulprüfung Minimal Duration of the Module:
Schlüsselqualifikationen: Fe mit englischsprachiger Fachlite und Ergebnissen; Qualitätsbew Verstehen von Teamprozesser Workload: Total: 180 h 165 h internship / practical cou 1 h seminar (attendance) Conditions:	tigkeit zum logischen, analytischen und kon ratur; Verständliche, sichere und überzeuge rußtsein; Kommunikationsfähigkeit; Fertigkei a; Grundsätze guter wissenschaftlicher Praxi rse (self-study) Recommended Semester: from 5.	nde Präsentation von Ideen, Konzepten t der Zusammenarbeit in Teams und s Credit Requirements: Bestehen der Modulprüfung Minimal Duration of the Module:

Part of the Module: Forschungsmodul Quantenalgorithmen

Mode of Instruction: internship

Language: English / German

Contact Hours: 1

Contents:

Mitarbeit an aktuellen Forschungsthemen

Literature:

Abhängig vom jeweiligen Thema

Assigned Courses:

Oberseminar Quantenalgorithmik

**

Examination

Forschungsmodul Quantenalgorithmen

practical exam, graded

Test Frequency:

Module INF-0473: Research Communication Networks	Module Networked Systems and	6 ECTS/LP
Forschungsmodul Vernetzte Syst	eme und Kommunikationsnetze	
Version 1.0.0 (since WS23/24) Person responsible for module: Prof. Dr. Michael Seufert		
auf dem Gebiet der vernetzten Sy aktuelles Wissen auf dem genann sie weiterführende Konzepte, Met Forschungsprojekten einbringen. die Fähigkeit zur Literaturrecherch diskutieren, sowie Zwischenergeb	nces: ngsmodul sind die Studierenden in der Lage, rsteme und Kommunikationsnetze zu versteh nten Gebiet und können in Forschungsprojek hoden, Verfahren, Techniken und Technolog Außerdem verfügen die Studierenden über o ne und die Lern- und Arbeitstechniken, um P onisse kritisch zu bewerten, zu kombinieren u keit zum logischen, analytischen und konzep	nen. Sie verfügen über detailliertes und ten aktiv mitarbeiten. Dazu verstehen gien und können dieses Wissen in die Team- und Kommunikationsfähigkeit roblemstellungen auf dem Gebiet zu und zu präsentieren.
und Ergebnissen; Qualitätsbewuß	ur; Verständliche, sichere und überzeugende tsein; Kommunikationsfähigkeit; Fertigkeit de Grundsätze guter wissenschaftlicher Praxis	-
Workload: Total: 180 h 15 h seminar (attendance) 165 h internship / practical course	e (self-study)	
Conditions: none		Credit Requirements: Bestehen der Modulprüfung
Frequency: each semester	Recommended Semester: 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 1	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Forschungs Mode of Instruction: internship Language: German Contact Hours: 1	smodul Vernetzte Systeme und Kommunil	kationsnetze

Contact Hours: 1

Contents:

Mitarbeit an aktuellen Forschungsthemen.

Literature:

wissenschaftliche Papiere, Handbücher

Assigned Courses:

Oberseminar Vernetzte Systeme und Kommunikationsnetze

*(online/digital) *

Forschungsmodul Vernetzte Systeme und Kommunikationsnetze

practical exam, graded

Test Frequency:

Module INF-0480: Research Module Intelligent Perception in	6 ECTS/LP
Technical Systems	
Forschungsmodul Intelligente Perzeption in Technischen Systemen	
Version 1.0.0 (since WS23/24)	

Person responsible for module: Prof. Dr. Jörg-Dieter Stückler

Learning Outcomes / Competences:

After participating in the research module, students are able to understand problems of medium complexity in the field of intelligent perception in technical systems. They have detailed and up-to-date knowledge in the aforementioned field and can actively participate in research projects. To this end, they understand advanced concepts, methods, procedures, techniques and technologies and can apply this knowledge in research projects. In addition, students have the teamwork and communication skills, the ability to research literature and the learning and working techniques to discuss problems in the field, as well as to critically evaluate, combine and present intermediate results.

Key qualifications: Ability to think logically, analytically and conceptually; Independent work with English-language scientific literature; Understandable, confident and convincing presentation of ideas, concepts and results; Quality awareness; Communication skills; Skill of working in teams and understanding team processes; Principles of good scientific practice.

Workload:

Total: 180 h

15 h seminar (attendance)

165 h internship / practical course (self-study)

Conditions:		Credit Requirements:
none		Passing the module exam
Frequency: each semester	Recommended Semester: 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 1	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Research Module Intelligent Perception in Technical Systems

Mode of Instruction: internship

Language: English / German

Contact Hours: 1

Contents:

Current research topics.

Literature:

Scientific papers, manuals

Assigned Courses:

Oberseminar Intelligente Perzeption in Technischen Systemen

**

Examination

Research Module Intelligent Perception in Technical Systems

practical exam, graded

Test Frequency:

Vorlesung Integrative Geographie	grative Geography	5 ECTS/LF
Version 2.0.0 (since WS22/23) Person responsible for module: Prof. I	Dr. Matthias Schmidt	
geography and human geography are central problem complexes and their c classification of integrative geography	geography"). Basic topics and current treated with a nexus to space, enviro current political and socio-economic re in the history of the discipline and cur ent and society are presented in their	research and questions from physical nment and society. Presentation of elevance, discussion of relevant questions
	ule, the students have in-depth knowl aphy. They are able to deal critically w	edge of the various approaches, theories ith current topics in the field of integrative
Workload: Total: 150 h		
		Credit Requirements: Pass the module exam
Total: 150 h Conditions:	Recommended Semester: from 1.	-

Part of the Module: Vorlesung Integrative Geographie / Lecture Integrative Geography

Mode of Instruction: lecture Language: German / English

Examination

GEO-4250 Integrative Geographie

module exam, module exam, graded

Module GEO-4251: Discourse Analysis Diskursanalyse		5 ECTS/LI
Version 2.0.0 (since WS22/23) Person responsible for module: Dr. /	Andreas Benz	
	ons of discourse analysis, concrete micr ell as fields of application and case studi	o- and macro-analytical procedures and es of discourse analysis procedures.
	odule, the students have in-depth knowle now and master different methods of dis	0
Workload: Total: 150 h		
Conditions: none		Credit Requirements: Pass the module exam
Frequency: annually usually in summer semester	Recommended Semester: 1 2.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination	

Part of the Module: Diskursanalyse / Discourse Analysis

Mode of Instruction: lecture, exercise course, seminar, internship

Language: German / English

Assigned Courses:

Diskursanalyse - Discourse Analysis (exercise course)

**

Examination GEO-4251 Diskursanalyse

module exam, Klausur, mündliche Prüfung, Hausarbeit, Übungsaufgabe oder Bericht, graded

Description:

written exam, oral exam, scientific term paper, practice assignment or report

Module GEO-4253: Remote Geowissenschaftliche Fernerku	-	5 ECTS/LP
Version 2.0.0 (since WS22/23) Person responsible for module:	Prof. Dr. Wolfgang Buermann	,
	using specific software. Remote sensing g	cquiring, analyzing and interpreting geodata eodata from various remote sensing
sensor concepts and to adequa and validation strategies in the o	ences: nd categorize data recorded by remote ser tely evaluate sensor data. In particular, the context of remote sensing. You will also, at tware solutions and have used this software	ey know the typical processing, calibration t least in some cases, acquire in-depth
Workload: Total: 150 h		
Conditions: none		Credit Requirements: Pass the module exam
Frequency: annually	Recommended Semester: 1 2.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	

Part of the Module: Geowissenschaftliche Fernerkundung / Remote Sensing in Geosciences

Mode of Instruction: lecture, exercise course, seminar, internship

Language: German / English

Examination

GEO-4253 Geowissenschaftliche Fernerkundung

module exam, Klausur, Hausarbeit, mündliche Prüfung, Übungsaufgabe oder Bericht, graded

Description:

written exam, scientific term paper, oral exam, practical exercise or report

Module GEO-4254: Modelling in Geowissenschaftliche Modellierung	Geosciences	5 ECTS/LP
Version 2.0.0 (since WS22/23) Person responsible for module: apl. Pr	rof. Andreas Philipp	
	ation using the "R" programming envi	ion of advanced geoscientific methods for ironment. The exercises are carried out ography and geosciences.
with the help of advanced programmin	ents can also efficiently prepare comp ig technology. They are able to indepe lyzes and visualizations with the help	lex geoscientific data sets independently endently design problem-related of R, implement them efficiently in terms of
Workload: Total: 150 h		
Conditions: none		Credit Requirements: Pass the module exam
Frequency: annually usually winter and summer semester	Recommended Semester: 1 2.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	

Part of the Module: Geowissenschaftliche Modellierung / Modelling in Geosciences

Mode of Instruction: exercise course, internship

Language: German / English

Assigned Courses:

Dicke Luft - Feinstaub, Ozon und Stickoxide verstehen und modellieren Bad atmosphere - Understanding and modeling particulate matter, ozone and nitrogene oxide (seminar) **

Examination

GEO-4254 Geowissenschaftliche Modellierung

module exam, mündliche Prüfung, Übungsaufgabe oder Bericht, graded

Description:

oral exam, exercise or report

Module GEO-4255: Programming Geowissenschaftliche Programmierun	-	5 ECTS/LP
Version 2.0.0 (since WS22/23) Person responsible for module: apl. Pr	rof. Christoph Beck	
	ation using the "R" programming env	ion of advanced geoscientific methods for ironment. The exercises are carried out ography and geosciences.
with the help of advanced programmin	ents can also efficiently prepare comp ig technology. They are able to indep lyzes and visualizations with the help	lex geoscientific data sets independently endently design problem-related of R, implement them efficiently in terms of
Workload: Total: 150 h		
Conditions: none		Credit Requirements: Pass the module exam
Frequency: annually usually winter and summer semester	Recommended Semester: 1 2.	Minimal Duration of the Module: 1 semester[s]

Part of the Module: Geowissenschaftliche Programmierung / Programming in Geosciences

Mode of Instruction: exercise course, internship

Language: German / English

Examination

GEO-4255 Geowissenschaftliche Programmierung

module exam, mündliche Prüfung, Übungsaufgabe oder Bericht, graded

Description:

oral exam, exercise or report

Module GEO-5122: Geoinformatics 1 10 ECTS/LP Geoinformatik 1 (10LP) 10

Version 2.0.0 (since WS22/23) Person responsible for module: Prof. Dr. Sabine Timpf

Contents:

In GIScience geodata is at the core of many applications. However, geodata can only be interpreted within a specific context where models are needed to produce answers to questions. In fact, the models that are hidden beneath a data collection effort are of as much interest and importance as the models used to derive additional knowledge (such as weather forecast models, models of erosion, models of migration patterns, models of transportation systems or models of wayfinding). Every one of us models every day for everyday purposes. Understanding how this modeling happens and how to make these models better as well as computationally tractable helps to become clearer thinkers and expert modelers in GIScience.

This module introduces the theoretical foundations of modeling from different viewpoints. It also shows how modeling of geographic information adds a temporal component, leading towards simulation models. It then goes on to deal with the issue of modeling complex systems using a specific type of simulation with a software called Netlogo. After becoming proficient in modeling and simulating, there is a need to evaluate the validity and interpret the results of these implemented models. Using a combination of ground-truthing in case studies as well as sensitivity analysis, the advantages but also the limitations of this modeling approach in GIScience.

Learning Outcomes / Competences:

The learning objectives of this module are a critical understanding of the issues of modeling and simulation in GIScience, a proficiency in spatio-temporal modeling using a multi-agent simulation framework, the ability to abstract from a concrete problem and implement the best model for the solution of the problem, the expert knowledge of how to validate and evaluate a simulation model.

Workload:

Total: 300 h

Conditions: none		Credit Requirements: Pass the module exam
Frequency: each winter semester	Recommended Semester: 1 2.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 4	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Seminar Modelling and Simulation

Mode of Instruction: seminar Language: English Contact Hours: 2 ECTS Credits: 5.0

Part of the Module: Exercises Modelling and Simulation

Mode of Instruction: exercise course Language: English Contact Hours: 2 ECTS Credits: 5.0

Examination

Geoinformatik 1: Modelling and Simulation (MScGI)

project work, graded

Module GEO-5129: Geoinformat	ics 2	10 ECTS/LP
Version 2.0.0 (since WS22/23) Person responsible for module: Prof. [Dr. Jukka Krisp	
Contents: Introduction to visual and computer-aid guidance with geodata and mining sof	ded methods of geographic data analysis tware.	s. Exercises on the computer under
visual geodata analysis. You have acc and approaches. You have developed	: hts have become acquainted with compu- quired the ability to describe processes w a functional set of tools for the visual an s. You can transfer the results of the assi	ith the help of functional mechanisms alysis and processing of geographic
Workload: Total: 300 h		
Conditions: none		Credit Requirements: Pass the module exam
Frequency: each semester part 1 each semester, part 2 in summer semester	Recommended Semester: 2 3.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 4	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Vorlesung/Semi Mode of Instruction: lecture, seminar Language: German / English Contact Hours: 2 ECTS Credits: 5.0		
Part of the Module: Übung/Seminar Mode of Instruction: exercise course Language: German / English Frequency: each summer semester Contact Hours: 2 ECTS Credits: 5.0	-	
Assigned Courses: Advanced Spatial Analysis (ASA) (s **	eminar)	
Examination Geoinformatik 2: Geodatenanalyse portfolio exam, Module exam, grac		

Module GEO-5135: Climate 1 Klima 1		10 ECTS/LF
Version 2.0.0 (since WS22/23) Person responsible for module: apl. F	Prof. Christoph Beck	
•	ting reference to this subject area. In th	nd climate change or from the research ne associated accompanying seminar,
	ch areas that either directly address the ial connection to it; problem-oriented tro	e topic of the climate system and eatment of associated questions in short
Remarks: Lecture with accompanying seminar		
Workload: Total: 300 h		
Conditions: none		Credit Requirements: Pass the module exam
Frequency: each winter semester winter term	Recommended Semester: 1 2.	Minimal Duration of the Module: 1 semester[s]

Part of the Module: Spezialvorlesung

Mode of Instruction: lecture Language: German / English Contact Hours: 2 ECTS Credits: 5.0

Literature:

IPCC (Intergovernmental Panel on Climate Change): Climate Change 2013. The Physical Science Basis. Fifth Assessment Report, Contribution of Working Group I.

Part of the Module: Begleitseminar

Mode of Instruction: seminar

Language: German / English

Contact Hours: 2 ECTS Credits: 5.0

ECIS Credits: 5

Examination

Klima 1

written exam / length of examination: 90 minutes, graded

Version 1.1.0 (since WS17/18) Person responsible for module: Prof. Dr. Björn Schuller Learning Outcomes / Competences: Knowledge: The students learn the principal concepts of sequential signal processing, signal source separation, an feature extraction and information reduction exemplified by medically relevant audio and bio signals. They further ga insight into machine learning principles such as learning dynamics and context as is needed for many intelligent sign analysis tasks. They will learn about different problems and solutions in the analysis of a variety of signals relevant it the context of health care, wellbeing, and general medical signals analysis. Students will get to know the mindset of modern machine learning, computer-aided health care, and get to know ethical implications. Skills: The students will be able to choose appropriate algorithms of signal processing and machine intelligence, further develop these, design new solutions, and apply these to a broad range of medical signal analysis problems. They will practice to think logically and conceptionally in order to select appropriate solutions to a given task. Studen will be able to recognise important technical developments in the field of signal processing, machine learning and e- Health/m-Health. Competences: The students are able to characterise, judge on the quality and suitability, and design suited algorithmic solutions for intelligent signal analysis with a focus on medical signals. They will further learn how to document and present results in a reasonable and meaningful way. Key skills: Formal methods; Knowledge of advantages and disadvantages of different design alternatives; Systematical advancement of design tools; Ability to work in teams; Knowledge of workflows and processes; Ability to find solutions for practical problems; Ability to work autonomously; Quality awareness; Scientific working; Literatur research. Workload: Total: 150 h 30 h secreise content using literature (self-study) 15 h studying of course content using liter	Module INF-0272: Intelligent Si Intelligente Signalanalyse in der Me		5 ECTS/LF
Knowledge: The students learn the principal concepts of sequential signal processing, signal source separation, an feature extraction and information reduction exemplified by medically relevant audio and bio signals. They further gainsight into machine learning principles such as learning dynamics and context as is needed for many intelligent signal analysis tasks. They will learn about different problems and solutions in the analysis of a variety of signals relevant in the context of health care, wellbeing, and general medical signals analysis. Students will get to know the mindset of modern machine learning, computer-aided health care, and get to know ethical implications. Skills: The students will be able to choose appropriate algorithms of signal processing and machine intelligence, further develop these, design new solutions, and apply these to a broad range of medical signal analysis problems. They will practice to think logically and conceptionally in order to select appropriate solutions to a given task. Student will be able to recognise important technical developments in the field of signal processing, machine learning and e-Health/m-Health. Competences: The students are able to characterise, judge on the quality and suitability, and design suited algorithmic solutions for intelligent signal analysis with a focus on medical signals. They are further able to realise th learn concepts in programs and machine learning models. Participants will be able to analyse and structure comple and processing nucleic group medical advantages of different design alternatives; Systematical advancement of design tools; Ability to work autonomously; Quality awareness; Scientific working; Literatur research. Workload: Totat: 150 h So h exercise course (attendance) So herercises / case studies (self-study) 1	Version 1.1.0 (since WS17/18)		
Knowledge of basic mathematic lectures should be present. Bestehen der Modulprüfung Frequency: irregular Recommended Semester: from 1. Minimal Duration of the Module: 1 semester[s] Contact Hours: 4 Repeat Exams Permitted: according to the examination August Semester:	Knowledge: The students learn the feature extraction and information reinsight into machine learning princip analysis tasks. They will learn about the context of health care, wellbeing	principal concepts of sequential signal p duction exemplified by medically relevan les such as learning dynamics and conte different problems and solutions in the , and general medical signals analysis.	nt audio and bio signals. They further gain ext as is needed for many intelligent signal analysis of a variety of signals relevant in Students will get to know the mindset of
algorithmic solutions for intelligent signal analysis with a focus on medical signals. They are further able to realise th learnt concepts in programs and machine learning models. Participants will be able to analyse and structure comple and practice-oriented problems in the field of m-Health and e-Health and to find suitable and state-of-the-art solution They know how to make scientifically meaningful evaluations of proposed systems. They will further learn how to document and present results in a reasonable and meaningful way. Key skills: Formal methods; Knowledge of advantages and disadvantages of different design alternatives; Systematical advancement of design tools; Ability to work in teams; Knowledge of workflows and processes; Ability to find solutions for practical problems; Ability to work autonomously; Quality awareness; Scientific working; Literatur research. Workload: Total: 150 h 30 h lecture (attendance) 60 h studying of course content through exercises / case studies (self-study) 15 h studying of course content using literature (self-study) 15 h studying of course content using provided materials (self-study) Conditions: Knowledge of basic mathematic lectures should be present. Frequency: irregular Recommended Semester: from 1. Repeat Exams Permitted: according to the examination	further develop these, design new so They will practice to think logically an will be able to recognise important te	olutions, and apply these to a broad rang nd conceptionally in order to select appr	ge of medical signal analysis problems. opriate solutions to a given task. Students
Key skills: Formal methods; Knowledge of advantages and disadvantages of different design alternatives; Systematical advancement of design tools; Ability to work in teams; Knowledge of workflows and processes; Ability to find solutions for practical problems; Ability to work autonomously; Quality awareness; Scientific working; Literatur research. Workload: Total: 150 h 30 h exercise course (attendance) 30 h lecture (attendance) 60 h studying of course content through exercises / case studies (self-study) 15 h studying of course content using literarture (self-study) 15 h studying of course content using provided materials (self-study) Conditions: Knowledge of basic mathematic lectures should be present. Frequency: irregular Recommended Semester: from 1. Contact Hours: Repeat Exams Permitted: according to the examination	algorithmic solutions for intelligent si learnt concepts in programs and ma and practice-oriented problems in th They know how to make scientificall	gnal analysis with a focus on medical si- chine learning models. Participants will l e field of m-Health and e-Health and to t y meaningful evaluations of proposed sy	gnals. They are further able to realise the be able to analyse and structure complex find suitable and state-of-the-art solutions
Total: 150 h 30 h exercise course (attendance) 30 h lecture (attendance) 60 h studying of course content through exercises / case studies (self-study) 15 h studying of course content using literarture (self-study) 15 h studying of course content using provided materials (self-study) 15 h studying of course content using provided materials (self-study) Conditions: Knowledge of basic mathematic lectures should be present. Frequency: irregular Recommended Semester: from 1. 1 semester[s] Contact Hours: 4	Key skills: Formal methods; Knowle Systematical advancement of design to find solutions for practical problem	edge of advantages and disadvantages n tools; Ability to work in teams; Knowled	dge of workflows and processes; Ability
Knowledge of basic mathematic lectures should be present. Bestehen der Modulprüfung Frequency: irregular Recommended Semester: from 1. Minimal Duration of the Module: 1 semester[s] Contact Hours: 4 Repeat Exams Permitted: according to the examination Jean	Total: 150 h 30 h exercise course (attendance) 30 h lecture (attendance) 60 h studying of course content thro 15 h studying of course content usin	g literarture (self-study)	
from 1. 1 semester[s] Contact Hours: Repeat Exams Permitted: according to the examination		ures should be present.	_
4 according to the examination	Frequency: irregular		
regulations of the study program			

Part of the Module: Intelligente Signalanalyse in der Medizin (Vorlesung)

Mode of Instruction: lecture

Language: English

Contact Hours: 2

Contents:

Topics: Basics of Signal Processing, Signal Source Separation, Data Acquisition and Annotation, Audio-Visual Feature Extraction, Machine Learning, e-Health, m-Health, Ethics, Python, Machine Learning Toolkits.

Literature:

Björn Schuller: "Intelligent Audio Analysis", Signals and Communication Technology, Springer, ISBN: 978-3642368059, 2013.

Part of the Module: Intelligente Signalanalyse in der Medizin (Übung)

Mode of Instruction: exercise course Language: English Frequency: irregular (usu. summer semester) Contact Hours: 2

Examination

Intelligente Signalanalyse in der Medizin

written exam / length of examination: 90 minutes, graded

Test Frequency:

	sive Data Sets	8 ECTS/L
Analyzing Massive Data Sets		
Version 1.2.0 (since SoSe18)		
Person responsible for module: Prof. D	r. Peter Michael Fischer	
Learning Outcomes / Competences:		
After attending the course, students wil	I be able to understand and evaluate the	e concepts and methods, procedures,
techniques, and technologies for analy	zing massively large data sets. Possible	content includes:
 Fundamentals of information retr 	ieval	
 Similarity search and clustering 		
 Analysis of data streams and terr 	nporal data	
 Web graphs: Link analysis and set 	ocial networks	
 Dynamic networks and information 	on diffusion	
 Recommender systems and onlir 	-	
 Computational methods for mass 	sive data sets	
Students will also be able to implement	t technical solution concepts for analyzin	g large data sets in programs.
Key Skills: Ability to think logically, and	alytically and conceptually, weigh up app	proaches to solutions, acquire
	pth knowledge; implement subject-speci	
-	ges/disadvantages of design alternatives	-
	dent application of suitable methods; abi	
	ility to solve problems under practical bo	oundary conditions; competence in
recognizing significant technical develo	pments;	
Workload:		
Total: 240 h		
30 h studying of course content using li		
90 h studying of course content through		
30 h studying of course content using p 60 h lecture (attendance)	brovided materials (self-study)	
30 h exercise course (attendance)		
· · ·		
Conditions:		
Module Database Systems (INF-0073)	- recommended	
Madula Diagrafa atmustures for aspendit		
-	er science (INF-0109) - recommended	
Module Discrete structures for compute Module Computer Science 3 (INF-0111	er science (INF-0109) - recommended I) - recommended	
Module Computer Science 3 (INF-0111	er science (INF-0109) - recommended I) - recommended Recommended Semester:	Minimal Duration of the Module:
Module Computer Science 3 (INF-0111 Frequency: Sommersemester	er science (INF-0109) - recommended) - recommended Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Module Computer Science 3 (INF-0111 Frequency: Sommersemester	er science (INF-0109) - recommended) - recommended Recommended Semester: from 1. Repeat Exams Permitted:	
-	er science (INF-0109) - recommended) - recommended Recommended Semester: from 1. Repeat Exams Permitted: according to the examination	
Module Computer Science 3 (INF-0111 Frequency: Sommersemester Contact Hours:	er science (INF-0109) - recommended) - recommended Recommended Semester: from 1. Repeat Exams Permitted:	
Module Computer Science 3 (INF-0111 Frequency: Sommersemester Contact Hours:	er science (INF-0109) - recommended) - recommended Recommended Semester: from 1. Repeat Exams Permitted: according to the examination	
Module Computer Science 3 (INF-0111 Frequency: Sommersemester Contact Hours: 6	er science (INF-0109) - recommended) - recommended Recommended Semester: from 1. Repeat Exams Permitted: according to the examination regulations of the study program	
Module Computer Science 3 (INF-0111 Frequency: Sommersemester Contact Hours: 6 Parts of the Module	er science (INF-0109) - recommended) - recommended Recommended Semester: from 1. Repeat Exams Permitted: according to the examination regulations of the study program	

Frequency: irregular (usu. summer semester)

Contact Hours: 4

Contents:

The lecture covers basic concepts for the analysis of massively large data sets

such as information extraction, similarity search, clustering, link and network analysis

as well as their implementation.

Literature:

- Mining of Massive Datasets. J. Leskovec, A. Rajaraman, J.D. Ullman. Cambridge UniversityPress, 2014
- D. Easley, J. Kleinberg.Networks, Crowds, and Markets: Reasoning About a Highly Connected World.Cambridge University Press, 2010.
- R. Baeza-Yates, B. Ribeiro-Neto: Modern Information Retrieval

Weitere Literatur wird in der Vorlesung bekannt gegeben

Assigned Courses:

Analyzing Massive Data Sets (lecture)

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Part of the Module: Analyzing Massive Data Sets (Übung)

Mode of Instruction: exercise course

Language: English / German

Frequency: irregular (usu. summer semester) Contact Hours: 2

Assigned Courses:

Übung zu Analyzing Massive Data Sets (exercise course)

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Examination

Analyzing Massive Data Sets

portfolio exam, graded

Test Frequency:

Module INF-0279: Music Informatics	5 ECTS/LP
Music Informatics	

Version 1.3.0 (since SoSe18)

Person responsible for module: Prof. Dr. Björn Schuller

Learning Outcomes / Competences:

Knowledge: The course Music Informatics presents the fundamental concepts of music theory and the music language and its representation in the visual, symbolic, and acoustic domain. Several digital formats for music symbolic representation, such as Music XML, MEI, Kern**, and MIDI protocol, as well as open source tools such as LilyPond and Csound will be introduced. Machine learning principles and techniques with applications in music information retrieval and computational musicology will be practically applied. Students will learn about different problems and solutions in the analysis of symbolic and acoustic music data. Students will get to know the mindset from both sides, the musicological and the computer scientist perspective.

Skills: The students will understand the basic principles of music theory and its representation in digital language, being able to analyse, interpret, and create musical samples in a variety of symbolic formats and programming languages. They will learn to apply machine learning procedures, such as feature extraction and pattern recognition, to music information retrieval problems, such as key detection and music-score synchronisation, amongst other. After participation, students will know how to advance existing concepts and approaches in the field of music informatics and data analysis. Furthermore, they will be able to recognise important technical developments in the field of data science and signal processing.

Competences: By integrating basic principles of music theory, its representation in digital language, and machine learning techniques, the students will be able to identify new problems and solutions in the field of music information retrieval considering a variety of musical styles and genres. The students are able to characterise, judge on the quality and suitability, and design suited algorithmic solutions for music data analysis in both the symbolic and the audio domain.

Participants will be able to analyse and structure complex and practice-oriented problems in the field of music informatics and to find suitable solutions, by using state-of-the-art tools and complementary methods, if needed. They know how to make scientifically meaningful evaluations of proposed systems. They will further learn how to document and present results in a reasonable and meaningful way.

Key skills: Computational musicology, Music theory, Digital Music Representation, Basics of Signal Processing, Machine Learning, Music Information Retrieval, Knowledge of advantages and disadvantages of different design alternatives; Systematical advancement of design tools; Ability to work in teams; Knowledge of workflows and processes; Ability to find solutions for practical problems; Ability to work autonomously; Quality awareness; Scientific working; Literature research.

Workload:

Total: 150 h

15 h studying of course content using provided materials (self-study)

60 h studying of course content through exercises / case studies (self-study)

15 h studying of course content using literarture (self-study)

30 h exercise course (attendance)

30 h lecture (attendance)

Conditions: Knowledge of basic mathematic lecture		Credit Requirements: Bestehen der Modulprüfung
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]

Contact Hours:	Repeat Exams Permitted:	
4	according to the examination	
	regulations of the study program	
Parts of the Module		
Part of the Module: Music Infe	ormatics (Lecture)	
Mode of Instruction: lecture		
Language: English		
Frequency: each summer sem	ester	
Contact Hours: 2		
Contents:		
In Music Informatics, the ba	sic principles of music theory will be presented	from both the traditional and
computational point of view.	Music will be evaluated in three domains: visu	ual, symbolic, and acoustic; and for each
of them: formats, programm	ing languages, and machine learning tools wil	be studied. This course will give a basic
introduction to music inform	ation retrieval and computational musicology b	by identify problems and solutions for
different kinds of musical ge	enres and styles.	
Literature:		
 Meinard Müller: "Fund ISBN: 978-3-319-219 	damentals of Music Processing: Audio, Analys. 44-8, 2015.	is, Algorithms, Applications." Springer,
 Björn Schuller: "Intelli 	gent Audio Analysis", Signals and Communica	tion Technology, Springer, ISBN:
978-3642368059, 201		
Part of the Module: Music Info	ormatics (Tutorial)	
Mode of Instruction: exercise	course	
Language: English		
Frequency: each summer sem	ester	
Contact Hours: 2	_	
Examination		
Music Informatics		
written exam / length of exa	mination: 90 minutes, graded	

Test Frequency:

Module INF-0293: Advanced Deep Learning Advanced Deep Learning	8 ECTS/LP
Version 1.0.0 (since WS18/19)	

Person responsible for module: Prof. Dr. Rainer Lienhart

Learning Outcomes / Competences:

After participating in the practical module, students have detailed and up-to-date knowledge in the field of machine learning, can identify significant technical developments and can implement a complete pipeline for multimodal data processing with deep neural networks. They can precisely describe and discuss problems and results in the field and apply learned concepts and methods to similar problems in machine learning. In addition, the students analyse advanced concepts, methods, procedures, techniques and technologies from the field of machine learning to apply them in research projects, transfer them to current industry-related tasks and actively participate in them. The students learn to transfer scientifically challenging topics in the field of machine learning to other research questions and, building on this, to work out a complex project in group work. They also have the teamwork and communication skills to discuss problems in the field, to discuss, describe and present questions and interim results. In addition, students can conduct detailed experiments and assess, compare and check results for plausibility.

Key qualifications:

Advanced mathematical-formal methodology; Translating subject-specific solution concepts into programs and models; Methods for developing larger software systems, construction of abstractions and architectures; Interdisciplinary knowledge; Systematic further development of design methods; Skill of confident and convincing presentation of ideas and concepts; Understanding of team processes; Skill of working in teams; Ability to lead teams; Familiarity with procedures and processes in the application environment of computer science; Skill of solving problems under practical boundary conditions; Self-reflection; Responsible action against the background of inadequacy and conflicting interests; Ability to expand existing knowledge independently; Quality awareness, meticulousness

Workload:

Total: 240 h

30 h studying of course content using provided materials (self-study)

30 h studying of course content using literarture (self-study)

120 h studying of course content through exercises / case studies (self-study)

20 h lecture (attendance)

40 h exercise course (attendance)

Conditions:		Credit Requirements:
Fundamental knowledge in computer "Multimedia Grundlagen 1", "Grundlag Maschinellen Lernens", "Multimedia C lectures "Multimedia 2" and "Machine	gen der Signalverarbeitung und des Grundlagen 2" as well as master's	Passing the portfolio examination
Frequency: each winter semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 6	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Advanced Deep Learning (Lecture) Mode of Instruction: lecture Language: German Contact Hours: 2

Contents:

- Deep Learning in general
- Deep Convolutional Neural Networks
- Transfer Learning
- Recurrent Neural Networks / LSTM Networks
- Natural Language Processing
- Multimodal Fusion (Vision+Language)
- Application: Image Captioning

Part of the Module: Advanced Deep Learning (Tutorial)

Mode of Instruction: exercise course

Language: German

Contact Hours: 4

Examination

Advanced Deep Learning

portfolio exam, The final grade is made up of assessed exercise sheets and an assessed team project., graded **Test Frequency:**

Module INF-0294: Speech Pathology Speech Pathology	5 ECTS/LP
Version 1.1.0 (since WS18/19) Person responsible for module: Prof. Dr. Björn Schuller	
Learning Outcomes / Competences:	
Knowledge: The students learn concepts relating to signal processing, speech language pathology, speech analysis, feature extraction, denoising and informat the analysis of automated voice pathology detection. They further gain insight in a particular focus on deep learning solutions, as is needed to diagnose a range will learn about different problems and solutions in the analysis of a variety of sp care and wellbeing.	tion reduction as exemplified through nto machine learning principles, with of different voice pathologies. They
Skills: The students will be able to choose appropriate algorithms of signal prod further develop these, design new solutions, and apply these to the task of voice how to analyse and structure complex problems in the field, to employ suitable transfer knowledge to similar tasks. After participation in the course, they will be models into programs. Students will be able to assess developed systems in a evolution and novelties in the fields of speech analysis and medical machine lea	e pathology detection. They will know approaches to solve them, and to able to implement approaches and scientific way. Important technical

Competences: The students are able to characterise, judge on the quality and suitability, and design suited algorithmic solutions for intelligent signal analysis with a focus on voice pathology detection. They are further able to present and document results in a reasonable and meaningful way.

Key skills: Formal methods; Knowledge of advantages and disadvantages of different design alternatives; Systematical advancement of design tools; Ability to work in teams; Knowledge of workflows and processes; Ability to find solutions for practical problems; Ability to work autonomously; Quality awareness; Scientific working; Literature research.

Workload:

Total: 150 h

60 h studying of course content through exercises / case studies (self-study)

15 h studying of course content using literarture (self-study)

15 h studying of course content using provided materials (self-study)

30 h exercise course (attendance)

30 h lecture (attendance)

Conditions: Knowledge of basic mathematic lecture		Credit Requirements: Bestehen der Modulprüfung
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 4	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Speech Pathology (Vorlesung) Mode of Instruction: lecture Language: English Contact Hours: 2

Valid Sommersemester 2024 - Printed 08.04.2024

Contents:

The course "Pathological Speech" will give an introduction to models of speech production (e.g., source-filter models) with a focus on aspects that are relevant to pathologies and their recognition using automated methods of signal processing and machine learning. Moreover, students learn about robust feature extraction, modern methods of machine learning and machine intelligence, and implementation of such systems on devices

Topics: Speech production; Phonetics; Speech and language pathology; Signal processing; Natural language processing; Speech analysis; Feature extraction; Machine learning; Deep learning; Denoising; Information reduction; Healthcare.

Literature:

- Björn Schuller, Anton Batliner: "Computational Paralinguistics: Emotion, Affect and Personality in Speech and Language Processing", Wiley, ISBN: 978-1119971368, 2013.
- Further literature is going to be announced during the lecture.

Part of the Module: Speech Pathology (Übung)

Mode of Instruction: exercise course Language: English

Contact Hours: 2

Examination

Speech Pathology

written exam / length of examination: 90 minutes, graded

Test Frequency:

Module INF-0307: Model-Based E Software Systems Modellbasierte Entwicklung und Analys		6 ECTS/LF
Version 1.1.0 (since SoSe19) Person responsible for module: Prof. D	r. Bernhard Bauer	
hrough automation and reuse. In the c development of software systems. The evaluate current technologies and stan participants build up skills for analyzing subsystems, configurations, or entire a	s of software systems deal with increas ourse, participants learn to apply and o y develop in-depth, subject-specific so dards for MDSD and analyze their app	compare methods for the model-driven lution concepts for MDSD. They can licability in practice-relevant tasks. The in the generation of infrastructure code, ney develop logical, analytical, and
communication skills; ability to expand procedures and processes in the applic	vledge; competence in networking diffe existing knowledge independently; qua cation environment of computer scienc t and document results in an understan	ality awareness; familiarity with e; knowing and understanding formal
Workload: Fotal: 180 h 23 h studying of course content using l 22 h studying of course content using p 30 h exercise course (attendance) 45 h lecture (attendance) 60 h studying of course content throug	provided materials (self-study)	
Conditions: Due to overlaps, the previous course "I must not have been taken.	Model-Driven Software Development"	
Frequency: irregular (usu. summer semester)	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours:	Repeat Exams Permitted: according to the examination	

Parts of the Module

Part of the Module: Modellbasierte Entwicklung und Analyse von Software Systemen (Vorlesung)

Mode of Instruction: lecture

Language: German

Contact Hours: 3

Contents:

Model-based development and analysis of software systems are concerned with increasing software production efficiency through automation and reuse. Infrastructure code, subsystems, configurations, or entire applications are generated from models.

Literature:

- slides
- Pohl et al. Software Product Line Engineering: Foundations, Principles, and Techniques
- Kleppe et al: MDA explained
- Hitz et al: UML@Work
- Further literature in the lecture

Part of the Module: Modellbasierte Entwicklung und Analyse von Software Systemen (Übung)

Mode of Instruction: exercise course Language: German Contact Hours: 2

Examination

Modellbasierte Entwicklung und Analyse von Software Systemen

oral exam / length of examination: 30 minutes, graded

Test Frequency:

Module INF-0308: Software-intensive Systeme	nsive Systems	6 ECTS/LP
Version 1.2.0 (since SoSe19) Person responsible for module: Prof.	Dr. Bernhard Bauer	
technical solution concepts into mode can describe the advantages and disa application context (K6). Problems ca (K5) and realized (K3). Furthermore, t enterprise architectures and know the name practice-relevant issues in ente for architecture creation and evaluation	6), and document software architectures. Is and know methods for developing such advantages of design alternatives (K4) and n be identified independently (K4), and so hey have developed skills for the analysis concepts and procedures for creating su- rprise architectures (K1). They can select on. The students know modeling language the competence to recognize significant teo	a abstractions and architectures. They d evaluate them in the respective olutions can be designed systematically s and structuring of problems in ch architectures. The students can and confidently apply suitable methods is and patterns to create software and
	vork different subject areas; ability to work ndependently; quality awareness; skill to p ence and professional qualification.	
Workload: Total: 180 h 22 h studying of course content using 23 h studying of course content using 45 h lecture (attendance) 60 h studying of course content throug 30 h exercise course (attendance)		
Conditions: The previous course "Software Archite Management" and the course "Softwa Devices" must not have been taken d	re-intensive Systems and Medical	
Frequency: Sommersemester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 5	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Software-intensive Systeme (Vorlesung)

Mode of Instruction: lecture

Language: German

Contact Hours: 3

Contents:

The lecture content includes patterns, modelling techniques and the evaluation of software architectures. Furthermore, the area of enterprise architecture management is addressed.

Literature:

- Bass et al: Software Architecture in Practice
- Clements et al: Documenting Software Architectures
- Clements et al: Evaluation of Software Architectures
- Kopetz: Real-Time Systems

Assigned Courses:

Software-intensive Systeme (lecture)

**

Part of the Module: Software-intensive Systeme (Übung)

Mode of Instruction: exercise course

Language: German

Contact Hours: 2

Assigned Courses:

Übung zu Software-intensive Systeme / Software-intensive Systeme und Medizinprodukte (exercise course)

Examination

Software-intensive Systeme

oral exam / length of examination: 30 minutes, graded

Test Frequency:

Module INF-0309: Real-Time S Echtzeitsysteme	Systems	8 ECTS/LF
Version 1.7.0 (since WS19/20) Person responsible for module: Prof. Dr. Sebastian Altmeyer		
systems, but especially in the areas	nced knowledge of real-time systems as	The theoretical foundations will be based
real-time requirements. Students wi timing behavior with respect to poss real-time schedules and their verific detail about the specifics of single-c	Il learn to apply, compare, and critically a sible certification of timing behavior. This ation. The lecture will also cover differen core and multi-core processors in the real suitability for real-time systems and to inv	includes the optimization and selection of t processor types, and will go into more
The course material will be exempli students using a simple real-time sy	fied by case studies from the automotive vstem.	and aerospace fields and applied by the
solutions to exercise problems; skill	nodical competence, consideration of app in presenting and documenting results in idently; quality awareness, meticulousne y and conflicting interests.	a comprehensible manner; ability to
Workload:		
Total: 240 h	ag literature (aelf atudu)	
Total: 240 h 30 h studying of course content usir		
Total: 240 h 30 h studying of course content usir	ough exercises / case studies (self-study)	
Total: 240 h 30 h studying of course content usir 90 h studying of course content thro 30 h studying of course content usir 60 h lecture (attendance)	ough exercises / case studies (self-study)	
Total: 240 h 30 h studying of course content usir 90 h studying of course content thro 30 h studying of course content usir 60 h lecture (attendance) 30 h exercise course (attendance)	ough exercises / case studies (self-study)	
Total: 240 h 30 h studying of course content usir 90 h studying of course content thro 30 h studying of course content usir 60 h lecture (attendance)	ough exercises / case studies (self-study)	
Total: 240 h 30 h studying of course content usir 90 h studying of course content thro 30 h studying of course content usir 60 h lecture (attendance) 30 h exercise course (attendance) Conditions:	ough exercises / case studies (self-study)	Minimal Duration of the Module: 1 semester[s]

Part of the Module: Echtzeitsysteme (Vorlesung)

Mode of Instruction: lecture Language: German / English

Contact Hours: 4

Contents:

- WCET Analysis
- Scheduling Analysis
- · Programming of real-time systems
- Processors for real-time systems
- · Real-time operating systems
- · Certification of real-time systems

Literature:

- Sanjoy Baruah, Marko Bertogna, Giorgio Buttazzo, Multiprocessor Scheduling for Real-Time Systems, Springer, 2015.
- Giorgio Buttazzo, Hard Real-Time Computing Systems: Predictable Scheduling Algorithms and Applications, Springer, 2011.
- Heinz Wörn, Uwe Brinkschulte, Echtzeitsysteme, Springer Verlag, Berlin/Heidelberg, 2005
- Uwe Brinkschulte, Theo Ungerer, Mikrocontroller und Mikroprozessoren, Springer Verlag, Heidelberg, dritte Auflage 2010

Part of the Module: Echtzeitsysteme (Übung)

Mode of Instruction: exercise course

Language: German

Contact Hours: 2

Examination

Echtzeitsysteme

oral exam / length of examination: 30 minutes, graded

Test Frequency:

this semester

Module INF-0315: Deep Learn	ning	5 ECTS/LP
Deep Learning		
Version 1.4.0 (since SoSe19)		
Person responsible for module: Pr	rof. Dr. Björn Schuller	
Learning Outcomes / Competen	ces:	
The course Deep Learning covers	the historical and formal fundamentals of I	Neural Networks, as well as the core
principles of Machine Learning and	d data modelling.	
	ents will have the skills and knowledge to b	
	cific tasks and know the pros and cons of d	-
	ey will be able to apply and implement the	
	ill have the ability to analyse Deep Neural I	Network-based models and to design
novel architectures and training me		l and concentual thinking. Students will
	s will improve their skills in logical, analytica Ily meaningful assessments in the field of n	
• •	t used to the way of thinking and the langua	• •
	bility to, convincingly, present their develop	
-	ractical tasks and solve many real-life probl	
	o develop the competence to identify signifi	• • • • • • •
Key qualifications: analytical skil	lls, data science cross-disciplinary knowled	ge, procedures and processes in creating
practical avatama chility to process	nt and document results in a comprehensib	a way, akill to ache probleme under
practical systems, ability to presen	it and document results in a comprehensio	le way, skill to solve problems under
	, quality awareness, meticulousness, team	
practical conditions, self-reflection	-	
practical conditions, self-reflection	-	
practical conditions, self-reflection Workload: Total: 150 h	-	
practical conditions, self-reflection Workload: Total: 150 h 15 h studying of course content us 15 h studying of course content us	, quality awareness, meticulousness, team sing provided materials (self-study) sing literarture (self-study)	
practical conditions, self-reflection Workload: Total: 150 h 15 h studying of course content us 15 h studying of course content us 60 h studying of course content the	, quality awareness, meticulousness, team sing provided materials (self-study)	
practical conditions, self-reflection, Workload: Total: 150 h 15 h studying of course content us 15 h studying of course content us 60 h studying of course content the 30 h lecture (attendance)	, quality awareness, meticulousness, team sing provided materials (self-study) sing literarture (self-study) rough exercises / case studies (self-study)	
practical conditions, self-reflection Workload: Total: 150 h 15 h studying of course content us 15 h studying of course content us	, quality awareness, meticulousness, team sing provided materials (self-study) sing literarture (self-study) rough exercises / case studies (self-study)	
practical conditions, self-reflection Workload: Total: 150 h 15 h studying of course content us 15 h studying of course content us 60 h studying of course content the 30 h lecture (attendance) 30 h exercise course (attendance)	, quality awareness, meticulousness, team sing provided materials (self-study) sing literarture (self-study) rough exercises / case studies (self-study)	
practical conditions, self-reflection, Workload: Total: 150 h 15 h studying of course content us 15 h studying of course content us 60 h studying of course content the 30 h lecture (attendance) 30 h exercise course (attendance) Conditions:	, quality awareness, meticulousness, team sing provided materials (self-study) sing literarture (self-study) rough exercises / case studies (self-study)	work
practical conditions, self-reflection, Workload: Total: 150 h 15 h studying of course content us 15 h studying of course content us 60 h studying of course content the 30 h lecture (attendance) 30 h exercise course (attendance) Conditions: Knowledge of basic mathematic le	, quality awareness, meticulousness, team sing provided materials (self-study) sing literarture (self-study) rough exercises / case studies (self-study)	work Credit Requirements:
practical conditions, self-reflection, Workload: Total: 150 h 15 h studying of course content us 15 h studying of course content us 60 h studying of course content the 30 h lecture (attendance) 30 h exercise course (attendance) Conditions: Knowledge of basic mathematic le	, quality awareness, meticulousness, team sing provided materials (self-study) sing literarture (self-study) rough exercises / case studies (self-study)	work Credit Requirements: Bestehen der Modulprüfung
practical conditions, self-reflection, Workload: Total: 150 h 15 h studying of course content us 15 h studying of course content us 60 h studying of course content the 30 h lecture (attendance)	, quality awareness, meticulousness, team sing provided materials (self-study) sing literarture (self-study) rough exercises / case studies (self-study) ectures should be present. Recommended Semester: from 1.	Work Credit Requirements: Bestehen der Modulprüfung Minimal Duration of the Module:
practical conditions, self-reflection, Workload: Total: 150 h 15 h studying of course content us 15 h studying of course content us 60 h studying of course content the 30 h lecture (attendance) 30 h exercise course (attendance) Conditions: Knowledge of basic mathematic le Frequency: irregular	, quality awareness, meticulousness, team sing provided materials (self-study) sing literarture (self-study) rough exercises / case studies (self-study) ectures should be present. Recommended Semester: from 1. Repeat Exams Permitted:	Work Credit Requirements: Bestehen der Modulprüfung Minimal Duration of the Module:
practical conditions, self-reflection, Workload: Total: 150 h 15 h studying of course content us 15 h studying of course content us 60 h studying of course content the 30 h lecture (attendance) 30 h exercise course (attendance) Conditions: Knowledge of basic mathematic le Frequency: irregular Contact Hours:	, quality awareness, meticulousness, team sing provided materials (self-study) sing literarture (self-study) rough exercises / case studies (self-study) ectures should be present. Recommended Semester: from 1.	Work Credit Requirements: Bestehen der Modulprüfung Minimal Duration of the Module:
practical conditions, self-reflection, Workload: Total: 150 h 15 h studying of course content us 15 h studying of course content us 60 h studying of course content the 30 h lecture (attendance) 30 h exercise course (attendance) Conditions: Knowledge of basic mathematic le Frequency: irregular Contact Hours:	, quality awareness, meticulousness, team sing provided materials (self-study) sing literarture (self-study) rough exercises / case studies (self-study) ectures should be present. Recommended Semester: from 1. Repeat Exams Permitted: according to the examination	Work Credit Requirements: Bestehen der Modulprüfung Minimal Duration of the Module:
practical conditions, self-reflection, Workload: Total: 150 h 15 h studying of course content us 15 h studying of course content us 60 h studying of course content the 30 h lecture (attendance) 30 h exercise course (attendance) Conditions: Knowledge of basic mathematic le Frequency: irregular Contact Hours: 4	, quality awareness, meticulousness, team sing provided materials (self-study) sing literarture (self-study) rough exercises / case studies (self-study) ectures should be present. Recommended Semester: from 1. Repeat Exams Permitted: according to the examination regulations of the study program	Work Credit Requirements: Bestehen der Modulprüfung Minimal Duration of the Module:
practical conditions, self-reflection, Workload: Total: 150 h 15 h studying of course content us 15 h studying of course content us 60 h studying of course content the 30 h lecture (attendance) 30 h exercise course (attendance) Conditions: Knowledge of basic mathematic le Frequency: irregular Contact Hours: 4 Parts of the Module	, quality awareness, meticulousness, team sing provided materials (self-study) sing literarture (self-study) rough exercises / case studies (self-study) ectures should be present. Recommended Semester: from 1. Repeat Exams Permitted: according to the examination regulations of the study program	Work Credit Requirements: Bestehen der Modulprüfung Minimal Duration of the Module:
practical conditions, self-reflection, Workload: Total: 150 h 15 h studying of course content us 15 h studying of course content us 60 h studying of course content the 30 h lecture (attendance) 30 h exercise course (attendance) Conditions: Knowledge of basic mathematic le Frequency: irregular Contact Hours: 4 Parts of the Module Part of the Module: Deep Learni	, quality awareness, meticulousness, team sing provided materials (self-study) sing literarture (self-study) rough exercises / case studies (self-study) ectures should be present. Recommended Semester: from 1. Repeat Exams Permitted: according to the examination regulations of the study program	Work Credit Requirements: Bestehen der Modulprüfung Minimal Duration of the Module:

Contents:

Perceptron, Feed-forward Neural Networks, Gradient-based Learning, Backpropagation, Recurrent Neural Networks, Convolutional Neural Networks, Autoencoders, Transfer Learning, Generative Adversarial Nets, Attention, Connectionist Temporal Classification, Data Preprocessing, Evaluation, Audio Classification, Object Detection, Natural Language Processing

Literature:

Ian Goodfellow; Yoshua Bengio; Aaron Courville (2016). Deep Learning. Cambridge, Massachusetts: MIT Press.

Further literature is going to be announced during the lecture.

Part of the Module: Übung zu Deep Learning

Mode of Instruction: exercise course

Language: German

Contact Hours: 2

Examination

Deep Learning

written exam / length of examination: 90 minutes, graded

Test Frequency:

Machine Learning and Computer Visio	<pre>iing and Computer Vision n</pre>	8 ECTS/LF
Version 1.0.0 (since SoSe19) Person responsible for module: Prof. D	r. Rainer Lienhart	
learning theory), data reduction (e.g. p and are able to apply them. They can a procedures in the field of multimedia da problems. They develop skills in logica multimedia data processing. Key qualifications : advanced mathem	odule, students possess advanced know I networks, hypothesis evaluation, insta rincipal component analysis), advanced analyse, understand and programmatic ata processing, as well as to appropriat I, analytical and conceptual thinking in natical-formal logic; implementation of s ent and implementation of solution strat	ance-based learning, Bayesian learning, I image processing and machine vision ally implement scientifically complex ely apply the principles learned to new the field of digital signal processing and subject-specific solution concepts; egies for complex problems; systematic
Workload:		
Total: 240 h		
,		
30 h exercise course (attendance) 60 h lecture (attendance)		
60 h lecture (attendance) 30 h studying of course content using p 90 h studying of course content throug	h exercises / case studies (self-study)	
60 h lecture (attendance) 30 h studying of course content using p	h exercises / case studies (self-study)	
60 h lecture (attendance) 30 h studying of course content using p 90 h studying of course content throug 30 h studying of course content using l Conditions:	h exercises / case studies (self-study)	Minimal Duration of the Module: 1 semester[s]

Parts of the Module

Part of the Module: Machine Learning and Computer Vision (Lecture)

Mode of Instruction: lecture

Language: German

Contact Hours: 4

Contents:

The lecture gives a good overview of all aspects of machine learning and machine extraction of information from multimedia data (e.g. "Google Image Search", "Google Goggles"). The learned concepts will be practised, analysed, and evaluated in the exercises using successful examples from practice. At the end of the semester, advanced topics such as object detection and object recognition of faces and people will be covered. The contents of the lecture include: Machine Learning (Decision Tree Learning, Artificial Neural Networks, Bayesian Learning, Discrete Adaboot), Data Reduction (Quantization (K-Means Clustering, Affinity Propagation), Dimensionality Reduction Techniques (PCA, NMF, Random Projection, MDS)) and Image Processing & Computer Vision (Salient Feature Points and Feature Descriptors, Object Detection (Face/Car/People Detection), Object Recognition (Face Recognition), Image Search with pLSA).

Literature:

Literature references will be announced at the beginning of the semester.

Assigned Courses:

Machine Learning and Computer Vision (lecture)

**

Part of the Module: Machine Learning and Computer Vision (Tutorial)

Mode of Instruction: exercise course

Language: German

Contact Hours: 2

Assigned Courses:

Übung zu Machine Learning and Computer Vision (exercise course)

Examination

**

Machine Learning and Computer Vision (Exam)

written exam / length of examination: 120 minutes, graded

Test Frequency:

each semester

Description:

The examination can be taken every semester during the examination period.

Module INF-0367: Advanced Ma Vision	achine Learning and Computer	5 ECTS/LP
Version 1.0.0 (since WS20/21)		
Person responsible for module: Prof.	Dr. Rainer Lienhart	
(support vector machines and deep r network architectures and systems) a implement scientifically complex proc appropriately apply the principles lea thinking in the field of machine learni Key qualifications : advanced mathe implementation of technical solution solution strategies of complex proble	nodule, students have in-depth advance neural networks and their basic building h and can apply these. They can analyse, redures in the field of image, text, video a rned to new problems. They develop skil ng and vision.	blocks) and machine vision (deep neural understand and programmatically and signal processing, as well as to lls in logical, analytical and conceptual
under practical boundary conditions		
Workload: Total: 150 h 30 h lecture (attendance) 60 h studying of course content throu 30 h exercise course (attendance) 15 h studying of course content using 15 h studying of course content using	· · · · ·	
Conditions: Kenntnisse in maschinellem Lernen und maschinellem Sehen (Master- Vorlesung INF-0092 "Multimedia II" bzw. INF-0316 "Machine Learning and Computer Vision")		Credit Requirements: Bestehen der Modulprüfung
Frequency: each winter semester	Recommended Semester: from 2.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 4	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Advanced Machine Learning and Computer Vision (Lecture)

Mode of Instruction: lecture

Language: German

Contact Hours: 2

Contents:

The lecture gives an in-depth insight into all aspects of machine learning and machine vision. The concepts learned will be practiced, analyzed and evaluated in the exercises using successful real-world examples. The contents of the lecture include: support vector machines, basic building blocks of deep neural networks (layer structures, normalization, attention mechanisms), as well as current reference architectures and systems for image, text, video processing and their combination with further sensor signals.

Literature:

Will be announced at the beginning of the semester.

Part of the Module: Advanced Machine Learning and Computer Vision (Tutorial)

Mode of Instruction: exercise course Language: German Contact Hours: 2

Examination

Advanced Machine Learning and Computer Vision (Examination)

written exam / length of examination: 90 minutes, graded

Test Frequency:

each semester

Description:

The examination can be taken every semester during the examination period.

Module INF-0371: Approximation Approximation Algorithms	Algorithms	5 ECTS/LF
Version 1.3.0 (since WS20/21) Person responsible for module: Prof. D	r. Tobias Mömke	
Learning Outcomes / Competences: Developing an understanding of centra mathematical tools to analyze algorithr problems. Key Skills: Ability to build intuitive und	I topics in the field of approximation a ns; improve the ability to abstract and	systematically solve optimization
optimization problems; deep understar	_	
Workload: Total: 150 h 30 h exercise course (attendance) 30 h lecture (attendance) 60 h studying of course content throug 15 h studying of course content using p 15 h studying of course content using p	iterarture (self-study)	
Conditions: Basic knowledge of Algorithms and Da Informatik 3") and Theoretical Compute in die Theoretische Informatik").		Credit Requirements: Passing the module exam
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 4	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Approximation Algorithms (Vorlesung)

Mode of Instruction: lecture Language: German / English

Contact Hours: 2

Contents:

Given an NP-hard optimization problem, how well can it be approximated in polynomial time? It is exciting and challenging to understand the approximability of fundamental optimization problems. This course mainly focuses on upper bounds, i.e., designing efficient approximation algorithms.

In this course, we will study several classes of problems, such as packing problems, network design, and graph problems. We will cover central algorithmic techniques for designing approximation algorithms, including greedy algorithms, dynamic programming, linear and semi-definite programming, and randomization.

Literature:

- David P. Williamson and David B. Shmoys, The Design of Approximation Algorithms, Cambridge University Press.
- Vijay V. Vazirani, Approximation Algorithms, Springer.

Part of the Module: Approximation Algorithms (Übung)

Mode of Instruction: exercise course Language: English / German

Canguage. English? Gen

Contact Hours: 2

Examination

Approximation Algorithms

portfolio exam / length of examination: 120 minutes, graded

Test Frequency:

Module INF-0380: Digital Health Digital Health

Version 1.0.0 (since SoSe21) Person responsible for module: Prof. Dr. Björn Schuller

Learning Outcomes / Competences:

Knowledge: Digital health is the use of information and communication technology for disease prevention and treatment. Students will get to know the key concepts, definitions, and technologies in the field of digital health. They will get insights into acceptability and usability of digital health applications in the context of various diseases such as depression, multiple sclerosis, and autism spectrum disorder. They will learn strategies for collecting medically-relevant data of various modalities, e.g., recording speech data using microphones or tracking heart rate via wearables. They will then learn about principal concepts of intelligent biosignal processing and analysis including feature extraction and machine learning in the context of healthcare applications. Finally, students will be made familiar with current and potential future implications of intelligent biosignal analysis to the health sector as well as sensitised to related ethical and data privacy aspects.

Skills: Students will be familiar with the basic concepts of digital health and its fields of application in modern healthcare. Students will be able to select appropriate methodology or design new approaches to be applied to a broad range of health-related signal processing and analysis tasks. Moreover, they will practice logical and conceptual thinking and combine knowledge of state-of-the-art technology and medical requirements in order to develop solutions for real-world scenarios in a healthcare context.

Competences: Students are prepared to work closely with healthcare professionals in interdisciplinary research and intervention projects. Students are able to plan and carry out medical data collections for health-related biosignal analysis tasks under consideration of ethical principles and data privacy regulations. They can cope with tools to extract meaningful information from the collected data. Furthermore, they know how to characterise and judge on the quality and suitability of existing approaches as well as design new intelligent biosignal processing and analysis solutions for healthcare applications. They are further able to realise the learnt concepts in programs and know how to make scientifically meaningful performance evaluations of the proposed systems.

Key skills: Formal methods; Knowledge of advantages and disadvantages of different design alternatives; Systematical advancement of design tools; Ability to work in teams; Knowledge of workflows and processes; Ability to find solutions for practical problems; Ability to work autonomously; Quality awareness; Scientific working; Literature research.

Workload:		
Total: 150 h		
30 h exercise course (attendance)		
60 h studying of course content through	ugh exercises / case studies (self-study)	
30 h lecture (attendance)		
15 h studying of course content usin	g literarture (self-study)	
15 h studying of course content usin	g provided materials (self-study)	
Conditions:		Credit Requirements:
Basic knowledge of mathematics as well as interest in healthcare applications		Bestehen der Modulprüfung
should be present.		
Frequency: irregular	Recommended Semester:	Minimal Duration of the Module:
	from 1.	1 semester[s]
Contact Hours:	Repeat Exams Permitted:	
4	according to the examination	
	regulations of the study program	
	1	

Parts of the Module

Part of the Module: Digital Health (Vorlesung)

Mode of Instruction: lecture

Language: English

Contact Hours: 2

Contents:

Public health, personalised medicine, usability, Internet of Things, digital health interventions, self-tracking, digital biomarker, medical data acquisition, wearables, digital signal processing, signal enhancement, feature extraction, machine learning, ethics, and data privacy.

Literature:

Panesar, A (2019): Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes. Coventry, UK: Apress.

Part of the Module: Digital Health (Übung) Mode of Instruction: exercise course

Language: English Frequency: irregular (usu. summer semester) Contact Hours: 2

Examination

Digital Health

written exam / length of examination: 90 minutes, graded

Test Frequency:

r Big Data	5 ECTS/LP
Dr. Tobias Mömke	
entral copetences in algorithm design for em can be accessed without restrictions ms; improvement of copetences in abstr	; aquisition of knowledge of act thinking and analyzing problems in a
_	
h exercises / case studies (self-study)	
	Credit Requirements: Bestehen der Modulprüfung
Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Repeat Exams Permitted: according to the examination	
	Dr. Tobias Mömke : entral copetences in algorithm design for em can be accessed without restrictions ms; improvement of copetences in abstr o an intuitive understanding of mathemat ; deep understanding of useful mathema provided materials (self-study) gh exercises / case studies (self-study) literarture (self-study) ta structures (for example Informatik 3 for example Stochastik für Informatiker Recommended Semester: from 1. Repeat Exams Permitted:

Part of the Module: Algorithms for Big Data (lecture)

Mode of Instruction: lecture

Language: German / English

Contact Hours: 2

Contents:

In modern data processing, we increasingly have the problem that there are large quantities of data which con only be stored on cheap and slow mass storage media. Algorithmically, this poses the problem that at each point in time, we can only access a snapshot of the data, for example in a sequential manner. In the course, we study algorithms that despite such limitations provably yield high quality results.

Literature:

Wissenschaftliche Papiere, Surveys, Skripte

Assigned Courses:

Algorithmen für Big Data (lecture)

**

Part of the Module: Algorithms for Big Data (exercise)

Mode of Instruction: exercise course

Language: English / German

Contact Hours: 2

Assigned Courses:

Übung zu Algorithmen für Big Data (exercise course)

Examination

**

Algorithms for Big Data

portfolio exam / length of examination: 90 minutes, graded

Test Frequency:

Module INF-0398: Software-intensive Systems and Medical Products Software-intensive Systeme und Medizinprodukte	6 ECTS/LP
Version 1.0.0 (since WS21/22) Person responsible for module: Prof. Dr. Bernhard Bauer	
Learning Outcomes / Competences: Students can create (K3), evaluate (K6), and document software architecture To this end, they can transfer technical solution concepts into models and kn abstractions and architectures. Such abstractions and architectures. They can describe the advantages and (K4). (K4) and can evaluate them in the respective application context (K6). Proble and solutions can be designed systematically (K5) and realized (K3).	ow methods for developing such disadvantages of design alternatives
Furthermore, they have basic knowledge of creating medical software accord for conformity assessment. Based on the European Medical Device Regulation mplement the required software life cycle process according to IEC 62304 at software requirement management, the link between (agile) software develop requirements regarding safety and security.	on (MDR), students learn how to nd IEC 82304, the requirements for
Key qualifications: Competence in networking different specialist areas; team to expand existing knowledge independently; quality awareness; ability to pre understandable way; practical experience and professional qualifications.	-
Workload: Total: 180 h 23 h studying of course content using literarture (self-study) 22 h studying of course content using provided materials (self-study) 60 h studying of course content through exercises / case studies (self-study) 45 h lecture (attendance) 30 h exercise course (attendance)	
Conditions: The previous course "Software Architectures and Enterprise Architecture Management" and the course "Software-intensive Systems" must not have been taken due to overlaps.	
Frequency: Sommersemester Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: Repeat Exams Permitted: 5 according to the examination regulations of the study program	
Parts of the Module	

Part of the Module: Software-intensive Systeme und Medizinprodukte (Vorlesung)

Mode of Instruction: lecture

Language: German

Contact Hours: 3

Contents:

The lecture content includes patterns, modelling techniques and the evaluation of software architectures. Furthermore, the development of medical devices is dealt with.

Literature:

- Bass et al: Software Architecture in Practice
- · Clements et al: Documenting Software Architectures
- · Clements et al: Evaluation of Software Architectures
- Richard N. Taylor, Nenad Medvidovic, and Eric M. Dashofy; Software Architecture: Foundations, Theory, and Practice
- BSI Empfehlungen für Medizinprodukte
- ZVE Empfehlungen für Medizinprodukte

Assigned Courses:

Software-intensive Systeme und Medizinprodukte (lecture)

**

Part of the Module: Software-intensive Systeme und Medizinprodukte (Übung)

Mode of Instruction: exercise course

Language: German

Contact Hours: 2

Assigned Courses:

Übung zu Software-intensive Systeme / Software-intensive Systeme und Medizinprodukte (exercise course)
**

Examination

Software-intensive Systeme

oral exam / length of examination: 30 minutes, graded

Test Frequency:

Module INF-0400: Knowledge Representation in Biomedicine Knowledge Representation in Biomedicine	5 ECTS/LF
Version 1.2.0 (since WS21/22) Person responsible for module: Prof. Dr. Frank Kramer Dr. Zaynab Hammoud	
Learning Outcomes / Competences: Students will have an understanding (K2) of the historical development of kn biomedicine and can articulate this knowledge (K1). They will possess a dee and the Semantic Web (K2). They will be able to apply this knowledge to van describe their components (K4). Students will develop an understanding of k in knowledge representation (K2) and can independently describe (K2), appl develop them (K5). They should comprehend the significance of terminologic classifications, being able to classify and explain them (K1, K2). Furthermore to conceptualize, develop, and apply ontologies for modeling and describing Additionally, students will gain an understanding of various data formats, par Framework) (K2). The module also aims to teach the skills to create, utilize, K4, K5). It introduces various knowledge databases and provides an overvie integration, ensuring knowledge accessibility, result reproducibility, and know Key Skills:	p understanding of semantic concepts ious tasks (K3), dissect models and ogic concepts and their application y (K3), analyze models (K4), and es, controlled vocabularies, thesauri, and e, the module aims to impart the ability complex knowledge structures (K5). ticularly RDF (Resource Description and analyze knowledge graphs (K2, K3, w of the challenges and methods in data vledge system interoperability (K1, K2).
Proficiency in logical, analytical, and conceptual thinking; Ability to solve con Skill in presenting and documenting results comprehensibly; Competence in practical systems; Capability for independent work with books and scientific communication skills.	procedures and processes for creating
Workload:	
Total: 150 h	
30 h (self-study) 30 h studying of course content through exercises / case studies (self study)	
30 h studying of course content through exercises / case studies (self-study) 30 h studying of course content using literarture (self-study)	
30 h exercise course (attendance)	
30 h lecture (attendance)	
Conditions:	Credit Requirements:
none	Passing the module exam

Conditions:		Credit Requirements:
none		Passing the module exam
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 4	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Knowledge Representation in Biomedicine

Mode of Instruction: lecture

Language: English

Contact Hours: 2

Contents:

The course Knowledge representation in Biomedicine covers the different aspects and forms used to model biomedical knowledge. During this course, students will acquire logical and analytical skills. They will study different forms of knowledge such as terminologies, ontologies, controlled vocabulary, thesaurus and much more. Furthermore, they will learn the different between these types and will be able to develop new solutions and implement them using RDF, XML or UMLS formats. They will inspect practical examples of knowledge forms used in biomedicine.

Literature:

- Handbuch der Medizinischen Informatik, Thomas M. Lehmann, 2. Auflage, 2014
- Biomedizinische Ontologie: Wissen strukturieren für den Informatik-Einsatz, Ludger Jamsem, Barry Smith (Hrsg.), 2008

Part of the Module: Übung zu Knowledge Representation in Biomedicine

Mode of Instruction: exercise course Language: English Contact Hours: 2

Examination

Knowledge Representation in Biomedicine

portfolio exam, graded

Test Frequency:

Module INF-0408: Extremal Cor Extremal Combinatorics	nbinatorics	5 ECTS/LF
Version 1.0.0 (since SoSe22) Person responsible for module: Prof.	Dr. Tobias Mömke	
Learning Outcomes / Competence Knowledge	S:	
	ral topics in the field of combinatorics; ad nprove the ability to abstract and system	
Methodical Competences		
They are able to understand complex	l write mathematical proofs in the contex reasoning and judge the correctness of roaches, as solutions to relevant questic	mathematical arguments. The students
Key Skills		
	of mathematical formalisms; ability to ic verful mathematical tools; Skills of mathe	
Workload: Total: 150 h 30 h exercise course (attendance) 15 h studying of course content using 15 h studying of course content using 60 h studying of course content throu 30 h lecture (attendance)		
Conditions: Basic knowledge in mathematics, in p Basic knowledge in graph theory is re	particular linear algebra is necessary. ecommended.	Credit Requirements: Passing the module exam
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
	Repeat Exams Permitted:	

Part of the Module: Extremal Combinatorics (Vorlesung)

Mode of Instruction: lecture

Language: English / alle Sprachen

Contact Hours: 2

Contents:

How many people do you need to invite for your party, in order to have 3 strangers or a group of 3 friends? If 10 people have keys to a safe, how many locks are necessary to make sure any 5 of them can open it? What is the dictator paradox, and should you be worried about it? This course provides an introduction to extremal combinatorics, which helps us to find

answers to the questions above.

Literature:

Part of the Module: Extremal Combinatorics (Übung)

Mode of Instruction: exercise course Language: English / alle Sprachen

Contact Hours: 2

Examination

Extremal Combinatorics

oral exam / length of examination: 45 minutes, graded

Test Frequency:

Module INF-0409: Cyber Security	y	6 ECTS/LF
Version 1.0.0 (since SoSe22)		
Person responsible for module: Prof. [Dr. Bernhard Bauer	
Learning Outcomes / Competences		
software architectures. To this end, they can transfer technica and know methods for developing sec security alternatives (K4) and evaluate independently (K4) and solutions syste developed skills for analyzing and stru procedures for creating such architect secure software development process They can select and safely apply suita	6), and document security aspects in the I solution concepts into development pro ure software. They can describe the adva them in the respective application conte ematically designed (K5) and implemente cturing the problems of security architect ures. Students can name practice-relevan es (K1). They can select suitable methods ble methods for creating and evaluating secure software and security a chnical developments.	cesses and IT architectures antages and disadvantages of xt (K6). Problems can be identified ed (K3). Furthermore, they have ures and know the concepts and ht issues in security architectures and ls for security architectures. The students
•	ork different subject areas; team and nd existing knowledge independently; qua ctical experience and professional aptitud	
Workload: Total: 180 h 23 h studying of course content using 22 h studying of course content using 60 h studying of course content throug 45 h lecture (attendance) 30 h exercise course (attendance)		
Conditions: none		
Frequency: each summer semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 5	Repeat Exams Permitted: according to the examination	
	regulations of the study program	

Mode of Instruction: lecture

Language: German

Contact Hours: 3

Contents:

The lecture content includes security standards, secure software development lifecycles, as well as security architectures, and their evaluation in respective technology contexts. and the evaluation of security architectures.

Literature:

Slides

- A. Deane, A. Kraus: The Official (ISC)2 CISSP CBK Reference
- · Further literature in the lecture on specific topics

Assigned Courses:

Cyber Security (lecture)

**

Part of the Module: Cyber Security (Übung)

Mode of Instruction: exercise course

Language: German

Contact Hours: 2

Assigned Courses:

Übung zu Cyber Security (exercise course)

**

Examination

Cyber Security

oral exam / length of examination: 30 minutes, graded

Test Frequency:

Module INF-0410: Gesture-Based Communication in Human- Computer Interaction Gesture-Based Communication in Human-Computer Interaction	8 ECTS/LP
Version 1.0.0 (since SoSe22) Person responsible for module: Prof. Dr. Elisabeth André)
Learning Outcomes / Competences: After successful participation in this module, students understand the essential concepts of gesture-based communication in human-computer interaction. They are able to translate technical solution concepts into programs and models and master the selection and application of suitable methods. They have the knowledge of the way of thinking and the language of application-relevant disciplines. Within the framework of the lecture, they learn to evaluate learning components in a scientifically meaningful way using suitable methods, to develop the methods and	

algorithms independently and to implement them technically. Particularly promoted in this framework are also the skills for confident and convincing presentation of ideas and concepts, comprehensible presentation and documentation of results, as well as logical, analytical and conceptual thinking.

Key qualifications: Advanced mathematical formal methodology, skill in analyzing and structuring complex computer science problems, skill in developing and implementing solution strategies for complex problems, understanding of team processes, skill in collaborating in teams, self-reflection; acting responsibly in the face of inadequacy and conflicting interests, quality awareness, meticulousness.

Workload:

Total: 240 h

120 h studying of course content through exercises / case studies (self-study)

15 h studying of course content using literarture (self-study)

15 h studying of course content using provided materials (self-study)

60 h exercise course (attendance)

30 h lecture (attendance)

Conditions: none		
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 6	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Gesture-Based Communication in Human-Computer Interaction (Lecture)

Mode of Instruction: lecture

Language: English

Frequency: each summer semester

Contact Hours: 2

Contents:

HCI methods and principles, Interaction design, Nonverbal communication, Gestures, Gesture recognition systems, Collaboration, Applied computer vision, Ubiquitous computing

Part of the Module: Gesture-Based Communication in Human-Computer Interaction (Exercise Course)

Mode of Instruction: exercise course

Language: English

Frequency: each summer semester

Contact Hours: 4

Examination

Gesture-Based Communication in Human-Computer Interaction

portfolio exam, graded

Test Frequency:

Module INF-0427: Deep Ubiquito Healthcare Deep Ubiquitous and Wearable Comp	ous and Wearable Computing for	8 ECTS/LP
Version 1.0.0 (since WS22/23) Person responsible for module: Prof. [Dr. Elisabeth André	,
After successful participation, they will to the guidelines of the user-centered They are able to translate current inter interaction devices, as well as to indep they are able to apply practice-relevan They are able to plan larger project tas	: d techniques of interaction design and en have the necessary knowledge to analy design process and to design software s raction paradigms and design guidelines bendently familiarize themselves with the at evaluation methods to assess the qual sks in small teams, solve them according enary sessions and present them as a tea	ze application scenarios according olutions tailored to the target group. into models and programs for novel e necessary technologies. Furthermore, ity of the created software prototype. g to a self-developed project plan and
and language of application-relevant c skill in leading teams; skill in presentin	and persuasive presentation of ideas and lisciplines; understanding of team proces og and documenting results in a compreh lity to contribute to science; competence ticulousness.	esses; skill in collaborating in teams; nensible manner; ability to expand
Workload: Total: 240 h 15 h studying of course content using 15 h studying of course content using 120 h studying of course content throu 30 h lecture (attendance) 60 h exercise course (attendance)	• • • • • • • • • • • • • • • • • • • •	
Conditions: Programming experience		
Frequency: each winter semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 6	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Practical Module Interaction Design and Engineering for Health Care Applications

Mode of Instruction: lecture

Language: English

Frequency: each summer semester

Contact Hours: 2

Contents:

The specific assignment for student projects is designed each year.

Literature:

Literature references will be announced at the beginning of the semester depending on the topic.

Part of the Module: Deep Ubiquitous and Wearable Computing for Healthcare (Exercise Course)

Mode of Instruction: exercise course Language: English Contact Hours: 4

Examination

Practical Module Interaction Design and Engineering for Health Care Applications

portfolio exam, graded

Test Frequency:

Module INF-0440: Quantum Algo Quantum Algorithms	prithms	5 ECTS/LF
Version 1.0.0 (since SoSe23)		J
Person responsible for module: Prof. D	Dr. Jakob Siegfried Kottmann	
zu erklären und Ihre Verwendung in al Strukturen aus dem Bereich der Quan beschreiben und potentielle Anwendur Sie in der Lage quantenalgorithmische übersetzen. Die Studierenden haben fr	ntnisse in der Quantenalgorithmik und si gorithmischen Strukturen zu beschreiber tenalgorithmik, wie die Suche, Fouriertra ngsgebiete bestimmen und vergleichen. Ansätze zu konstruieren und in diskrete undiertes Basiswissen in grundlegenden d in der Lage quantenalgorithmische Eler	n. Sie können etablierte algorithmische nsform, und Phasenabschätzung, Nach Besuch der Veranstaltung sind Operationen auf Qubitsysteme zu quantenalgorithmische Strukturen
Denken; Eigenständiges Erarbeiten vo	nsfähigkeit; Sicherer Umgang mit mathe n algorithmischen Lösungsansätzen; Gr Isätze guter wissenschaftlicher Praxis;	-
Workload: Total: 150 h 60 h studying of course content throug 15 h studying of course content using h 15 h studying of course content using h 30 h exercise course (attendance) 30 h lecture (attendance)	literarture (self-study)	
Conditions: Grundkenntnisse in linearer Algebra w	erden empfohlen.	Credit Requirements: Bestehen der Modulprüfung.
Frequency: each summer semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours:	Repeat Exams Permitted: according to the examination	

Part of the Module: Quantum Algorithms (Vorlesung) Mode of Instruction: lecture Language: English / German Contact Hours: 2

Foundations of Quantum Information Processing:

- qubits and their representation
- · BraKet notation and necessary structures from linear algebra
- · operations on qubits: circuits and gates

Quantum Algorithms

- quantum search and amplitude amplification
- · quantum fourier transform and it's applications
- quantum simulation
- · variational quantum algorithms
- · differentiable quantum algorithmic procedures
- quantum heuristics
- · usecases from current day research

Literature:

Basics of Quantum Information/Quantum Computation:

• Michal Nielsen; Isaac Chuang: Quantum Computation and Quantum Information

Basics of quantum mechanics:

- Richard P. Feynman; Robert B. Leighton; Matthew Sands: Feynman-Vorlesungen über Physik: Band III, Quantenmechanik
- original scripts are online: https://www.feynmanlectures.caltech.edu/info/

Overview over variational quantum algorithms:

- https://doi.org/10.1103/RevModPhys.94.015004
- https://doi.org/10.1038/s42254-021-00348-9

More on quantum algorithms:

 http://theory.caltech.edu/~preskill/ph229/ (chapter 5 provides a good summary of the well-known "traditional" quantum algorithms)

Assigned Courses:

Quantum Algorithms (lecture)

**

Part of the Module: Quantum Algorithms (Übung)

Mode of Instruction: exercise course

Language: English

Contact Hours: 2

Assigned Courses:

Übung zu Quantum Algorithms (exercise course)

**

Examination

Quantum Algorithms

oral exam / length of examination: 25 minutes, graded

Test Frequency:

Module INF-0450: Clinical Resea Klinisches Forschungsdatenmanagen	_	5 ECTS/LP
Version 1.0.0 (since SoSe23) Person responsible for module: Prof. I Yevgeniia Ignatenko	Dr. Frank Kramer	
patient survey forms; ability to indeper medical study; practical understanding evaluation and analysis options of coll They will also enhance their skills in te Key skills: Skill in logical, analytical an	ng of the data loop in clinical research; indently design and create a minimal da g extraction, transformation and loading ected data through feasibility queries. eamwork, communication, and self-org	ata set and own FHIR- resource for a g processes in providing data for research; anization by completing assignments. ork with textbooks and scientific literature,
Workload: Total: 150 h 30 h lecture (attendance) 30 h exercise course (attendance) 15 h studying of course content using 60 h studying of course content throug 15 h studying of course content using	gh exercises / case studies (self-study)	
Conditions: Module IT Infrastructure in Medical Inf recommended	ormation Systems (INF-0312) -	Credit Requirements: Passing the module exam
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 4	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Clinical Researce Mode of Instruction: lecture Language: German / English Contact Hours: 2	ch Data Management (lecture)	

This lecture covers current topics in the context of research data management.

This includes the following content:

Introduction to research data management

Data management plan

The life cycle of research data

ETL

Data processing, analysis and visualization

Metadata

Data storage and archiving. Research data repositories

Legal foundations

Literature:

- Handbuch der Medizinischen Informatik, Thomas M. Lehmann, 2. Auflage, 2014
- Biomedizinische Ontologie: Wissen strukturieren f
 ür den Informatik-Einsatz, Ludger Jamsem, Barry Smith (Hrsg.), 2008

Part of the Module: Clinical Research Data Management (practical)

Mode of Instruction: exercise course Language: German / English

Contact Hours: 2

Assigned Courses:

Klinisches Forschungsdatenmanagement (lecture)

**

Übung zu Klinisches Forschungsdatenmanagement (exercise course)

**

Examination

Clinical Research Data Management

portfolio exam, graded

Test Frequency:

Content Creation for Virtual Environm	tion for Virtual Environments ents	8 ECTS/LP
Version 1.0.0 (since SoSe23)		
Person responsible for module: Prof.	Dr. Elisabeth André	
and integrating 2D/3D graphics and a language of application-relevant discip hand and generatively with procedura the content into applications, to develo of confident and convincing presentat	S: bodule, students will understand essentia udio for virtual environments. They have plines. Within the framework of the lectu I methods and algorithms, taking into a op algorithms independently and to imp ion of ideas and concepts, comprehens ic, musical, logical, analytical and concept	e the knowledge of the mindset and ure, they learn to create content by ccount design principles, to integrate lement them technically. The skills ible presentation and documentation
and confident application of appropria complex computer science problems,	Il in working in teams, self-reflection; ac	-
Workload: Total: 240 h 60 h exercise course (attendance) 30 h lecture (attendance) 15 h studying of course content using 120 h studying of course content throu 15 h studying of course content using	ugh exercises / case studies (self-study)
Conditions: none		
Frequency: each summer semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours:	Repeat Exams Permitted: according to the examination	
6	regulations of the study program	

Mode of Instruction: lecture

Language: German / English

Contact Hours: 2

Part of the Module: Content Creation for Virtual Environments (Exercise Course)

Mode of Instruction: exercise course

Language: German / English

Contact Hours: 4

Examination

Content Creation for Virtual Environments

portfolio exam, graded

Test Frequency:

lodule INF-0462: Embedded Har mbedded Hardware Lab	dware Lab	8 ECTS/LP
ersion 1.0.0 (since WS23/24) erson responsible for module: Prof. D	r. Sebastian Altmeyer	
	ollowing areas at an advanced, practical s, physical principles of electronic compo	- · ·
rcuit design process and apply it directed ind implement it independently using the sadvantages of schematic and textual ariant. Furthermore, they combine sym- be components of their self-built micro ased on the clock frequency achieved complex task, to solve it according to oppropriately in a plenary session. ey qualifications: Skill in presenting uality awareness, meticulousness; pro-	ates and build a half-adder and a full-add ctly in a practical way by designing their of he hardware description language VHDL I hardware description and can decide w hachronous and asynchronous processes processor. Finally, students evaluate the l and the hardware effort required. In a fi a self-developed sound project plan and and documenting ideas, concepts and re bject-bound work and time management; existing knowledge independently; self-r	own RISC-V processor. They model They learn the advantages and when it makes sense to use which to achieve a good interaction of e efficiency of their implementation nal project phase, they learn to plan d to discuss and present the results esults in a comprehensible manner; s selection and confident use of
Jorkload: otal: 240 h D h exercise course (attendance) D h lecture (attendance) 20 h studying of course content throug 5 h studying of course content using p 5 h studying of course content using p		
onditions: lodule Foundations of Technical Com ecommended	puter Science (INF-0138) -	
requency: irregular	Recommended Semester: 1.	Minimal Duration of the Module: 1 semester[s]
ontact Hours:	Repeat Exams Permitted: according to the examination regulations of the study program	
arts of the Module	according to the examination	

Part of the Module: Embedded Hardware Lab (Lecture)

Mode of Instruction: lecture

Language: English / German

Contact Hours: 2

Contents:

The course "Hardware Design" presents methods of logical design of digital circuits, starting with the abstract description in a hardware description language (like VHDL) up to the physical implementation on transistor level. In the practical part of the course, hardware design is illustrated using the example of a five-stage processor pipeline. The result is an executable processor developed in VHDL for an FPGA prototype board.

Literature:

- Uwe Brinkschulte, Theo Ungerer, Mikrocontroller und Mikroprozessoren, Springer Verlag, Heidelberg, dritte Auflage 2010
- John L. Hennessy, David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann,
 5. Auflage, 2011

Part of the Module: Embedded Hardware Lab (Exercise)

Mode of Instruction: exercise course

Language: English / German

Contact Hours: 4

Examination

Embedded Hardware Lab

practical exam, graded

Test Frequency:

when a course is offered

Description:

Successful participation in the internship, project presentation at the end of the semester

Worlds Lab Embodied Characters and Interactive Virtual Worlds Lab Version 1.0.0 (since WS23/24) Person responsible for module: Prof. Dr. Elisabeth André Laarning Outcomes / Competences: As part of the pracitcal module, students implement interactive multimedia applications in the areas of 2D/3D/Virtual Reality/Serious Games/Simulations/Robotics. Essential concepts and techniques of embodied characters and virtual worlds include planning, making and integrating 2D/3D graphics, animations, user interfaces, storytelling and audio for virtual environments as well as conceptualizing and implementing user interaction. After successful participation, students will have the knowledge of the mindset and language of application-relevant disciplines. During the internship, they learn to create content by hand and generatively with procedural methods and algorithms, aking into account design and musical principles, to integrate the content into applications, to develop algorithms independently and to implement them technically. Particularly encouraged in this context are also the skills of confident and convincing presentation of ideas and concepts; knowledge of the thinking and language of application-relevant disciplines; understanding of team processe; skill in working in teams; ability to lead teams; skill in confident and convincing presentation of ideas and concepts; knowledge of the thinking and language of application-relevant disciplines; understanding of team processe; skill in working in teams; ability to lead teams; skill in confident and convence; competence in recognizing significant technical developments; quality awarenes, meticulousness. Worklosd: Partotical course (attendance) Eredit Requirements: Parsing the module exam Internsh			
Version 1.0.0 (since WS23/24) Person responsible for module: Prof. Dr. Elisabeth André Learning Outcomes / Competences: As part of the practical module, students implement interactive multimedia applications in the areas of 2D/3D/Virtual Reality/Serious Games/Simulations/Robotics. Essential concepts and techniques of embodied characters and virtual vorids include planning, making and integrating 2D/3D graphics, animations, user interfaces, storptelling and audio for virtual environments as well as conceptualizing and implementing user interaction. After successful anticipation, students will have the knowledge of the mindset and language of application-relevant disciplines. During the internship, they learn to create content by hand and generatively with procedural methods and algorithms haking into account design and musical principles, to integrate the content into applications, to develop algorithms haking into account design and musical principles, to integrate the content into applications. Key Qualifications: Aesthetic, design, artistic and musical fundamentals, design of embodied characters and virtual workis; skill in confident and convincing presentation of ideas and concepts; knowledge of the thinking and language of application-relevant disciplines; understanding of team processes; skill in working in teams; ability to lead teams; skill in contributions to science; competence in recognizing significant technical developments; quality awareness, meticulousness. Workload: Totai: 240 h 30 h internship / practical course (attendance) 510 h studying of course content through exercises / case studies (self-study) Conditions: Frequency: each winter semester Recommended Semester: from 1. Contact Hours: 6 Programming experience Prot the Module: Practical Module Embodied Characters and Interactive Virtual Worlds Minimal Duration of the Module: 1 semester[s] Parts of the Module: Practical Module Embodied Characters and Interactive Virtual Worlds Mode of Instruction: internship Language: German / English Contact	Worlds Lab		8 ECTS/LP
Person responsible for module: Prof. Dr. Elisabeth André Learning Outcomes / Competences: As part of the practical module, students implement interactive multimedia applications in the areas of 2D/3D/Virtual Reality/Serious Games/Simulations/Robotics. Essential concepts and techniques of embodied characters and virtual worlds include planning, making and integrating 2D/3D graphics, animations, user interfaces, storytelling and audio for virtual environments as well as conceptualizing and Implementing user interaction. After successful participation, students will have the knowledge of the mindset and language of application-relevant disciplines. During the internship, they learn to create content by hand and generatively with procedural methods and algorithms, aking into account design and musical principles, to integrate the content into applications, to develop algorithms of appendently and to implement them technically. Particularly encouraged in this context are also the skills of confident and convincing presentation of ideas and concepts, comprehensible presentation and documentation of results, as well as creative, aesthetic, musical, logical, analytical and conceptus thinking. Key Qualifications: Aesthetic, design, artistic and musical fundamentals, design of embodied characters and virtual worlds; skill in confident and convincing presentation of ideas and concepts, knowledge of the thinking and language of application-relevant disciplines; understanding of team processes; skill in working in teams; ability to lead teams; skill in confident and convincing presentation of results; ability to expand existing knowledge independently ability to make contributions to science; competence in recognizing significant technical developments; quality awareness, meticulousness. Workoat: Ista: 240 h 0 h) hiernship / practical course (attendance) 1 NF-0178 Entithrung in die Spieleprogrammierung (optional) - INF-0178 Praktikum Spieleprogrammierung (optional) - INF-0178 Praktikum Spieleprogrammierung (optional) - INF-		Virtual Worlds Lab	
Learning Outcomes / Competences: As part of the practical module, students implement interactive multimedia applications in the areas of 2D/3D/Virtual Reality/Serious Games/Simulations/Robotics. Essential concepts and techniques of embodied characters and wirtual workls include planning, making and integrating 2D/3D graphics, animations, user interfaces, storytelling and audio for virtual environments as well as conceptualizing and implementing user interaction. After successful carticipation, students will have the knowledge of the mindset and language of application-relevant disciplines. During the internship, they learn to create content by hand and generatively with proceedival methods and algorithms, taking into account design and musical principles, to integrate the content into applications, to develop algorithms independently and to implement then technically. Particularly encouraged in this context are also the skills of confident and convincing presentation of ideas and concepts (sourgethand). Key Qualifications: Aesthetic, design, artistic and musical fundamentals, design of embodied characters and virtual worlds; skill in configent and convincing presentation of deas and concepts; knowledge of the thinking and language of application-relevant disciplines; understanding of team processes; skill in working in teams; ability to lead teams; skill in configent and convincing presentation of desas and concepts; knowledge independently ability to make contributions to science; competence in recognizing significant technical developments; quality awareness, meticulousness. Workload: Non-4056 Content Creation for Virtual Environments (recommended) NF-0458 Content Creation for Virtual Environments (recommended) NF-0458 Content Creation for Virtual Environments (recommended) NF-0458 Content Creation			
As part of the practical module, students implement interactive multimedia applications in the areas of 2D/3D/Virtual Reality/Serious Games/Simulations/Robotics. Essential concepts and techniques of embodied characters and wirtual worlds include planning, making and integrating 2D/3D graphics, animations, user interactors. After successful participation, students will have the knowledge of the mindset and language of application-relevant disciplines. During the internship, they learn to create content by hand and generatively with procedural methods and algorithms independently and to implement them technically. Particularly encouraged in this context are also the skills of confident and convincing presentation of ideas and concepts, comprehensible presentation and documentation of results, as well as creative, aesthetic, musical, logical, analytical and concepts; knowledge of the thinking and language of application-relevant disciplines; understanding of team processes; skill in working in teams; ability to lead teams; skill in confident and convincing presentation of ideas and concepts; knowledge of the thinking and language of application-relevant disciplines; understanding of team processes; skill in working in teams; ability to lead teams; skill in comprehensible presentation and documentation of results; ability to expand existing knowledge independently ability to make contributions to science; competence in recognizing significant technical developments; quality awareness, meticulousness. Workload: 1 NIF-0456 Content Creation for Virtual Environments (recommended) i NIF-0179 Einführung in die Spieleprogrammierung (optional) Frequency: each winter semester from 1. 8 Repeat Exams Permitted: according to the examination regulations of the study program Parts of the Module: Practo the Module: Practof the Module: Practo the Module: Practo the field of "Embo			
worlds; skill in confident and convincing presentation of ideas and concepts; knowledge of the thinking and language of application-relevant disciplines; understanding of team processes; skill in working in teams; ability to lead teams; skill in comprehensible presentation and documentation of results; ability to expand existing knowledge independently ability to make contributions to science; competence in recognizing significant technical developments; quality awareness, meticulousness. Workload: Total: 240 h 300 h internship / practical course (attendance) 150 h studying of course content through exercises / case studies (self-study) Conditions: • Programming experience • INF-0456 Content Creation for Virtual Environments (recommended) • INF-0133 Praktikum Spieleprogrammierung (optional) • INF-0133 Praktikum Spieleprogrammierung (optional) Frequency: each winter semester Repeat Exams Permitted: according to the examination regulations of the study program Part of the Module: Practical Module Embodied Characters and Interactive Virtual Worlds Wode of Instruction: internship Language: German / English Contact Hours: 6 Contact Hours: 6	As part of the pracitcal module, studer Reality/Serious Games/Simulations/Re virtual worlds include planning, making and audio for virtual environments as a participation, students will have the kn During the internship, they learn to cre taking into account design and musica independently and to implement them confident and convincing presentation	ts implement interactive multimedia application of the minimum strain of the minimum strains and the m	es of embodied characters and ions, user interfaces, storytelling g user interaction. After successful application-relevant disciplines. th procedural methods and algorithms, applications, to develop algorithms is context are also the skills of presentation and documentation of
150 h studying of course content through exercises / case studies (self-study) Conditions: Programming experience INF-0456 Content Creation for Virtual Environments (recommended) INF-0179 Einführung in die Spieleprogrammierung (optional) INF-0183 Praktikum Spieleprogrammierung (optional) Passing the module exam Frequency: each winter semester Recommended Semester: from 1. Minimal Duration of the Module: 1 semester[s] Contact Hours: Repeat Exams Permitted: according to the examination regulations of the study program Image: Semester [s] Parts of the Module: Practical Module Embodied Characters and Interactive Virtual Worlds Worlds Mode of Instruction: internship Language: German / English Contact Hours: 6 Contents: The specific task from the field of "Embodied Characters and Interactive Virtual Worlds" is designed anew each	of application-relevant disciplines; und skill in comprehensible presentation ar ability to make contributions to science awareness, meticulousness. Workload: Total: 240 h	erstanding of team processes; skill in wo nd documentation of results; ability to exp e; competence in recognizing significant t	rking in teams; ability to lead teams; band existing knowledge independently;
 Programming experience INF-0456 Content Creation for Virtual Environments (recommended) INF-0179 Einführung in die Spieleprogrammierung (optional) INF-0183 Praktikum Spieleprogrammierung (optional) Frequency: each winter semester Recommended Semester: from 1. Contact Hours: Repeat Exams Permitted: according to the examination regulations of the study program Parts of the Module Parts of the Module: Practical Module Embodied Characters and Interactive Virtual Worlds Mode of Instruction: internship Language: German / English Contact Hours: 6 Contents: The specific task from the field of "Embodied Characters and Interactive Virtual Worlds" is designed anew each 			
from 1. 1 semester[s] Contact Hours: Repeat Exams Permitted: according to the examination regulations of the study program Parts of the Module Practical Module Embodied Characters and Interactive Virtual Worlds Mode of Instruction: internship Language: German / English Contact Hours: 6 Contact Hours: 6 Contents: The specific task from the field of "Embodied Characters and Interactive Virtual Worlds" is designed anew each	 INF-0456 Content Creation for V INF-0179 Einführung in die Spie 	leprogrammierung (optional)	-
6 according to the examination regulations of the study program Parts of the Module Parts of the Module: Practical Module Embodied Characters and Interactive Virtual Worlds Mode of Instruction: internship Embodied Characters and Interactive Virtual Worlds Contact Hours: 6 Contents: The specific task from the field of "Embodied Characters and Interactive Virtual Worlds" is designed anew each	Frequency: each winter semester		
Part of the Module: Practical Module Embodied Characters and Interactive Virtual Worlds Mode of Instruction: internship Language: German / English Contact Hours: 6 Contents: The specific task from the field of "Embodied Characters and Interactive Virtual Worlds" is designed anew each	Contact Hours: 6	according to the examination	
Mode of Instruction: internship Language: German / English Contact Hours: 6 Contents: The specific task from the field of "Embodied Characters and Interactive Virtual Worlds" is designed anew each	Parts of the Module		
The specific task from the field of "Embodied Characters and Interactive Virtual Worlds" is designed anew each	Part of the Module: Practical Module Mode of Instruction: internship Language: German / English Contact Hours: 6	e Embodied Characters and Interactiv	e Virtual Worlds
		Embodied Characters and Interactive Vir	tual Worlds" is designed anew each

Literature:

Ändert sich jedes Jahr und wird daher in der Veranstaltung bekannt gegeben

Assigned Courses:

Embodied Characters and Interactive Virtual Worlds Lab (internship)

**

Examination

Practical Module Embodied Characters and Interactive Virtual Worlds

practical exam, graded

Test Frequency:

Module INF-0465: Machine Machine Learning for Healthcar	-	8 ECTS/LF
Version 1.0.0 (since WS23/24)		
Person responsible for module:	Prof. Dr. Elisabeth André	
healthcare. This course aims to healthcare, encompassing num to enhance clinical workflows as of topics, including statistical ma	this course, students will have a grasp of the give students a comprehensive insight into t erous health data modalities (such as EHR, i s machine learning methodologies and tools. achine learning, deep learning, transfer learn I models, and time series analysis.	he application of machine learning for maging, speech, mobile, and wearables) We will be delving into a broad range
of practice-relevant tasks; skill i implementing solution strategies thinking; methods for developin	ical-formal basics; competence in networking n analyzing and structuring computer science s; quantitative aspects of computer science; s g larger software systems, construction of ab nting and documenting results in an understa	e problems; skill in developing and skill in logical, analytical and conceptual stractions and architectures; skill in
Workload:		
Total: 240 h		
15 h studying of course content	using provided materials (self-study)	
15 h studying of course content		
120 h studying of course conter 30 h lecture (attendance)	nt through exercises / case studies (self-study	/)
60 h exercise course (attendance)	ce)	
Conditions:		Credit Requirements:
Programming experience		Passing the module exam
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours:	Repeat Exams Permitted:	
oontaot nou of		1
6	according to the examination	

Parts of the Module

Part of the Module: Machine Learning for Healthcare (Lecture)

Mode of Instruction: lecture

Language: English

Contact Hours: 2

Part of the Module: Machine Learning for Healthcare (Exercise)

Mode of Instruction: exercise course

Language: English

Frequency: each winter semester

Contact Hours: 4

Examination

Machine Learning for Healthcare portfolio exam, graded

Test Frequency: when a course is offered

Valid Sommersemester 2024 - Printed 08.04.2024

Module INF-0466: Biophotonics Biophotonics	5 ECTS/LP
Version 1.0.0 (since WS23/24)	
Person responsible for module: Prof. Dr. Sebastian Zaunseder	

Learning Outcomes / Competences:

Subject-related competences:

After successful participation, students have knowledge and competences with regard to biophotonic methods for diagnostic applications. Students have basic knowledge from the field of photonics and know basic principles of light-tissue interaction. They are familiar with the functional principles of selected biophotonic methods for diagnostics, are able to work with them or with data from them and to interpret results. Student can also contribute to the (further) development of corresponding methods.

Methodological competencies:

Students are able to deal independently with the functionality and possible applications of biophotonic processes, to prepare biophotonic measurement data using common script languages such as Matlab or Python, and to document and interpret the application of methods for data preparation appropriately. Students also have basic competencies in the area of modeling/simulation of biophotonic processes.

Interdisciplinary Competencies:

The students are able to apply the acquired knowledge in any area of study that deals with diagnostically relevant data. In addition, the module teaches essential problem-solving skills, whereby an abstract way of thinking as well as a structured approach to problem solving are learned.

Key skills:

Ability to think logically, analytically and conceptually; ability to present and document results in a comprehensible manner; ability to communicate orally and in writing in a way that is appropriate to the situation and specific to the target group; ability to work together in teams; ability to solve problems under practical boundary conditions; ability to expand existing knowledge independently; quality awareness.

Workload:

Total: 150 h

30 h exercise course (attendance)

30 h lecture (attendance)

60 h studying of course content through exercises / case studies (self-study)

30 h studying of course content using provided materials (self-study)

Conditions: basic math skills; basic progra	mming skills	Credit Requirements: Passing the module exam
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 4	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Biophotonics (Lecture)

Mode of Instruction: lecture

Language: English / German

Contact Hours: 2

The lecture deals with the fundamentals, implementation and application of biophotonic methods. The following contents are covered:

- Fundamentals of photonics
- · Basics of light-tissue interaction
- Selected biophotonic methods in medical diagnostics (e.g. optical coherence tomography, laser speckle imaging, pulse oximetry)
- · Introduction to possibilities for modeling and simulation in the context of biophotonics

Literature:

- Bigio, I. J., & Fantini, S. (2016). Quantitative Biomedical Optics. Cambridge University Press. https:// doi.org/10.1017/CBO9781139029797
- Keiser, G. (2016). Biophotonics. Springer Singapore. https://doi.org/10.1007/978-981-10-0945-7
- Boudoux, C (2017). Fundamentals of Biomedical OpticsFrom light interactions with cells to complex imaging systems. Blurb

Part of the Module: Biophotonics (Exercise)

Mode of Instruction: exercise course

Language: English / German

Contact Hours: 2

Contents:

The exercise teaches practical skills in the context of biophotonic methods. The focus is on computational aspects of biophotonic methods and solving concrete problems related to diagnostically applicable biophotonic methods. The following contents are covered:

- · Familiarization with and preparation of biophotonic measurement methods and their application
- · Handling of biophotonic measurement data
- Modeling and simulation in the context of biophotonic methods

Examination

Biophotonics

portfolio exam, graded

Test Frequency:

Module INF-0472: Management of Communication Networks Management von Kommunikationsnetzen	5 ECTS/LP
Version 1.0.0 (since WS23/24)	
Person responsible for module: Prof. Dr. Michael Seufert	
Learning Outcomes / Competences:	
Die Vorlesung vermittelt den Studierenden Kenntnisse und Fähigkeiten im Be	ereich des Managements von
Kommunikationsnetzen. Das Modul behandelt die verschiedenen Aspekte de	s effizienten und sicheren Betriebs von
Kommunikationsnetzen und bereitet die Studierenden darauf vor, komplexe N	letzinfrastrukturen erfolgreich zu planen,
zu implementieren und zu verwalten.	
Die Studierenden erwerben ein fundiertes Wissen über die Grundlagen des N	letzmanagements, einschließlich
der verschiedenen Managementebenen, -protokolle und -werkzeuge. Sie ver	stehen die Bedeutung des
Netzmanagements für die effektive Nutzung von Kommunikationsnetzen.	
Das Modul vermittelt den Studierenden umfassende Kenntnisse und Fähigke	iten, um Netzelemente effektiv zu
verwalten, Management-Systeme einzusetzen, Geräte zu konfigurieren und F	-
Des Weiteren werden Themen wie Messungen in Kommunikationsnetzen, ak	tives und passives Netzmonitoring,
Quality of Service (QoS)/Quality of Experience (QoE), Automatisierung des N	
Softwarisierung von Kommunikationsnetzen, Netzsicherheit und Netzneutrali	
Die Studierenden erlangen ein tieferes Verständnis für die Zusammenhänge	
des Netzmanagements und deren praktischer Anwendung. Sie können komp	• •
analysieren und Lösungsansätze entwickeln. Sie können Leistungsdaten von	
potenzielle Engpässe erkennen und Diagnoseverfahren anwenden, um Netz	probleme zu analysieren und zu
beheben.	
Die Studierenden können die Wirksamkeit von Netzmanagementlösungen be	
Leistung und Sicherheit von Kommunikationsnetzen analysieren. Sie können	-
vergleichen und bewerten, um fundierte Entscheidungen zu treffen und Empf	ehlungen für Verbesserungen
abzugeben.	
Die Studierenden werden befähigt, neue Ansätze und Konzepte im Bereich d	
Sie können innovative Lösungen entwerfen, die über die herkömmlichen Met	
Herausforderungen des Netzmanagements gerecht werden. Sie sind in der L	age, neue Managementstrategien und -
techniken zu erforschen und diese in der Praxis umzusetzen.	
Die Studierenden sind in der Lage, die Auswirkungen des Netzmanagements	auf organisatorische Ziele und
Geschäftsprozesse zu bewerten. Sie können den Mehrwert von effektivem N	-
Gesellschaft quantifizieren und geeignete Bewertungsmethoden anwenden, u	um die Kosten, Risiken und Nutzen des
Netzmanagements zu analysieren.	
Die Übung zum Management von Kommunikationsnetzen ergänzt die Vorles	
Möglichkeit, ihr erlerntes Wissen in praktischen Szenarien in realen oder simi	
Übung umfasst praktische Übungen, Fallstudien und Projekte, die es den Stu	• •
m Bereich des Netzmanagements weiterzuentwickeln und ihre Problemlösur	igskompetenzen zu stärken.
Schlüsselqualifikationen: Fachspezifische Vertiefung; Kenntnisse der Denk	weise und Sprache
anwendungsrelevanter Disziplinen; Kennnisse des Einsatzgebiets sowie der	Vor-/Nachteile von alternativen
Technologien und Bewertung im jeweiligen Anwendungszusammenhang; Ko	mpetenz zum Erkennen von
bedeutenden technischen Entwicklungen; Auswahl und sichere Anwendung	geeigneter Konzepte und Methoden;
Umsetzen fachlicher Lösungskonzepte; Fertigkeit zur Lösung von Problemen	unter praxisnahen Randbedingungen;
Fähigkeit zur verständlichen Darstellung und Dokumentation von Ergebnisse	n; Fertigkeit der Zusammenarbeit in
Teams	
Workload:	
Total: 150 h	
30 h lecture (attendance)	
20 h avaraisa asuraa (attandanaa)	

- 30 h exercise course (attendance)
- 15 h studying of course content using literarture (self-study)

60 h studying of course content through exercises / case studies (self-study) 15 h studying of course content using provided materials (self-study)		
Conditions: Credit Requirements: none Bestehen der Modulprüfung		
Frequency: each summer semester ab dem SoSe 2024	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 4	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Management von Kommunikationsnetzen (Vorlesung)

Mode of Instruction: lecture

Language: English / German

Frequency: irregular

Contact Hours: 2

Contents:

- Definitionen und Modelle für Netzmanagement
- Netzelemente und Managementsysteme
- Konfiguration von Netzelementen und Troubleshooting
- Aktive und passive Netzmessungen
- Quality of Service (QoS)
- Datenmodelle für und Automatisierung von Netzmanagement
- Virtualisierung und Softwarisierung von Kommunikationsnetzen
- Netzsicherheit
- Quality of Experience (QoE)
- Netzneutralität

Literature:

- Clemm A.: Network Management Fundamentals, Cisco Press, 2006
- · Claise B., Wolter R.: Network Management: Accounting and Performance Strategies, Cisco Press, 2007
- Edelman J, Lowe S. S., Oswalt M.: Network Programmability and Automation, O'Reilly, 2018
- Capobianco J. W.: Automate Your Network, 2019
- Garrett J.: Data Analytics for IT Networks, Cisco Press, 2019
- Claise B., Clarke J., Lindblad J.: Network Programmability with YANG, Addison-Wesley, 2019
- Chou E.: Mastering Python Networking, Packt, 2020
- Kurose J.W., Ross K.W.: Computer Networking A Top-Down Approach, 7th edition, Pearson, 2016
- Göransson P., Black C., Culver T.: Software Defined Networks: A Comprehensive Approach, 2nd edition, Morgan Kaufmann, 2017

Assigned Courses:

Management von Kommunikationsnetzen (lecture)

**

Part of the Module: Management von Kommunikationsnetzen (Übung)

Mode of Instruction: exercise course

Language: English / German

Frequency: irregular

Contact Hours: 2

Assigned Courses:

Übung zu Management von Kommunikationsnetzen (exercise course)

**

Examination

Management von Kommunikationsnetzen

portfolio exam / length of examination: 30 minutes, graded

Test Frequency:

Module INF-0476: Computer Vision für Intelligente Syst		5 ECTS/LF
Version 1.0.0 (since WS23/24) Person responsible for module: Prof.	Dr. Jörg-Dieter Stückler	
depth scientific level and will be able two-view geometry, deep learning ba keypoints and point correspondences simultaneous localization and mappin and disadvantages of different methor problems. Students have developed	g methodological foundations of compute to implement appropriate algorithms for a sics for images and point clouds, image i s, factor graphs and probabilistic state es ng, 3D object detection, 3D mapping. Par ods and can analyze and select them for a skills for analyzing and structuring maching proaches for implementing algorithms for	advanced problems: Image formation, motion estimation and optical flow, timation, visual odometry and visual ticipants understand the advantages applications and apply them to new ne vision problems for intelligent
Key qualifications: Ability to think lo	gically, analytically and conceptually; sel	
-	tages/disadvantages of design alternative cientifically meaningful assessments usin	es, evaluation in the respective
and models; knowledge of the advan application context; ability to make so presentation of results; ability to work Workload: Total: 150 h 15 h studying of course content using 15 h studying of course content using	tages/disadvantages of design alternative cientifically meaningful assessments using in teams.	es, evaluation in the respective
and models; knowledge of the advan application context; ability to make so presentation of results; ability to work Workload: Total: 150 h 15 h studying of course content using 60 h studying of course content throu 30 h lecture (attendance)	tages/disadvantages of design alternative cientifically meaningful assessments using in teams. g provided materials (self-study) g literarture (self-study) ugh exercises / case studies (self-study)	es, evaluation in the respective
and models; knowledge of the advant application context; ability to make so presentation of results; ability to work Workload: Total: 150 h 15 h studying of course content using 60 h studying of course content using 60 h studying of course content throut 30 h lecture (attendance) 30 h exercise course (attendance) Conditions: • Basic programming knowledge	tages/disadvantages of design alternative cientifically meaningful assessments using in teams. g provided materials (self-study) g literarture (self-study) ugh exercises / case studies (self-study)	es, evaluation in the respective g appropriate methods. Comprehensible

Parts of the Module

Part of the Module: Computer Vision for Intelligent Systems (Lecture)

Mode of Instruction: lecture Language: English / German

Contact Hours: 2

This lecture teaches basic methods and algorithms for computer vision for intelligent systems. The lecture covers the following topics:

- Image formation, geometric primitives and transformations.
- Two-view geometry
- · Basics of deep learning for images and point clouds
- Motion estimation in images and optical flow
- · Keypoints, descriptors and point correspondences
- Camera motion estimation from images
- · Factor graphs and probabilistic state estimation
- · Visual simultaneous localization and mapping
- · 3D object detection
- 3D mapping

Literature:

Lecture slides will be provided. Additional literature will be provided in lecture and exercises.

Recommended textbooks:

- Yi Ma, Stefano Soatto, Jana Kos Košecká, S. Shankar Sastry. An Invitation to 3-D Vision
- R. Szeliski. Computer vision: algorithms and applications
- K. Murphy. Machine Learning: A Probabilistic Perspective
- Goodfellow, Bengio and Courville. Deep Learning. https://www.deeplearningbook.org

Part of the Module: Computer Vision for Intelligent Systems (Exercises)

Mode of Instruction: exercise course

Language: English / German

Contact Hours: 2

Examination

Computer Vision for Intelligent Systems

written exam / length of examination: 90 minutes, graded

Test Frequency:

Module INF-0499: Foundation Me Foundation Models in Deep Learning	odels in Deep Learning	5 ECTS/LP
Version 1.0.0 (since SoSe24) Person responsible for module: Prof. D	r. Rainer Lienhart	
robotics (e.g. recursive state estimation perception, mapping, SLAM) from a pro- relevant tasks. Students can analyse a skills in logical, analytical and conceptu- methods from the concepts learned in	odule, participants understand basics and n, Gaussian and non-parametric filters, k obabilistic point of view and can apply le nd evaluate problems in this context. Pa ual thinking in the field of probabilistic rot a targeted manner, apply them confident The module imparts competencies for re	Calman filters, motion and localisation, arned concepts to complex, practice- rticipation in this module promotes botics. Students can select suitable tly and transfer them to new problems,
interdisciplinary knowledge; developme	natical-formal logic; implementation of su ent and implementation of solution strate s; ability to solve problems under practica	gies for complex problems; systematic
Workload:		
Total: 150 h		
30 h exercise course (attendance) 30 h lecture (attendance)		
15 h studying of course content using p	provided materials (self-study)	
60 h studying of course content throug		
15 h studying of course content using I		
Conditions:		Credit Requirements:
Kenntnisse in maschinellem Lernen un (MasterVorlesung INF-0092 "Multimed and Computer Vision").	d maschinellem Sehen ia II" bzw. INF-0316 "Machine Learning	Bestehen der Modulprüfung
Knowledge in machine learning and ma "Multimedia II" or INF-0316 "Machine L	achine vision (Master lecture INF-0092 earning and Computer Vision")	
Frequency: each summer semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours:	Repeat Exams Permitted:	
4	according to the examination	
	regulations of the study program	
Parts of the Module		-
Part of the Module: Probabilistic Ro	botics (Lecture)	
Mode of Instruction: lecture	()	
Language: German		

Language: German Contact Hours: 2

Valid Sommersemester 2024 - Printed 08.04.2024

- 1. Introduction to Probabilistic Robotics
- 2. Recursive State Estimation
- 3. Gaussian Filters
- 4. Nonparametric Filters
- 5. Robot Motion
- 6. Robot Perception
- 7. Mobile RobotLocalization: Markow and Gaussian
- 8. Mobile Robot Localization: Grid and MonteCarlo
- 9. Occupancy Grid Mapping
- 10. SLAM

Literature:

References will be announced at the beginning of the semester.

Assigned Courses:

Foundation Models in Deep Learning (lecture)

**

Part of the Module: Probabilistic Robotics (Tutorial)

Mode of Instruction: exercise course

Language: German

Contact Hours: 2

Assigned Courses:

Übung zu Foundation Models in Deep Learning (exercise course)

**

Examination

Probabilistic Robotics (Examination)

oral exam / length of examination: 30 minutes, graded

Test Frequency:

each semester

Description:

The examination can be taken every semester during the examination period.

Module INF-0504: Medical Monitoring and Advanced Sensor DataProcessingMedical Monitoring and Advanced Sensor Data Processing	8 ECTS/LP
Version 1.0.0 (since SoSe24) Person responsible for module: Prof. Dr. Sebastian Zaunseder	
Learning Outcomes / Competences:	

Subject-related competences:

After successful participation, students have knowledge and competences with regard to the field of medical monitoring. Students have basic knowledge on the background of medical monitoring and common technical solutions for clinical and out-of-hospital use. They are familiar with the functional principles of various methods relevant to medical monitoring and their interpretation. Students can also contribute to the (further) development of monitoring applications.

Methodological competencies:

Students are able to deal independently with solutions to medical monitoring. In particular, they are able to process medical data using common script languages such as Python, to document their solutions and to interpret processing results appropriately. In addition, Students have basic competencies in the handling of monitoring data and devices for monitoring.

Interdisciplinary Competencies:

The students are able to apply the acquired knowledge in any area of study that deals with (medical) data. In addition, the module teaches essential problem-solving skills, whereby an abstract way of thinking as well as a structured approach to problem solving are learned.

Key skills:

Ability to think logically, analytically and conceptually; ability to present and document results in a comprehensible manner; ability to communicate orally and in writing in a way that is appropriate to the situation and specific to the target group; ability to work together in teams; ability to solve problems under practical boundary conditions; ability to expand existing knowledge independently; quality awareness.

Workload:

Total: 150 h

60 h studying of course content using provided materials (self-study)

60 h exercise course (attendance)

90 h studying of course content through exercises / case studies (self-study)

30 h lecture (attendance)

Conditions: basic math skills; basic programming skills; basic knowledge on handling digital signals		Credit Requirements: Passing the module exam
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 6	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Medical monitoring and advanced sensor data processing (Lecture)

Mode of Instruction: lecture

Language: English / German

Contact Hours: 2

The lecture deals with the fundamentals, implementations and applications of medical monitoring. The following topics, all of them elaborate with respect and in close connection to medical monitoring, are covered:

- · Fundamentals of medical monitoring (basic ideas, history, current solutions, trends)
- · Fundamentals of sensor data fusion
- Preprocessing approaches (e.g. denoising by conventional filters, Kalman filters and autoencoders)
- Dimension reduction and source separation (e.g. principal component analysis and independent component analysis)
- Feature extraction by functional transforms (e.g. time-frequency transforms)
- · Basic detection/classification approaches

Literature:

S. Bernhard, A. Brensing, and K.-H. Witte, *Biosignalverarbeitung*. De Gruyter, 2019. doi: 10.1515/9783110442434.

Assigned Courses:

Medical Monitoring and Advanced Sensor Data Processing (lecture)

**

Part of the Module: Medical Monitoring and Advanced Sensor Data Processing (Exercise)

Mode of Instruction: exercise course

Language: English / German

Contact Hours: 4

Contents:

The exercise teaches practical skills with relevance to the field of medical monitoring. The focus is handling and processing data from/for monitoring applications. The following contents are covered:

- · Familiarization with techniques of data acquisition and handling data
- · Denoising of data of variable origin
- · Application of feature extraction and dimension reduction techniques
- · Prediction/detection of (patho)physiological states
- Techniques for visualization and interpretation of sensor data

Assigned Courses:

Exercise to Medical Monitoring and Advanced Sensor Data Processing (exercise course)

**

Examination

Medical Monitoring and Advanced Sensor Data Processing

portfolio exam, graded

Test Frequency:

Module INF-0506: Search Engine Retrieval	es and Neural Information	8 ECTS/LP
Search Engines and Neural Information	on Retrieval	
Version 1.0.0 (since SoSe24)		I
Person responsible for module: Prof. I	Dr. Annemarie Friedrich	
and retrieval of information, addressin	s the power of neural networks to enhanc g many of the challenges posed by the co nt in the area of large language models (c	omplexity and variability of natural
	ts are able to explain the concepts and m tion retrieval. In particular, the course cov	
 Basics of traditional information Vector-based document and que Ranking with embeddings Question answering, entity seare Multimodal retrieval Interactive information retrieval and the search of the se	ery representations (topic modeling and r ch, and knowledge graphs	neural representations)
information retrieval problems. They wand identify gaps in the state-of-the-arsystems. They will further learn how to meaningful way. Participants will also Key skills: Formal methods; Knowled work in teams; Knowledge of workflow	uch as feature extraction, embedding lear vill be able to perform literature research i t. They know how to make scientifically no o document and present results and comp deepen their programming skills in Pytho lge of advantages and disadvantages of o vs and processes; Ability to find solutions	n the area of information retrieval, neaningful evaluations of proposed blex ideas in a reasonable and n. different design alternatives; Ability to
autonomously; Quality awareness; Sc Workload: Total: 240 h 30 h exercise course (attendance) 60 h lecture (attendance) 120 h studying of course content throu 15 h studying of course content using 15 h studying of course content using	ugh exercises / case studies (self-study) literarture (self-study)	
Conditions:		Credit Requirements:
Recommended: linear algebra, basic probability theory, Python programming.		Bestehen der Modulprüfung
The course content is complementary Datasets.	to INF-0277 Analyzing Massive	
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 6	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Search Engines and Neural Information Retrieval (Lecture)

Language: English / German

Contact Hours: 4

Contents:

This first part of this interactive course will cover the basics of traditional search engine technology, topic modeling, query expansion, collaborative filtering, neural networks, word and document embeddings, transformers, text classification, ranking and learning to rank, question answering, and evaluation designs. The second part of the course will dive into the recent literature on neural information retrieval including (for example) multi-modal search, interactive retrieval systems, entity search, personalization, and retrieval-augmented generative artificial intelligence. We will also discuss aspects related to responsible information retrieval such as bias and transparency.

The course design is complementary to INF-0277 Analyzing Massive Datasets, which focuses on compute frameworks and algorithms for processing big data.

Literature:

- Bhaskar Mitra; Nick Craswell, An Introduction to Neural Information Retrieval, 2018. doi: 10.1561/1500000061.
- Tonellotto, Nicola. "Lecture Notes on Neural Information Retrieval." ArXiv abs/2207.13443 (2022): https:// arxiv.org/abs/2207.13443
- Dan Jurafsky and James H. Martin. Speech and Language Processing. 3rd edition draft available here: https://web.stanford.edu/~jurafsky/slp3/
- Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, *Introduction to Information Retrieval*, Cambridge University Press. 2008. https://nlp.stanford.edu/IR-book/information-retrieval-book.html

Assigned Courses:

Search Engines and Neural Information Retrieval (Lecture) (lecture)

**

Part of the Module: Search Engines and Neural Information Retrieval (Exercise)

Language: English / German

Contact Hours: 2

Assigned Courses:

Search Engines and Neural Information Retrieval (Exercise) (exercise course)

**

Examination

Search Engines and Neural Information Retrieval

portfolio exam, graded

Test Frequency:

Probabilistic Machine Learning	stic Machine Learning	8 ECTS/LF
Version 1.0.0 (since SoSe24) Person responsible for module: I	Prof. Dr. Jörg-Dieter Stückler	
depth scientific level and will be multivariate distributions, probab theory, expectation maximization processes, probabilistic dimension Participants understand the adva for applications and apply them the probabilistic machine learning pro-	ences: owing methodological foundations of proba able to implement appropriate algorithms for ilistic graphical models, maximum likelihoo n, linear and logistic regression, probabilisti onality reduction, deep generative models, antages and disadvantages of different met o new problems. Students have developed oblems and know concepts and approache the competence to recognize significant so	or advanced problems: Univariate and od and a-posteriori estimation, information ic deep neural networks, Gaussian and probabilistic state-space models. thods and can analyze and select them d skills for analyzing and structuring es for implementing algorithms for these
appropriate methods; independe and models; knowledge of the a	nk logically, analytically and conceptually; s nt work with textbooks; implementation of t dvantages/disadvantages of design alterna ke scientifically meaningful assessments us work in teams.	technical solution concepts in programs tives, evaluation in the respective
	hrough exercises / case studies (self-study using provided materials (self-study)	y)
Conditions: • Basic programming knowle • Basic knowledge of probal • Recommended: Basic kno	pility theory	Credit Requirements: Passing the module exam
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours:	Repeat Exams Permitted:	

Part of the Module: Probabilistic Machine Learning (Lecture)

- Mode of Instruction: lecture Language: English
- Contact Hours: 4

This lecture teaches basic methods and algorithms for probabilistic machine learning. The lecture includes the following topics:

- 1. Univariate and multivariate distributions
- 2. Probabilistic graphical models
- 3. Maximum likelihood and a-posteriori estimation
- 4. Information theory
- 5. Expectation maximization
- 6. Linear and logistic regression
- 7. Probabilistic deep neural networks
- 8. Gaussian processes
- 9. Probabilistic dimensionality reduction
- 10. Deep generative models
- 11. Probabilistic state-space models

Literature:

Lecture slides will be provided. Additional references to literature will be provided in lecture and exercises.

Recommended textbooks:

- C. Bishop. Pattern Recognition and Machine Learning. Springer, 2006
- K. Murphy. Machine Learning: A Probabilistic Perspective. MIT Press, 2012
- K. Murphy. Probabilistic Machine Learning: An Introduction. MIT Press, 2022
- K. Murphy. Probabilistic Machine Learning: Advanced Topics. MIT Press, 2023

Assigned Courses:

Probabilistic Machine Learning (lecture)

**

Part of the Module: Probabilistic Machine Learning (Exercises)

Mode of Instruction: exercise course

Language: English

Contact Hours: 2

Assigned Courses:

Exercises for Probabilistic Machine Learning (exercise course)

Examination

Probabilistic Machine Learning

written exam / length of examination: 120 minutes, graded

Test Frequency:

Health Care Lab	ed Artificial Intelligence for	8 ECTS/LF
Human-Centered Artificial Intelligence	for Health Care Lab	
Version 1.0.0 (since SoSe24) Person responsible for module: Prof. D	r. Elisabeth André	
development of health-related applicati master the selection and safe application in the research field. Furthermore, com organization are taught through the pro-	odule, students are familiar with basic co ons. They are able to translate technica on of suitable methods. In addition, they petencies in the areas of teamwork and pressing of project tasks and their indepe e mindset and language of the research	I solution concepts into models and will gain an insight into current work communication skills as well as self- endent project planning. In the context
consolidation; interdisciplinary knowled knowledge of the mindset and languag of practice-relevant tasks; familiarity wi science; ability to present and documer independently; competence in recogniz	nnical solution concepts into programs a lge; ability to make scientifically meaning e of application-relevant disciplines; abil th procedures and processes in the app nt results in a comprehensible manner; a zing significant technical developments.	oful evaluations using suitable methods ity to work in teams; knowledge lication environment of computer ability to expand existing knowledge
Applications" bereits belegt wurde.		
Workload: Total: 240 h 60 h exercise course (attendance) 30 h lecture (attendance) 120 h studying of course content throug 15 h studying of course content using li 15 h studying of course content using p	iterarture (self-study)	
Conditions: Programming experience		Credit Requirements: Bestehen der Modulprüfung
Frequency: each summer semester	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours:	Repeat Exams Permitted: according to the examination	
6	regulations of the study program	

Language: German / English

Contact Hours: 2 Contents: TODO

Literature:

TODO

Assigned Courses:

Human-Centered Artificial Intelligence for Health Care Lab (lecture)

**

Part of the Module: Human-Centered Artificial Intelligence for Health Care Lab (Exercise Course)

Mode of Instruction: exercise course

Language: German / English

Contact Hours: 4

Assigned Courses:

Übung zu Human-Centered Artificial Intelligence for Health Care Lab (exercise course)

**

Examination

Human-Centered Artificial Intelligence for Health Care Lab

portfolio exam, graded

Test Frequency:

Module PHM-0291: Quantum Quantum Computing	Computing	6 ECTS/LP
Version 1.0.0 (since WS23/24) Person responsible for module: Pr	rof Dr. Markus Hevl	
Contents:		
 Qbits, quantum gates and quantum gates	uantum circuits	
 Physical realizations 		
Quantum noise		
Quantum error correction		
Quantum algorithms		
 Digital quantum simulation 		
Learning Outcomes / Competen	ices:	
The students acquire basic	understanding of the principles of quantur	n computers and their applications.
 They have the skills to const 	truct concrete quantum circuits and algorit	thms.
		ormation processing as well as to follow the
modern developments in the		
• • •	qualifications: Abstraction skills through t	
quantum computing languag	ge, familiarization with English professiona	al language.
Workload:		
Total: 180 h		
	rough exercises / case studies (self-study)
20 h studying of course content us	and literarture (self-study)	
40 h studying of course content us	sing provided materials (self-study)	
40 h studying of course content us 20 h exam preparation (self-study)	sing provided materials (self-study))	
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (sing provided materials (self-study))	
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (Conditions:	sing provided materials (self-study)) (attendance)	Credit Requirements:
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (Conditions: Basic knowledge of quantum mec	sing provided materials (self-study)) (attendance) hanics such as acquired in lectures	Credit Requirements: Bestehen der Modulprüfung
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (Conditions: Basic knowledge of quantum mech PHM-0017 Theoretische Physik II,	sing provided materials (self-study)) (attendance) hanics such as acquired in lectures , INF-0437 Grundlagen der	
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (Conditions: Basic knowledge of quantum mech PHM-0017 Theoretische Physik II, Quanteninformationsverarbeitung,	sing provided materials (self-study)) (attendance) hanics such as acquired in lectures , INF-0437 Grundlagen der , or INF-0440 Quantum Algorithms.	Bestehen der Modulprüfung
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (Conditions: Basic knowledge of quantum mech PHM-0017 Theoretische Physik II, Quanteninformationsverarbeitung, Frequency: every 4th semester ic	sing provided materials (self-study)) (attendance) hanics such as acquired in lectures , INF-0437 Grundlagen der , or INF-0440 Quantum Algorithms. dR Recommended Semester:	Bestehen der Modulprüfung Minimal Duration of the Module:
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (Conditions: Basic knowledge of quantum mech PHM-0017 Theoretische Physik II, Quanteninformationsverarbeitung, Frequency: every 4th semester ic im WS	sing provided materials (self-study) (attendance) hanics such as acquired in lectures , INF-0437 Grundlagen der , or INF-0440 Quantum Algorithms. dR Recommended Semester: from 1.	Bestehen der Modulprüfung
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (Conditions: Basic knowledge of quantum mech PHM-0017 Theoretische Physik II, Quanteninformationsverarbeitung, Frequency: every 4th semester ic im WS Contact Hours:	sing provided materials (self-study) (attendance) hanics such as acquired in lectures , INF-0437 Grundlagen der , or INF-0440 Quantum Algorithms. dR Recommended Semester: from 1. Repeat Exams Permitted:	Bestehen der Modulprüfung Minimal Duration of the Module:
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (Conditions: Basic knowledge of quantum mech PHM-0017 Theoretische Physik II, Quanteninformationsverarbeitung, Frequency: every 4th semester ic im WS	sing provided materials (self-study) (attendance) hanics such as acquired in lectures , INF-0437 Grundlagen der , or INF-0440 Quantum Algorithms. dR Recommended Semester: from 1. Repeat Exams Permitted: according to the examination	Bestehen der Modulprüfung Minimal Duration of the Module:
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (Conditions: Basic knowledge of quantum mech PHM-0017 Theoretische Physik II, Quanteninformationsverarbeitung, Frequency: every 4th semester ic im WS Contact Hours:	sing provided materials (self-study) (attendance) hanics such as acquired in lectures , INF-0437 Grundlagen der , or INF-0440 Quantum Algorithms. dR Recommended Semester: from 1. Repeat Exams Permitted:	Bestehen der Modulprüfung Minimal Duration of the Module:
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (Conditions: Basic knowledge of quantum mech PHM-0017 Theoretische Physik II, Quanteninformationsverarbeitung, Frequency: every 4th semester ic im WS Contact Hours:	sing provided materials (self-study) (attendance) hanics such as acquired in lectures , INF-0437 Grundlagen der , or INF-0440 Quantum Algorithms. dR Recommended Semester: from 1. Repeat Exams Permitted: according to the examination	Bestehen der Modulprüfung Minimal Duration of the Module:
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (Conditions: Basic knowledge of quantum mech PHM-0017 Theoretische Physik II, Quanteninformationsverarbeitung, Frequency: every 4th semester ic im WS Contact Hours: 4	sing provided materials (self-study) (attendance) hanics such as acquired in lectures , INF-0437 Grundlagen der , or INF-0440 Quantum Algorithms. dR Recommended Semester: from 1. Repeat Exams Permitted: according to the examination regulations of the study program	Bestehen der Modulprüfung Minimal Duration of the Module:
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (Conditions: Basic knowledge of quantum mech PHM-0017 Theoretische Physik II, Quanteninformationsverarbeitung, Frequency: every 4th semester ic im WS Contact Hours: 4 Parts of the Module	sing provided materials (self-study) (attendance) hanics such as acquired in lectures , INF-0437 Grundlagen der , or INF-0440 Quantum Algorithms. dR Recommended Semester: from 1. Repeat Exams Permitted: according to the examination regulations of the study program	Bestehen der Modulprüfung Minimal Duration of the Module:
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (Conditions: Basic knowledge of quantum mech PHM-0017 Theoretische Physik II, Quanteninformationsverarbeitung, Frequency: every 4th semester ic im WS Contact Hours: 4 Parts of the Module Part of the Module: Quantum Co Mode of Instruction: lecture Language: English / German	sing provided materials (self-study) (attendance) hanics such as acquired in lectures , INF-0437 Grundlagen der , or INF-0440 Quantum Algorithms. dR Recommended Semester: from 1. Repeat Exams Permitted: according to the examination regulations of the study program	Bestehen der Modulprüfung Minimal Duration of the Module:
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (Conditions: Basic knowledge of quantum mech PHM-0017 Theoretische Physik II, Quanteninformationsverarbeitung, Frequency: every 4th semester ic im WS Contact Hours: 4 Parts of the Module Part of the Module: Quantum Co Mode of Instruction: lecture	sing provided materials (self-study) (attendance) hanics such as acquired in lectures , INF-0437 Grundlagen der , or INF-0440 Quantum Algorithms. dR Recommended Semester: from 1. Repeat Exams Permitted: according to the examination regulations of the study program	Bestehen der Modulprüfung Minimal Duration of the Module:
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (Conditions: Basic knowledge of quantum mech PHM-0017 Theoretische Physik II, Quanteninformationsverarbeitung, Frequency: every 4th semester ic im WS Contact Hours: 4 Parts of the Module Part of the Module: Quantum Co Mode of Instruction: lecture Language: English / German	sing provided materials (self-study) (attendance) hanics such as acquired in lectures , INF-0437 Grundlagen der , or INF-0440 Quantum Algorithms. dR Recommended Semester: from 1. Repeat Exams Permitted: according to the examination regulations of the study program	Bestehen der Modulprüfung Minimal Duration of the Module:
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (Conditions: Basic knowledge of quantum mech PHM-0017 Theoretische Physik II, Quanteninformationsverarbeitung, Frequency: every 4th semester ic im WS Contact Hours: 4 Parts of the Module Part of the Module: Quantum Co Mode of Instruction: lecture Language: English / German Contact Hours: 2	sing provided materials (self-study) (attendance) hanics such as acquired in lectures , INF-0437 Grundlagen der , or INF-0440 Quantum Algorithms. dR Recommended Semester: from 1. Repeat Exams Permitted: according to the examination regulations of the study program	Bestehen der Modulprüfung Minimal Duration of the Module:
40 h studying of course content us 20 h exam preparation (self-study) 60 h lecture and exercise course (Conditions: Basic knowledge of quantum mech PHM-0017 Theoretische Physik II, Quanteninformationsverarbeitung, Frequency: every 4th semester ic im WS Contact Hours: 4 Parts of the Module Part of the Module: Quantum Co Mode of Instruction: lecture Language: English / German Contact Hours: 2 Learning Outcome:	sing provided materials (self-study) (attendance) hanics such as acquired in lectures , INF-0437 Grundlagen der , or INF-0440 Quantum Algorithms. dR Recommended Semester: from 1. Repeat Exams Permitted: according to the examination regulations of the study program	Bestehen der Modulprüfung Minimal Duration of the Module:

Part of the Module: Quantum Computing (Tutorial)

Mode of Instruction: exercise course

Language: English / German Contact Hours: 2

Learning Outcome:

see module description

Contents:

see module description

Literature:

- D. DiVincenzo, Quantum Computation, Science 270, 255-261 (1995)
- M. Nielsen and I. Chuang, Quantum Computation and Quantum Information (Cambridge University Press, 2000)
- J. Stolze and D. Suter, Quantum Computing (Wiley-VCH, 2004)
- E. Grumbling and M. Horowitz, Quantum Computing: Progress and Prospects (The National Academies Press, 2019)

Examination

Quantum Computing

oral exam / length of examination: 30 minutes, graded

	Itimedia Computing & Computer	4 ECTS/LP
Vision (MA) Seminar Multimedia Computing (M	(4)	
Version 1.0.0 (since SoSe14)		
Person responsible for module: Pro	of, Dr. Rainer Lienhart	
-	,	_
methods, procedures, techniques, image and video processing, mach individual seminar topic. Participants possess scientific met comprehensibly in speech and writ field critically and argumentatively. Furthermore, they learn to recognis oriented manner. The participants They understand how to structure a focus on essential messages and o apply chains of argumentation and confidently deal with common pres target group, apply various modera Key qualifications : Presentation t	res: Idents can independently work out and ana and technologies from the field of multimed ine learning, and image and video search) modology, communication skills, and the ab ing and to discuss and evaluate scientifical se logical structures of thinking and argume can formulate clearly and comprehensibly a a talk that is clear and easy to follow. Additi convey them in a comprehensible way, ever solution strategies in the event of disruptio entation media and use them interactively. tion techniques, and keep their audience e echniques; literature research; principles of echniques, and technologies from different	ia computing and computer vision (e.g. and evaluate them in relation to the ility to present a special topic clearly and ly challenging topics from the named intation and use them in a goal- and present subject content freely. onally, the students know how to in with complex content. They skilfully ins. The students understand how to They manage to gear a talk to a specific ingaged even over a longer period. good scientific practice; evaluating
Workload: Total: 120 h 90 h preparation of written term pa 30 h seminar (attendance)	pers (self-study)	
Conditions: none		
Frequency: each semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Seminar Mul Mode of Instruction: seminar	timedia Computing (MA)	

Language: German

Frequency: each summer semester

Contact Hours: 2

Contents:

The concrete topic of the seminar from the wide-ranging field of multimedia is determined anew each year and adapted to current trends.

Literature:

current research literature

Assigned Courses:

Seminar über Multimedia und Maschinelles Sehen (Master) (seminar)

**

Examination

Presentation and written paper

seminar, graded

Test Frequency:

	ware- and Systems Engineering	4 ECTS/LP
(Master) Seminar Software- und Systems Eng	ineering (Master)	
Version 1.1.0 (since SoSe14)		
Person responsible for module: Prof.	Dr. Wolfgang Reif	
Learning Outcomes / Competence		
After successful completion of the se	minar, students are able to understand, to ods, procedures, techniques and technolog	-
specific topic clearly and comprehens	ommunication skills and the ability to use sibly in speech and writing and to discuss ey will also be able to recognize the logica	challenging scientific topics from
understand how to structure a preser	e clearly and understandably and to presentation in a clear and comprehensible way in a comprehensible way even for comple	and how to focus the presentation on
und diese interaktiv einzusetzen. Sie	ent aufzutreten und souverän mit gängige schaffen es, einen Vortrag auf eine bestin auern zu motivieren und verschiedene Mo	nmte Zielgruppe auszurichten und den
-	ent themselves and how to deal confident to a specific target group and to motivate to guide a discussion.	
Soft Skills:		
 Literature research Independently work with Englis Analytical competence 	h technical literature	
Working methodical		
 Principles of good scientific pra 	ctice	
	ral) ideas, concepts and results in a comp	rehensible and convincing manner and
to document them		
Ability to think logically, abstract Awareness for quality aspects	tly, analytically and conceptually and to a	gue precisely
Communication skills		
Time management		
 Evaluation of solution approach 	nes, procedures, techniques and technolog	gies from different points of view
Workload:		
Total: 120 h		
90 h preparation of written term pape	rs (self-study)	
30 h seminar (attendance)		
Conditions:		
none		
Frequency: irregular (usu. winter	Recommended Semester:	Minimal Duration of the Module:
semester)	from 1.	1 semester[s]
Contact Hours:	Repeat Exams Permitted:	
2	according to the examination regulations of the study program	
		J

Parts of the Module

Part of the Module: Seminar Software- und Systems Engineering (Master)

Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

Contents:

The topics of the seminar deal with current trends in Software and Systems Engineering on the level of graduate students. The topics change from year to year and are regulary adapted to reflect new developments.

Literature:

Depends on the concrete topic.

Examination

Seminar Software- und Systems Engineering (Master)

written/oral exam / length of examination: 45 minutes work period for assignment: 3 months, graded

Test Frequency:

Seminar Datenbanksysteme für Maste	base Systems Master	4 ECTS/LF
Version 1.0.0 (since SoSe16)		
Person responsible for module: Prof. [Dr. Peter Michael Fischer	
Learning Outcomes / Competences	:	
concepts, methods, procedures, techn individual seminar topic from the ment They have the scientific methodology, topic in a clear and understandable ma and evaluate scientifically challenging structures of reasoning and argumenta The participants can formulate clearly how to structure a lecture in a clear an and convey them in a comprehensible argumentation and solution strategies The students understand how to prese	communication skills and ability to use anner, both verbally and in writing, and to topics from the named field. They will a ation and use them in a goal-oriented m and comprehensibly and present specia of comprehensible way and how to focu way, even in the case of complex conte in the event of disruptions. ent themselves and how to deal confider	tabase systems in relation to the appropriate media to present a specific o critically and argumentatively discuss so be able to recognize the logical anner. list content freely. They understand a the lecture on essential messages nt. They skilfully apply chains of tty with common presentation media
even during longer lecture durations a Key qualifications: Literature research, methodical competence; Scientific me confident and convincing (written and for their documentation; Skill in logical awareness, meticulousness; Commun techniques and technologies from diffe	nd to apply various moderation techniques ; Independent work with English-language thodology; Principles of good scientific p oral) presentation of (practical or theore , abstract, analytical and conceptual thir ication skills; Time management; Evaluate	es. ge specialist literature; Analytical- ractice; Skill in the comprehensible, ical) ideas, concepts and results and king and formal argumentation; Quality
even during longer lecture durations a Key qualifications: Literature research methodical competence; Scientific me confident and convincing (written and for their documentation; Skill in logical awareness, meticulousness; Commun techniques and technologies from diffe Workload:	nd to apply various moderation techniques ; Independent work with English-language thodology; Principles of good scientific p oral) presentation of (practical or theore , abstract, analytical and conceptual thir ication skills; Time management; Evaluate	es. ge specialist literature; Analytical- ractice; Skill in the comprehensible, ical) ideas, concepts and results and king and formal argumentation; Quality
even during longer lecture durations a Key qualifications: Literature research, methodical competence; Scientific me confident and convincing (written and for their documentation; Skill in logical awareness, meticulousness; Commun techniques and technologies from diffe Workload: Total: 120 h	nd to apply various moderation technique ; Independent work with English-language thodology; Principles of good scientific p oral) presentation of (practical or theore , abstract, analytical and conceptual thir ication skills; Time management; Evaluate erent points of view.	es. ge specialist literature; Analytical- ractice; Skill in the comprehensible, ical) ideas, concepts and results and king and formal argumentation; Quality
even during longer lecture durations a Key qualifications: Literature research, methodical competence; Scientific me confident and convincing (written and for their documentation; Skill in logical awareness, meticulousness; Commun techniques and technologies from diffe Workload: Total: 120 h 90 h preparation of written term paper	nd to apply various moderation technique ; Independent work with English-language thodology; Principles of good scientific p oral) presentation of (practical or theore , abstract, analytical and conceptual thir ication skills; Time management; Evaluate erent points of view.	es. ge specialist literature; Analytical- ractice; Skill in the comprehensible, ical) ideas, concepts and results and king and formal argumentation; Quality
even during longer lecture durations a Key qualifications: Literature research, methodical competence; Scientific me confident and convincing (written and for their documentation; Skill in logical awareness, meticulousness; Commun techniques and technologies from diffe Workload: Total: 120 h 90 h preparation of written term papers 30 h seminar (attendance)	nd to apply various moderation technique ; Independent work with English-language thodology; Principles of good scientific p oral) presentation of (practical or theore , abstract, analytical and conceptual thir ication skills; Time management; Evaluate erent points of view.	es. ge specialist literature; Analytical- ractice; Skill in the comprehensible, ical) ideas, concepts and results and king and formal argumentation; Quality
even during longer lecture durations a Key qualifications: Literature research, methodical competence; Scientific me confident and convincing (written and for their documentation; Skill in logical awareness, meticulousness; Commun techniques and technologies from diffe Workload: Total: 120 h 90 h preparation of written term papers 30 h seminar (attendance) Conditions:	nd to apply various moderation techniqu ; Independent work with English-language thodology; Principles of good scientific p oral) presentation of (practical or theore , abstract, analytical and conceptual thir ication skills; Time management; Evalua- erent points of view.	es. ge specialist literature; Analytical- ractice; Skill in the comprehensible, ical) ideas, concepts and results and king and formal argumentation; Quality
even during longer lecture durations a Key qualifications: Literature research methodical competence; Scientific me confident and convincing (written and for their documentation; Skill in logical awareness, meticulousness; Commun techniques and technologies from diffe Workload: Total: 120 h 90 h preparation of written term papers 30 h seminar (attendance) Conditions: Module Database Systems (INF-0073)	nd to apply various moderation techniqu ; Independent work with English-language thodology; Principles of good scientific p oral) presentation of (practical or theore , abstract, analytical and conceptual thir ication skills; Time management; Evalua- erent points of view.	es. ge specialist literature; Analytical- ractice; Skill in the comprehensible, ical) ideas, concepts and results and king and formal argumentation; Quality
even during longer lecture durations a Key qualifications: Literature research, methodical competence; Scientific me confident and convincing (written and for their documentation; Skill in logical awareness, meticulousness; Commun techniques and technologies from diffe Workload: Total: 120 h 90 h preparation of written term papers 30 h seminar (attendance) Conditions: Module Database Systems (INF-0073) Frequency: irregular (usu. summer	nd to apply various moderation techniqu ; Independent work with English-language thodology; Principles of good scientific p oral) presentation of (practical or theore , abstract, analytical and conceptual thir ication skills; Time management; Evaluate erent points of view.	es. ge specialist literature; Analytical- ractice; Skill in the comprehensible, ical) ideas, concepts and results and king and formal argumentation; Quality ation of approaches, procedures,
even during longer lecture durations a Key qualifications: Literature research, methodical competence; Scientific me confident and convincing (written and for their documentation; Skill in logical awareness, meticulousness; Commun techniques and technologies from diffe Workload: Total: 120 h 90 h preparation of written term paper 30 h seminar (attendance) Conditions: Module Database Systems (INF-0073) Frequency: irregular (usu. summer semester)	nd to apply various moderation techniqu ; Independent work with English-language thodology; Principles of good scientific p oral) presentation of (practical or theore , abstract, analytical and conceptual thir ication skills; Time management; Evalua- erent points of view. s (self-study)) - recommended Recommended Semester:	es. ge specialist literature; Analytical- ractice; Skill in the comprehensible, ical) ideas, concepts and results and king and formal argumentation; Quality ation of approaches, procedures,
even during longer lecture durations a Key qualifications: Literature research, methodical competence; Scientific me confident and convincing (written and for their documentation; Skill in logical awareness, meticulousness; Commun techniques and technologies from diffe Workload: Total: 120 h 90 h preparation of written term papers 30 h seminar (attendance) Conditions: Module Database Systems (INF-0073) Frequency: irregular (usu. summer semester) Contact Hours:	nd to apply various moderation techniqu ; Independent work with English-language thodology; Principles of good scientific p oral) presentation of (practical or theore , abstract, analytical and conceptual thir ication skills; Time management; Evalua- erent points of view. s (self-study)) - recommended Recommended Semester: from 1.	es. ge specialist literature; Analytical- ractice; Skill in the comprehensible, ical) ideas, concepts and results and king and formal argumentation; Quality ation of approaches, procedures,
Key qualifications: Literature research methodical competence; Scientific me confident and convincing (written and for their documentation; Skill in logical	nd to apply various moderation techniqu ; Independent work with English-language thodology; Principles of good scientific p oral) presentation of (practical or theore , abstract, analytical and conceptual thir ication skills; Time management; Evalua- erent points of view. s (self-study)) - recommended Recommended Semester: from 1. Repeat Exams Permitted:	es. ge specialist literature; Analytical- ractice; Skill in the comprehensible, ical) ideas, concepts and results and king and formal argumentation; Quality ation of approaches, procedures,

Part of the Module: Seminar Datenbanksysteme für Master

Mode of Instruction: seminar Language: German / English

Language. German / Engi

Contact Hours: 2

Contents:

Current research contributions from the field of "Databases and Information Systems".

Literature:

Current research contributions

Assigned Courses:

Seminar Datenbanksysteme für Master (seminar)

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Examination

lecture and written elaboration seminar, graded Test Frequency: when a course is offered

Valid Sommersemester 2024 - Printed 08.04.2024

Module INF-0251: Seminar Artificial Intelligence Seminar Artificial Intelligence	4 ECTS/LP
Version 1.0.0 (since SoSe17) Person responsible for module: PD Dr. Jonghwa Kim	
Contents:	nmar tarm ar mid Dacambar far winter tarm
The seminar will take place as a block seminar at the end of June for sur The topic area for this seminar will be redefined annually, taking into acc	

Learning Outcomes / Competences:

After attending the seminar, students are able to independently develop, analyze and evaluate advanced problems, concepts, methods, procedures, techniques and technologies in the field of "Artificial Intelligence and Intelligent Systems" in relation to the individual seminar topic from the mentioned field. They have the scientific methodology, communication skills and ability to use appropriate media to present a specific topic clearly and comprehensibly, both verbally and in writing, and to discuss and evaluate scientifically challenging topics from the named field critically and argumentatively. They will also be able to recognize the logical structures of reasoning and argumentation and use them in a goal-oriented manner. The participants can formulate clearly and comprehensibly and present specialist content freely. They understand how to structure a lecture in a clear and comprehensible way and how to focus the lecture on essential messages and convey them in a comprehensible way, even in the case of complex content. They skilfully apply chains of argumentation and solution strategies in the event of disruptions. The students understand how to present themselves and how to deal confidently with common presentation media and to use them interactively. They manage to gear a lecture to a specific target group and to motivate the listener even during longer lecture durations and to apply various moderation techniques.

Key qualifications: Evaluation of approaches, procedures, techniques and technologies from different points of view; literature research; independent work with English-language technical literature; analytical-methodical competence; scientific methodology; principles of good scientific practice; skill in the comprehensible, confident and convincing (written and oral) presentation of (practical or theoretical) ideas, concepts and results and in documenting them; skill in logical, abstract, analytical and conceptual thinking and formal argumentation; quality awareness, meticulousness; communication skills; time management.

Workload:

Total: 120 h 30 h seminar (attendance)

90 h preparation of written term papers (self-study)

Conditions: none		Credit Requirements: Passing the module exam
Frequency: usu. at least once per acad. year	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Seminar Artificial Intelligence

Mode of Instruction: seminar Language: German / English Contact Hours: 2 ECTS Credits: 4.0

Contents:

The seminar will take place as a block seminar at the end of June for summer term or mid-December for winter term. The topic area for this seminar will be redefined annually, taking into account new trends in "Artificial Intelligence and Intelligent Systems".

Literature:

current research literature

Examination

Seminar Artificial Intelligence written/oral exam, graded

Test Frequency:

and Wellbeing (Master)	mbedded Intelligence for Health Care	4 ECTS/LP
	or Health Care and Wellbeing (Master)	
Version 1.0.0 (since WS17/18) Person responsible for module: Pr	rof. Dr. Björn Schuller	
statements, concepts, methods, and for Health Care and Wellbeing. The employ suitable media, to present scientifically challenging themes for thinking and debating and employ Participants can express themselve how to structure a talk, to focus it them in a suitable way. The lines of Students know how to perform end manage to orient a talk toward a c different methods of moderation.	nts will be able to autonomously acquire and pproaches, techniques, and technologies in t bey possess the scientific techniques, commu understandingly a special topic in spoken an rom the field in a critical way. Furthermore, th	he field of Embedded Intelligence nication skills, and the ability to d written, and to discuss and evaluate ey can recognise logical structures of esent scientific topics. They understand trial messages, and to communicate bances are applied by the students. lia and to use them interactively. They o over a longer duration, and to employ
	d work with English technical literature; Comr	nunication skills: Ability to present (in
report in the markup language La	theoretical ideas in an understandable, confic FeX; Evaluation of methods, technologies, an	lent, and convincing way; Writing a
	ΓeX; Evaluation of methods, technologies, an	lent, and convincing way; Writing a
report in the markup language La Quality awareness. Workload: Total: 120 h 90 h preparation of written term pa	ΓeX; Evaluation of methods, technologies, an	lent, and convincing way; Writing a
report in the markup language LaT Quality awareness. Workload: Total: 120 h 90 h preparation of written term pa 30 h seminar (attendance) Conditions:	ΓeX; Evaluation of methods, technologies, an	dent, and convincing way; Writing a d solutions w.r.t. different aspects;

Parts of the Module

Part of the Module: Seminar Embedded Intelligence for Health Care and Wellbeing (Master)

Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

Contents:

In the seminar Embedded Intelligence for Health Care and Wellbeing, recent research works in this field are going to be discussed. This comprises both the acquisition of data through sensors and (e.g., microphones or electrodes) and the analysis and the modelling of the data. One important aspect is also the practicability of modern deep learning methods. Health Care and Wellbeing applications reach from tracking of health states (e.g., epilepsy or depression) to personal assistance services.

The participating students will work on a certain aspect, supervised by a research associate of the chair. They will summarise their results in a written report and an oral presentation.

Topics: E-Health, M-Health, Sensor Signal Analysis, Vital Signs, Big Data.

Literature:

Wird vom Dozenten oder der Dozentin bekannt gegeben

Examination

Seminar Embedded Intelligence for Health Care and Wellbeing (Master)

written/oral exam, graded

Test Frequency:

Module INF-0314: Seminar IT Infrastructure in Medical Information Systems for Master Students	4 ECTS/LP
Seminar IT-Infrastrukturen in der Medizin für Master	

Version 1.0.0 (since SoSe19)

Person responsible for module: Prof. Dr. Frank Kramer

Learning Outcomes / Competences:

After attending the seminar, students are able to independently develop, analyze and evaluate advanced problems, concepts, methods, procedures, techniques and technologies in the field of IT infrastructures for translational medical research in relation to the individual seminar topic from the mentioned field. They have the scientific methodology, communication skills and ability to use appropriate media to present a specific topic in a clear and comprehensible manner, both verbally and in writing, and to critically and argumentatively discuss and evaluate scientifically challenging topics from the named field. They will also be able to recognize the logical structures of reasoning and argumentation and use them in a goal-oriented manner. The participants can formulate clearly and comprehensible way and how to focus the lecture on essential messages and convey them in a comprehensible way, even in the case of complex content. They skilfully apply chains of argumentation and solution strategies in the event of disruptions. The students understand how to present themselves and how to deal confidently with common presentation media and to use them interactively. They manage to gear a lecture to a specific target group and to motivate the listener even during longer lecture durations and to apply various moderation techniques.

Key Skills: Literature research; Independent work with English-language specialist literature; Analytical-methodical competence; Scientific methodology; Principles of good scientific practice; Skill in the comprehensible, confident and convincing (written and oral) presentation of (practical or theoretical) ideas, concepts and results and for their documentation; Skill in logical, abstract, analytical and conceptual thinking and formal argumentation; Quality awareness, meticulousness; Communication skills; Time management; Evaluation of approaches, procedures, techniques and technologies from different points of view.

Workload:

Total: 120 h

90 h preparation of written term papers (self-study)30 h seminar (attendance)

Conditions:		Credit Requirements:
none		Passing the module examination
Frequency: each semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Seminar IT Infrastructure in Medical Information Systems for Master Students Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

Contents:

Current topics of IT infrastructures in medicine

Literature:

will be presented in the respective kickoff event.

Assigned Courses:

Seminar IT-Infrastrukturen in der Medizin für Master (seminar)

**

Examination

Seminar IT Infrastructure in Medical Information Systems for Master Students

written/oral exam, graded

Test Frequency:

dvanced problems, concepts, and evaluate them in relation to present a special topic clearly and llenging topics from the named n and use them in a goal- esent subject content freely. , the students know how to complex content. They skilfully e students understand how to manage to gear a talk to a specific
and evaluate them in relation to present a special topic clearly and llenging topics from the named n and use them in a goal- esent subject content freely. , the students know how to complex content. They skilfully e students understand how to
Ilenging topics from the named n and use them in a goal- esent subject content freely. , the students know how to complex content. They skilfully e students understand how to
esent subject content freely. , the students know how to complex content. They skilfully le students understand how to
scientific practice; evaluating
dit Requirements: sing the module examination
imal Duration of the Module: emester[s]
1

Part of the Module: Seminar Process Mining

Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

ECTS Credits: 4.0

Contents:

Current Research Topics in the Field of Process Mining: Process Discovery, Conformance Checking, Enhancement, Preprocessing of logs (clustering, filtering), Handling of Noise, Synthesis based methods, Process Mining and Data Mining, Statistical methods in Process Mining, case studies, tooling.

Das Seminar eignet sich zur Vorbereitung auf Abschlussarbeiten und Projektmodule.

Literature:

Literature depends on the chosen topic

Seminar Process Mining

written/oral exam / length of examination: 60 minutes work period for assignment: 2 months, graded

Test Frequency:

Seminar Computational Intellige	Computational Intelligence (Master) nce (Master)	4 ECTS/LP
Version 1.0.0 (since SoSe20) Person responsible for module: I	Prof. Dr. Björn Schuller	
statements, concepts, methods, They possess the scientific techn understandingly a special topic in from the field in a critical way. Fu them constructively. Participants can express themse how to structure a talk, to focus i them in a suitable way. The lines Students know how to perform e	ents will be able to autonomously acquire an approaches, techniques, and technologies in hiques, communication skills, and the ability to h spoken and written, and to discuss and eva inthermore, they can recognise logical structu lives in a clear and understandable way and p t - also given a complex content - on the esse of arguments and strategies in case of distu- nergetically, to cope with the presentation me certain audience, to motivate the listeners also	the field of Computational Intelligence. o employ suitable media, to present iluate scientifically challenging themes irres of thinking and debating and employ present scientific topics. They understand ential messages, and to communicate rbances are applied by the students. edia and to use them interactively. They
management; Literature research to present (in written and spoker	tals of good scientific practice; Analytical-met n; Self-contained work with English technical n) practical and theoretical ideas in an unders nguage LaTeX; Evaluation of methods, techn	literature; Communication skills; Ability tandable, confident, and convincing way;
Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term p	papers (self-study)	
Conditions: none		Credit Requirements: Bestehen der Modulprüfung
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]

Part of the Module: Seminar Computational Intelligence (Master)

Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

Contents:

Fuzzy Logic, Neural Networks, Evolutionary Computation, Learning Theory, Probabilistic Methods

Literature:

To be announced by the lecturers.

Seminar Computational Intelligence (Master)

written/oral exam, graded

Test Frequency:

Module INF-0337: Seminar En Seminar Embedded Systems (Mag		4 ECTS/LF
Version 1.0.0 (since SoSe20) Person responsible for module: Pr	of. Dr. Sebastian Altmeyer	
-	nts are able to independently develop, and chniques and technologies in the field of e	
topic in a clear and comprehensibl challenging topics from the aforem	gy, communication skills and ability to use e manner, both verbally and in writing, and entioned field in a critical and argumentat reasoning and argumentation and use the	d to discuss and evaluate scientifically ive manner. They will also be able to
how to structure a scientific preser essential messages and convey th apply chains of argumentation and present themselves and how to de	arly and comprehensibly and present spec tation in a clear and comprehensible way em in a comprehensible way, even in the solution strategies in the event of disrupti al confidently with common presentation r a specific target group and to motivate the deration techniques.	and how to focus the presentation on case of complex content. They skilfully fons. The students understand how to nedia and to use them interactively. They
methodical competence; Scientific confident and convincing (written a for their documentation; Skill in log	earch; Independent work with English-lang methodology; Principles of good scientific and oral) presentation of (practical or theor ical, abstract, analytical and conceptual th nunication skills; Time management; Eval different points of view.	e practice; Skill in the comprehensible, retical) ideas, concepts and results and ninking and formal argumentation; Quality
Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term pa	pers (self-study)	
Conditions: none		
Frequency: each semester	Recommended Semester: 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Parts of the Module Part of the Module: Seminar Em Mode of Instruction: seminar	bedded Systems (Master)	

Language: German / English

Contact Hours: 2

Contents:

In the seminar, topics from the field of embedded systems will be covered. Each seminar participant receives individual literature references, which are then to be supplemented in the course of the seminar by further independently compiled references. The seminar will end with a written paper and a presentation on the topic covered.

Literature:

given individually and self research

Assigned Courses:

Seminar Embedded Systems (Master) (seminar)

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Examination

Seminar Embedded Systems (Master)

written/oral exam, graded

Test Frequency:

Seminar Digital Health (Master)	Digital Health (Master)	4 ECTS/LP
Version 1.0.0 (since SoSe20) Person responsible for module: I	Prof. Dr. Björn Schuller	
statements, concepts, methods, the scientific techniques, commu a special topic in spoken and wri in a critical way. Furthermore, the constructively. Participants can express themse how to structure a talk, to focus i them in a suitable way. The lines Students know how to perform e	lents will be able to autonomously acquire a approaches, techniques, and technologies i inication skills, and the ability to employ suit tten, and to discuss and evaluate scientifica ey can recognise logical structures of thinkin elves in a clear and understandable way and t - also given a complex content - on the ess of arguments and strategies in case of dist nergetically, to cope with the presentation m certain audience, to motivate the listeners a	n the field of Digital Health. They possess able media, to present understandingly Ily challenging themes from the field ag and debating and employ them present scientific topics. They understand sential messages, and to communicate urbances are applied by the students. nedia and to use them interactively. They
Literature research; Self-contain written and spoken) practical and	od scientific practice; Analytical-methodologi ed work with English technical literature; Co d theoretical ideas in an understandable, co aTeX; Evaluation of methods, technologies,	mmunication skills; Ability to present (in nfident, and convincing way; Writing a
Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term	papers (self-study)	
Conditions: none		
Frequency: irregular	Recommended Semester: from 5.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	

Part of the Module: Seminar Digital Health (Master) Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

Contents:

In the seminar Digital Health, recent research works in this field are going to be discussed. This comprises both the acquisition of data through sensors and (e.g., microphones or electrodes) and the analysis and the modelling of the data. One important aspect is also the practicability of modern deep learning methods. Digital Health applications reach from tracking of health states (e.g., epilepsy or depression) to personal assistance services. The participating students will work on a certain aspect, supervised by a research associate of the chair. They will summarise their results in a written report and an oral presentation.

Topics: E-Health, M-Health, Sensor Signal Analysis, Vital Signs, Big Data.

Literature:

To be announced by the lecturer

Examination

Seminar Digital Health (Master)

written/oral exam, graded

Test Frequency:

	oftware Engineering of Distributed	4 ECTS/LF
Systems (MA) Seminar Software Engineering vei	rteilter Systeme (MA)	
Version 1.0.0 (since SoSe20) Person responsible for module: Pr	of. Dr. Bernhard Bauer	
concepts, methods, procedures, te the particular seminar topic from the ability to use appropriate media to discuss and evaluate scientifically they can recognize the logical stru- can formulate clearly and compre- lecture clearly and understandably with complex content. They skillful The students understand how to p interactively. They manage to gear durations, and apply various mode Key qualifications: Literature resea	nts can independently develop, analyze and echniques, and technologies in software en- ne named field. They have the scientific me present a specific case clearly and compre- challenging topics from the named field criti- ctures of thinking and argumentation and u nensibly and present subject content freely. y, focus the study on essential messages, a ly apply chains of argumentation and soluti- resent themselves and confidently deal with r a lecture to a specific target group, motiva- eration techniques. arch; independent work with English-langua	gineering for distributed systems about thodology, communication skills, and ehensibly in speech and writing and to tically and argumentatively. Furthermore se them goal-oriented. The participants They understand how to structure a nd understandably convey them, even on strategies in the event of disruptions. h joint presentation media and use them ate the listener even during longer lecture
confident, and convincing (written and in documenting them; skills in quality awareness, meticulousness	methodology; principles of good scientific p and oral) presentation of (practical or theor logical, abstract, analytical and conceptual s; communication skills; time management; a different points of view. Translated with wy	etical) ideas, concepts, and results thinking and formal argumentation; evaluation of approaches, procedures,
Total: 120 h 90 h preparation of written term pa 30 h seminar (attendance)	apers (self-study)	
-	Software Engineering of Distributed ot have been taken due to overlaps.	
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		

Literature:

Will be presented in the respective kick-off event.

Assigned Courses:

Seminar Software Engineering verteilter Systeme (Master) (seminar)

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Examination

Seminar Software Engineering verteilter Systeme (MA)

written/oral exam, graded

Test Frequency:

Module INF-0346: Seminar Au Engineering (MA) Seminar Automotive Software and	Itomotive Software and Systems Systems Engineering (MA)	4 ECTS/LF
Version 1.0.0 (since SoSe20) Person responsible for module: Pro	of. Dr. Bernhard Bauer	
methods, procedures, techniques, a particular seminar topic from the na- to use appropriate media to presen and evaluate scientifically challengi can recognize the logical structures formulate clearly and comprehensil clearly and understandably, focus t complex content. They skillfully app students understand how to presen interactively. They manage to gear durations, and apply various moder Key qualifications: Literature resear methodical competence; scientific confident, and convincing (written a and in documenting them; skills in l quality awareness, meticulousness	tts can independently analyze and evaluate and technologies in Automotive Software 8 amed area. They have the scientific method it a specific case clearly and comprehensib ing topics from the named field critically an s of thinking and argumentation and use the bly and present subject content freely. The the study on important messages, and under only chains of argumentation and solution st at themselves and confidently deal with join a lecture to a specific target group, motiva	A Systems Engineering about the dology, communication skills, and ability ly in speech and writing and to discuss d argumentatively. Furthermore, they em goal-oriented. The participants can y understand how to structure a lecture erstandably convey them, even with rategies in the event of disruptions. The t presentation media and use them te the listener even during longer lecture ge specialist literature; analytical- ractice; skills in the understandable, etical) ideas, concepts, and results thinking and formal argumentation; evaluation of approaches, procedures,
Workload: Total: 120 h 90 h preparation of written term par 30 h seminar (attendance)	pers (self-study)	
	damentals of Software Engineering for 040) must not have been taken due to	
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination	

Parts of the Module

Part of the Module: Seminar Automotive Software and Systems Engineering (MA)

Mode of Instruction: seminar

Language: German

Contact Hours: 2

Contents:

Current software engineering topics from industry and research.

Literature:

Will be presented in the respective kick-off event.

Seminar Automotive Software and Systems Engineering (MA)

written/oral exam, graded

Test Frequency:

Mode of Instruction: seminar Language: German	Contrare and Cystellis Englicelling (
Parts of the Module Part of the Module: Seminar Avionic	Software and Systems Engineering (MA)
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Conditions: The previous course "Seminar Grundla Avionic Systems (MA)" (INF-0041) mus	gen des Software Engineering für st not have been taken due to overlaps.	
Workload: Total: 120 h 90 h preparation of written term papers 30 h seminar (attendance)	(self-study)	1
longer lecture durations, and apply vari Key qualifications: Literature research; methodical competence; scientific meth confident, and convincing (written and o and in documenting them; skills in logic quality awareness, meticulousness; cor		e specialist literature; analytical- actice; skills in the understandable, ical) ideas, concepts, and results ninking and formal argumentation; valuation of approaches, procedures,
appropriate media to present a specific evaluate scientifically challenging topics can recognize the logical structures of t can formulate clearly and comprehensi lecture clearly and understandably focu in the case of complex content. They sh disruptions. The students understand h	case clearly and comprehensibly in spe s from the named field critically and argu- thinking and argumentation and use the bly and present subject content freely. T is the study on important messages and killfully apply chains of argumentation ar ow to present themselves and confident ge to gear a lecture to a specific target o	eech and writing and to discuss and umentatively. Furthermore, they m goal-oriented. The participants hey understand how to structure a understandably convey them, even ad solution strategies in the event of the deal with joint presentation media
methods, procedures, techniques, and	an independently analyze and evaluate technologies in Avionic Software & Syst ey have the scientific methodology, com	ems Engineering about the particular
Version 1.0.0 (since SoSe20) Person responsible for module: Prof. D	r. Bernhard Bauer	
Engineering (MA) Seminar Avionic Software and Systems	ic Software and Systems	

Contents:

Current software engineering topics from industry and research.

Literature:

Will be presented in the respective kick-off event.

Seminar Avionic Software and Systems Engineering (MA)

written/oral exam, graded

Test Frequency:

Seminar Menschzentrierte Künstlic	uman-Centered Artificial Intelligence	4 ECTS/LP
Version 1.0.0 (since SoSe20) Person responsible for module: Pro	of. Dr. Elisabeth André	,
concepts, methods, procedures, te related to the individual seminar top skills and ability to use appropriate verbally and in writing, and to critica from the named field. They will also and use them in a goal-oriented ma specialist content freely. They unde focus the lecture on essential mess content. They skilfully apply chains understand how to present themse interactively. They manage to gear lecture durations and to apply vario Key qualifications: Literature rese methodical competence; Scientific	ts are able to independently work out, analy chniques and technologies in the field of "hu pic from the mentioned field. They have the media to present a specific topic in a clear a ally and argumentatively discuss and evalua to be able to recognize the logical structures anner. The participants can formulate clearly erstand how to structure a lecture in a clear sages and convey them in a comprehensible of argumentation and solution strategies in lves and how to deal confidently with comm a lecture to a specific target group and to m ous moderation techniques. earch; Independent work with English-langua methodology; Principles of good scientific p	iman-centered artificial intelligence" scientific methodology, communication and comprehensible manner, both ite scientifically challenging topics of reasoning and argumentation v and comprehensibly and present and comprehensible way and how to e way, even in the case of complex the event of disruptions. The students on presentation media and to use them notivate the listener even during longer
	nd aral) procontation of (practical or theoret	-
for their documentation; Skill in log	nd oral) presentation of (practical or theoret ical, abstract, analytical and conceptual thin nunication skills; Time management.	cal) ideas, concepts and results and
for their documentation; Skill in log awareness, meticulousness; Comm Workload: Total: 120 h 90 h preparation of written term pa 30 h seminar (attendance)	ical, abstract, analytical and conceptual thin nunication skills; Time management.	cal) ideas, concepts and results and
for their documentation; Skill in log awareness, meticulousness; Comm Workload: Total: 120 h 90 h preparation of written term pa 30 h seminar (attendance) Conditions:	ical, abstract, analytical and conceptual thin nunication skills; Time management.	cal) ideas, concepts and results and
for their documentation; Skill in log awareness, meticulousness; Comn Workload: Total: 120 h 90 h preparation of written term pa	ical, abstract, analytical and conceptual thin nunication skills; Time management.	cal) ideas, concepts and results and

Parts of the Module

Part of the Module: Seminar Human-Centered Artificial Intelligence

Mode of Instruction: seminar

Language: German

Contact Hours: 2

Contents:

Topics in the field of "Human-Centered Artificial Intelligence"

Literature:

References will be announced at the preliminary meeting.

Seminar Human-Centered Artificial Intelligence

written/oral exam, graded

Test Frequency:

Module INF-0364: Seminar Software Engineering in Safety- and Security-Critical Systems (MA)Seminar Software Engineering in sicherheitskritischen Systemen (MA)	4 ECTS/LP
Version 1.0.0 (since WS20/21) Person responsible for module: Prof. Dr. Bernhard Bauer	
Learning Outcomes / Competences:	

After attending the seminar, students can independently develop, analyze and evaluate advanced problems, concepts, methods, procedures, techniques, and technologies in software engineering in safety-critical systems and related disciplines about the particular seminar topic from the named field. They have the scientific methodology, communication skills, and ability to use appropriate media to present a specific case clearly and comprehensibly in speech and writing and to discuss and evaluate scientifically challenging topics from the named field critically and argumentatively. Furthermore, they can recognize the logical structures of thinking and argumentation and use them goal-oriented. The participants can formulate clearly and comprehensibly and present subject content freely. They understand how to structure a lecture clearly and understandably, focus on essential messages, and coherently convey them, even with complex content. They skillfully apply chains of argumentation and solution strategies in the event of disruptions. The students understand how to present themselves and confidently deal with joint presentation media and use them interactively. They manage to gear a lecture to a specific target group, motivate the listener even during longer lecture durations, and apply various moderation techniques.

Key qualifications: Literature research; independent work with English-language specialist literature; analyticalmethodical competence; scientific methodology; principles of good scientific practice; skills in the understandable, confident, and convincing (written and oral) presentation of (practical or theoretical) ideas, concepts, and results and in documenting them; skills in logical, abstract, analytical and conceptual thinking and formal argumentation; quality awareness, meticulousness; communication skills; time management; evaluation of approaches, procedures, techniques, and technologies from different points of view. Translated with www.DeepL.com/Translator (free version)

Workload:

Total: 120 h 30 h seminar (attendance)

90 h preparation of written term papers (self-study)

Conditions:		
none		
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Seminar Software Engineering in sicherheitskritischen Systemen (MA)

Mode of Instruction: seminar

Language: German

Contact Hours: 2

Contents:

Current software engineering topics from industry and research.

Literature:

Will be presented in the respective kick-off event.

Assigned Courses:

Seminar Software Engineering in sicherheitskritischen Systemen (Master) (seminar)

**

Examination

Seminar Software Engineering in sicherheitskritischen Systemen (MA) written/oral exam, graded

Test Frequency:

Module INF-0385: Seminar Reso Seminar Resource Aware Algorithmic	urce Aware Algorithmics (Master s (Master)) 4 ECTS/LP
Version 1.0.0 (since SoSe21) Person responsible for module: Prof. I	Dr. Tobias Mömke	
Learning Outcomes / Competences After attending the seminar, the stude techniques in a self-sufficient manner.	: nts are able to understand basic algorith	mic concepts, methods, tools and
They have acquired communication sl scientific topic both as a talk and in wr		and the use of media to present a specific
	ont of the audience, using state of the a	derstandable and inspiring manner. They rt presentation tools and media. They
clean scientific practice; ability to pres	logical and analytical thinking; ability to	rstandable and structured manner (both
Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term paper	s (self-study)	
Conditions: Good knowledge of content taught in r as "Mathematik für Informatiker 1" an Knowledge about algorithms and data	d "Diskrete Strukturen und Logik."	Credit Requirements: Passing of the module exam
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Seminar Resour Mode of Instruction: seminar	rce Aware Algorithmics (Master)	

Language: German / English

Contact Hours: 2

Contents:

The topics of the seminar are related to research in resource aware algorithmics. The precise topics change over time, in order to reflect up-to-date developments.

Literature:

Depending on the topic of the seminar.

Assigned Courses:

Seminar Resource Aware Algorithmics (Master) (seminar)

*(online/digital) *

Seminar Resource Aware Algorithmics (Master)

written/oral exam, graded

Test Frequency:

Seminar Digitale Ethik (Master)	igital Ethics (Master)	4 ECTS/LP
Version 1.0.0 (since WS21/22) Person responsible for module: Pr	rof. Dr. Robert Lorenz	
-	udents can independently work out and ar and technologies from the field of digital e	
	thodology, communication skills, and the a iting and to discuss and evaluate scientific.	
oriented manner. The participants They understand how to structure focus on essential messages and apply chains of argumentation and confidently deal with common pres	ise logical structures of thinking and argun can formulate clearly and comprehensibly a talk that is clear and easy to follow. Add convey them in a comprehensible way, ev d solution strategies in the event of disrupt sentation media and use them interactively ation techniques, and keep their audience	y and present subject content freely. itionally, the students know how to yen with complex content. They skilfully ions. The students understand how to y. They manage to gear a talk to a specific
• •	techniques; literature research; principles techniques, and technologies from differer	
Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of presentations	(self-study)	
Conditions: none		Credit Requirements: Passing the module examination
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination	
	regulations of the study program	

Mode of Instruction: seminar

Language: English / German Contact Hours: 2

ECTS Credits: 4.0

Contents:

The topics of the seminar change over time, in order to reflect up-to-date developments

Literature:

Literature depends on the chosen topic

Seminar Digital Ethics (Master)

presentation / length of examination: 45 minutes, graded

Test Frequency:

Seminar Organic Computing (Mast	ganic Computing (Master)	4 ECTS/LP
Version 1.0.0 (since WS22/23)		
Person responsible for module: Pro	of. Dr. Jörg Hähner	
-	dents are able to independently work out logies in the fields of organic computing a	
special topic clearly and comprehe	lology, communication skills and ability to nsibly in speech and writing and to discus y and argumentatively. Furthermore, they e them in a goal-oriented manner.	s and evaluate scientifically challenging
structure a presentation clearly and	nd comprehensibly and present specialis I reasonable and how to focus on essentian ney skilfully apply lines of argument and s	als and convey those in a comprehensible
•		th common presentation media, using tivate the listener even during longer talks
and convincing manner (written and	practical and theoretical) ideas, concepts a d oral); Ability to think logically, abstractly, as, meticulousness; Communication skills as and technologies.	analytically and conceptually and
Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term pap	pers (self-study)	
Conditions: none		
Frequency: each semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		

Literature:

Literature depending on the current topics: scientific papers or books.

Assigned Courses:

Seminar Organic Computing (Master) (seminar)

**

Examination

Presentation and written paper.

written/oral exam, graded

Test Frequency:

Module INF-0424: Seminar Machine Learning (MA)	4 ECTS/LP
Seminar Machine Learning (MA)	

Version 1.0.0 (since WS22/23)

Person responsible for module: Prof. Dr. Bernhard Bauer

Learning Outcomes / Competences:

After attending the seminar, the students are able to independently work out, analyze and evaluate advanced problems, concepts, methods, procedures, techniques, and technologies in the field of Medical Information Sciences concerning the particular seminar topic from the named field. They have the scientific methodology, communication skills, and ability to use appropriate media to present a specific case clearly and comprehensibly in speech and writing and to discuss and evaluate scientifically challenging topics from the named field critically and argumentatively. Furthermore, they can recognize the logical structures of thinking and argumentation and use them goal-oriented. The participants can formulate clearly and comprehensibly and present subject content freely. They understand how to structure a lecture clearly and understandably, focus the study on important messages, and convey them in a comprehensible way, even with complex content. They skillfully apply chains of argumentation and solution strategies in the event of disruptions. The students understand how to present themselves and confidently deal with joint presentation media and use them interactively. They manage to gear a lecture to a specific target group, motivate the listener even during longer lecture durations, and apply various moderation techniques.

Key qualifications: Literature research; independent work with English-language specialist literature; analyticalmethodical competence; scientific methodology; principles of good scientific practice; skills in the understandable, confident, and convincing (written and oral) presentation of (practical or theoretical) ideas, concepts, and results and in documenting them; skills in logical, abstract, analytical and conceptual thinking and formal argumentation; quality awareness, meticulousness; communication skills; time management; evaluation of approaches, procedures, techniques, and technologies from different points of view. Translated with www.DeepL.com/Translator (free version)

Workload:

Total: 120 h

90 h preparation of written term papers (self-study)

30 h seminar (attendance)

Conditions: none		
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Machine Learning (Seminar)

Mode of Instruction: seminar

Language: German

Contact Hours: 2

Contents:

This seminar will cover the basics of Medical Information Sciences. Various topics are to be worked on, which are to serve as a basis for a subsequent practical course.

Literature:

Will be presented at the respective kick-off event.

Assigned Courses:

Seminar Machine Learning (Master) (seminar)

**

Examination

Presentation and written paper written/oral exam, graded

Test Frequency:

Module INF-0439: Seminar Qua Seminar Quantum Algorithms (Mast		4 ECTS/LP
Version 1.0.0 (since SoSe23) Person responsible for module: Prof	. Dr. Jakob Siegfried Kottmann	
wird empfohlen. Spezifische Theme aufgegriffene Anwendungsbeispiele	der Vorlesung "Quantum Algorithms" verti n orientieren sich an aktueller Forschung. und Themenfelder vertieft oder neue The bschlussarbeit im Bereicht der Quantenal	Hierbei werden in der Vorlesung menfelder erschlossen. Das Seminar
Methoden, Verfahren, Techniken un erarbeiten, zu analysieren und bezo Sie verfügen über die wissenschaftli entsprechender Medien, um ein spe wissenschaftlich anspruchsvolle The diskutieren und zu bewerten. Außer erkennen und zielführend einsetzen Die Teilnehmenden können klar und Vortrag klar und nachvollziehbar zu Botschaften auszurichten und diese Störungen wenden sie gekonnt an. Die Studierenden verstehen es, prä- und diese interaktiv einzusetzen. Sie Zuhörer auch bei längeren Vortrags Schlüsselqualifikationen: Literatur Analytisch-methodische Kompetenz Fertigkeit der verständlichen, sicher (praktischen oder theoretischen) Ide logischen, abstrakten, analytischen	nd die Studierenden in der Lage, weiterfüh d Technologien auf dem Gebiet der Quar gen auf das individuelle Seminarthema au che Methodik, Kommunikationsfähigkeit u zielles Thema in Wort und Schrift klar und emenstellungen aus dem genannten Gebie dem können sie die logischen Strukturen d verständlich formulieren und Fachinhalte strukturieren und auch bei komplexen Inh verständlich zu vermitteln. Argumentation sent aufzutreten und souverän mit gängig e schaffen es, einen Vortrag auf eine best dauern zu motivieren und verschiedene M rrecherche; Eigenständiges Arbeiten mit e ; Wissenschaftliche Methodik; Grundsätze en und überzeugenden (schriftlichen und ten, Konzepten und Ergebnissen und zu c und konzeptionellen Denken und formaler eitmanagement; Bewertung von Lösungs	Attenalgorithmen selbstständig zu us dem genannten Gebiet zu bewerten. und Fähigkeit zum Einsatz d verständlich zu präsentieren und et kritisch und argumentativ zu des Denkens und Argumentierens e frei vortragen. Sie verstehen es, einen halten den Vortrag auf wesentliche nsketten und Lösungsstrategien bei en Präsentationsmedien umzugehen immte Zielgruppe auszurichten und den loderationstechniken anzuwenden. englischsprachiger Fachliteratur; e guter wissenschaftlicher Praxis; mündlichen) Darstellung von leren Dokumentation; Fertigkeit zum r Argumentation; Qualitätsbewußtsein,
Workload: Total: 120 h 90 h preparation of written term pap 30 h seminar (attendance)	ers (self-study)	
Conditions: none		Credit Requirements: Bestehen der Modulprüfung
Frequency: each semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Seminar Quantum Algorithms (Master)

Mode of Instruction: seminar

Language: English / German

Frequency: each summer semester

Contact Hours: 2

Contents:

Die Themen des Seminars werden jedes Mal neu festgelegt und aktuellen Entwicklungen angepasst.

Literature:

Abhängig vom gewählten Thema

Assigned Courses:

Seminar Quantum Algorithms (Master) (seminar)

**

Examination

Seminar Quantum Algorithms (Master)

written/oral exam, graded

Test Frequency:

	eory of distributed and parallel	4 ECTS/LF
Systems (Master) Seminar Theorie verteilter und parallel	er Systeme (Master)	
Version 1.0.0 (since SoSe23)		
Person responsible for module: Prof. D	r. Kirstin Peters	
Learning Outcomes / Competences:		
Nach dem Besuch des Seminars sind o Methoden, Verfahren, Techniken und T selbstständig zu erarbeiten, zu analysie Gebiet zu bewerten. Sie verfügen über die wissenschaftlich entsprechender Medien, um ein spezie wissenschaftlich anspruchsvolle Them diskutieren und zu bewerten. Außerder erkennen und zielführend einsetzen. Die Teilnehmenden können klar und ver Vortrag klar und nachvollziehbar zu str Botschaften auszurichten und diese ver Störungen wenden sie gekonnt an.	die Studierenden in der Lage, weiterführ Fechnologien auf dem Gebiet der Theorie eren und bezogen auf das individuelle Se e Methodik, Kommunikationsfähigkeit un elles Thema in Wort und Schrift klar und enstellungen aus dem genannten Gebier m können sie die logischen Strukturen de erständlich formulieren und Fachinhalte f ukturieren und auch bei komplexen Inha erständlich zu vermitteln. Argumentations	e verteilter und paralller Systeme eminarthema aus dem genannten ad Fähigkeit zum Einsatz verständlich zu präsentieren und t kritisch und argumentativ zu es Denkens und Argumentierens rei vortragen. Sie verstehen es, einen Iten den Vortrag auf wesentliche sketten und Lösungsstrategien bei
Zuhörer auch bei längeren Vortragsdau Schlüsselqualifikationen: Literaturred Analytisch-methodische Kompetenz; W Fertigkeit der verständlichen, sicheren praktischen oder theoretischen) Ideen ogischen, abstrakten, analytischen und	chaffen es, einen Vortrag auf eine bestin uern zu motivieren und verschiedene Mo cherche; Eigenständiges Arbeiten mit en /issenschaftliche Methodik; Grundsätze und überzeugenden (schriftlichen und m , Konzepten und Ergebnissen und zu de d konzeptionellen Denken und formaler / management; Bewertung von Lösungsar	derationstechniken anzuwenden. glischsprachiger Fachliteratur; guter wissenschaftlicher Praxis; nündlichen) Darstellung von ren Dokumentation; Fertigkeit zum Argumentation; Qualitätsbewußtsein,
Workload: Total: 120 h 90 h preparation of written term papers		
30 h seminar (attendance)		
30 h seminar (attendance) Conditions: none		Credit Requirements: Bestehen der Modulprüfung
Conditions:	Recommended Semester: from 1.	-
Conditions:		Bestehen der Modulprüfung Minimal Duration of the Module:
Conditions: none Frequency: each summer semester Contact Hours:	from 1. Repeat Exams Permitted: according to the examination	Bestehen der Modulprüfung Minimal Duration of the Module:

Language: German

Frequency: irregular

Contact Hours: 2

Contents:

Die Themen des Seminars werden jedes Mal neu festgelegt und an aktuelle Entwicklungen angepasst.

Literature:

Abhängig vom gewählten Thema

Examination

Seminar Theorie verteilter und paralleler Systeme (Master)

written/oral exam, graded

Test Frequency:

Module INF-0444: Seminar G Seminar Generative Künstliche Ir	ienerative Artificial Intelligence Itelligenz	4 ECTS/LF
Version 1.0.0 (since SoSe23) Person responsible for module: P	rof. Dr. Elisabeth André	
concepts, methods, procedures, t relation to the individual seminar t skills and ability to use appropriat and in writing, and to discuss and argumentatively. They will also be them in a goal-oriented manner. T content freely. They understand h lecture on essential messages an	ents are able to independently work out, an echniques and technologies in the field of	"Generative Artificial Intelligence" in the scientific methodology, communication and comprehensibly, both verbally rom the named field critically and f reasoning and argumentation and use comprehensibly and present specialist mprehensible way and how to focus the even in the case of complex content.
understand how to present thems interactively. They manage to gea lecture durations and to apply var	elves and how to deal confidently with cor ar a lecture to a specific target group and t ious moderation techniques.	
understand how to present thems interactively. They manage to gea lecture durations and to apply var Key qualifications: Literature res methodical competence; Scientific confident and convincing (written for their documentation; Skill in lo	elves and how to deal confidently with cor ar a lecture to a specific target group and t ious moderation techniques. search; Independent work with English-lan c methodology; Principles of good scientifi and oral) presentation of (practical or theo	o motivate the listener even during longer guage specialist literature; Analytical- c practice; Skill in the comprehensible,
understand how to present thems interactively. They manage to gea lecture durations and to apply var Key qualifications: Literature res methodical competence; Scientific confident and convincing (written for their documentation; Skill in lo	elves and how to deal confidently with cor ar a lecture to a specific target group and t ious moderation techniques. search; Independent work with English-lan c methodology; Principles of good scientifi and oral) presentation of (practical or theo gical, abstract, analytical and conceptual t imunication skills; Time management.	o motivate the listener even during longer guage specialist literature; Analytical- c practice; Skill in the comprehensible, iretical) ideas, concepts and results and
understand how to present thems interactively. They manage to gea lecture durations and to apply var Key qualifications: Literature res methodical competence; Scientific confident and convincing (written for their documentation; Skill in lo awareness, meticulousness; Com Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term p Conditions:	elves and how to deal confidently with cor ar a lecture to a specific target group and t ious moderation techniques. search; Independent work with English-lan c methodology; Principles of good scientifi and oral) presentation of (practical or theo gical, abstract, analytical and conceptual t imunication skills; Time management.	o motivate the listener even during longer guage specialist literature; Analytical- c practice; Skill in the comprehensible, iretical) ideas, concepts and results and
understand how to present thems interactively. They manage to gea lecture durations and to apply var Key qualifications: Literature res methodical competence; Scientific confident and convincing (written for their documentation; Skill in lo awareness, meticulousness; Com Workload: Total: 120 h 30 h seminar (attendance)	elves and how to deal confidently with cor ar a lecture to a specific target group and t ious moderation techniques. search; Independent work with English-lan c methodology; Principles of good scientifi and oral) presentation of (practical or theo gical, abstract, analytical and conceptual t imunication skills; Time management.	o motivate the listener even during longer guage specialist literature; Analytical- c practice; Skill in the comprehensible, iretical) ideas, concepts and results and

arts of the Module

Part of the Module: Seminar Generative Artificial Intelligence

Mode of Instruction: seminar

Language: German / English

Frequency: each summer semester

Contact Hours: 2

Contents:

Topics in the field of "Generative Artificial Intelligence"

Literature:

References will be announced at the preliminary meeting.

Assigned Courses:

Seminar Generative Künstliche Intelligenz (seminar)

**

Examination

Seminar Generative Artificial Intelligence written/oral exam, graded Test Frequency: when a course is offered

Production Systems (Maste	Software and Artificial Intelligence for er) e Intelligenz in der Produktion (Master)	4 ECTS/LF
Version 1.0.0 (since SoSe23) Person responsible for module: I	Prof. Dr. Wolfgang Reif	
-	e seminar, students are able to understand, to nethods, procedures, techniques and technolo	-
specific topic clearly and compre	ds, communication skills and the ability to use hensibly in speech and writing and to discuss v. They will also be able to recognize the logica	challenging scientific topics from
understand how to structure a pr	ulate clearly and understandably and to prese esentation in a clear and comprehensible way hem in a comprehensible way even for comple	and how to focus the presentation on
und diese interaktiv einzusetzen	präsent aufzutreten und souverän mit gängige . Sie schaffen es, einen Vortrag auf eine bestir agsdauern zu motivieren und verschiedene Mo	nmte Zielgruppe auszurichten und den
	present themselves and how to deal confiden ation to a specific target group and to motivate ques to guide a discussion.	
Soft Skills:		
to document them • Ability to think logically, ab • Awareness for quality aspon • Communication skills • Time management	c practice nd oral) ideas, concepts and results in a comp stractly, analytically and conceptually and to a	rgue precisely
Workload: Total: 120 h 90 h preparation of written term 30 h seminar (attendance)		
Conditions: none		
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Seminar Software und Künstliche Intelligenz in der Produktion (Master)

Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

Contents:

The topics of the seminar deal with current trends in Software and Systems Engineering on the level of graduate students. The topics change from year to year and are regulary adapted to reflect new developments.

Literature:

Depends on the concrete topic.

Examination

Seminar Software und Künstliche Intelligenz in der Produktion (Master)

written/oral exam / length of examination: 45 minutes

work period for assignment: 3 months, graded

Test Frequency:

Module INF-0448: Seminar Seminar zu nebenläufigen Syste	on Concurrent Systems (Master) emen (Master)	4 ECTS/LP
Version 1.0.0 (since SoSe23) Person responsible for module:	Prof. Dr. Robert Lorenz	
-	ences: students can independently work out and ar s, and technologies from the field of digital e	
	nethodology, communication skills, and the a writing and to discuss and evaluate scientifica ly.	
They understand how to structur focus on essential messages an apply chains of argumentation a confidently deal with common pr target group, apply various mod Key qualifications: Presentation	ts can formulate clearly and comprehensibly re a talk that is clear and easy to follow. Add d convey them in a comprehensible way, ev nd solution strategies in the event of disrupti resentation media and use them interactively eration techniques, and keep their audience n techniques; literature research; principles	itionally, the students know how to en with complex content. They skilfully fons. The students understand how to 7. They manage to gear a talk to a specific engaged even over a longer period. of good scientific practice; evaluating
solution approaches, procedure:	s, techniques, and technologies from differer	it points of view.
Total: 120 h 90 h preparation of presentation 30 h seminar (attendance)	s (self-study)	
Conditions: Module Process Mining (INF-02	43) - recommended	Credit Requirements: Passing the module examination
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Seminar D Mode of Instruction: seminar Language: English / German	igital Ethics (Master)	

Contact Hours: 2

ECTS Credits: 4.0

Contents:

The topics of the seminar change over time, in order to reflect up-to-date developments

Literature:

Literature depends on the chosen topic

Examination

Seminar Digital Ethics (Master)

written/oral exam, graded

Test Frequency:

	Diagnostic Sensing (Master)	4 ECTS/LP
Seminar Diagnostische Sensorik	(Master)	
Version 1.0.0 (since SoSe23)		
Person responsible for module: P	Prof. Dr. Sebastian Zaunseder	
Learning Outcomes / Competer	nces:	
-	ents are able to independently work out and	
	and technologies in the field of Diagnostic	-
	s, communication skills and the ability to us	
	nensibly, both verbally and in writing, and to y. They will also be able to recognize and u	-
argumentation in a goal-oriented	-	se logical structures of reasoning and
	early and comprehensibly and present spec	ialist content freely. They understand how
	comprehensible way and how to focus the ta	
them in a comprehensible way.		5
The students understand how to	present themselves and how to deal confide	ently with common presentation media.
They manage to gear a lecture to	a specific target group and to motivate the	listener and to apply various moderation
techniques.		
•	c methodology; Principles of good scientific and oral) presentation of (practical or th	practice; Skill in the comprehensible,
Workload:		
Total: 120 h		
	apers (self-study)	
30 h seminar (attendance)	apers (self-study)	
30 h seminar (attendance) Conditions:	apers (self-study)	Credit Requirements:
30 h seminar (attendance) Conditions:	apers (self-study)	Credit Requirements: Passing of the module exam
90 h preparation of written term p 30 h seminar (attendance) Conditions: none Frequency: irregular	Recommended Semester:	Passing of the module exam Minimal Duration of the Module:
30 h seminar (attendance) Conditions: none Frequency: irregular	Recommended Semester:	Passing of the module exam
30 h seminar (attendance) Conditions: none Frequency: irregular Contact Hours:	Recommended Semester: Repeat Exams Permitted:	Passing of the module exam Minimal Duration of the Module:
30 h seminar (attendance) Conditions: none Frequency: irregular	Recommended Semester: Repeat Exams Permitted: according to the examination	Passing of the module exam Minimal Duration of the Module:
30 h seminar (attendance) Conditions: none Frequency: irregular Contact Hours:	Recommended Semester: Repeat Exams Permitted:	Passing of the module exam Minimal Duration of the Module:
30 h seminar (attendance) Conditions: none Frequency: irregular Contact Hours: 2	Recommended Semester: Repeat Exams Permitted: according to the examination	Passing of the module exam Minimal Duration of the Module:
30 h seminar (attendance) Conditions: none Frequency: irregular Contact Hours: 2 Parts of the Module	Recommended Semester: Repeat Exams Permitted: according to the examination regulations of the study program	Passing of the module exam Minimal Duration of the Module:
30 h seminar (attendance) Conditions: none Frequency: irregular Contact Hours: 2 Parts of the Module Part of the Module: Seminar Dia	Recommended Semester: Repeat Exams Permitted: according to the examination regulations of the study program	Passing of the module exam Minimal Duration of the Module:
30 h seminar (attendance) Conditions: none Frequency: irregular Contact Hours: 2 Parts of the Module Part of the Module: Seminar Dia Mode of Instruction: seminar Language: German / English	Recommended Semester: Repeat Exams Permitted: according to the examination regulations of the study program	Passing of the module exam Minimal Duration of the Module:
30 h seminar (attendance) Conditions: none Frequency: irregular Contact Hours: 2 Parts of the Module Part of the Module: Seminar Dia Mode of Instruction: seminar	Recommended Semester: Repeat Exams Permitted: according to the examination regulations of the study program	Passing of the module exam Minimal Duration of the Module:

Contents:

The topics of the seminar change over time, in order to reflect up-to-date developments

Literature:

Literature depends on the chosen topic

Assigned Courses:

Seminar Diagnostische Sensorik (Master) (seminar)

**

Examination

Seminar Diagnostic Sensing (Master)

written/oral exam, graded

Test Frequency:

Module INF-0468: Seminar Na	tural Language Understanding	4 ECTS/LF
(Master)		
Seminar Natural Language Underst	anding (Master)	
Version 1.0.0 (since WS23/24)		
Person responsible for module: Pro	f. Dr. Annemarie Friedrich	
inguistics, exploring how machines a subfield of natural language proce algorithms, models, and systems fo that computers can process and ma	nderstanding delves into the fascinating rea can comprehend and process human lang essing (NLP) and computational linguistics r understanding and representing the mean mipulate. Exemplary topics discussed in th c role labeling, semantic parsing, discourse	uage. Computational semantics is that focuses on the development of ning of natural language text in a way is seminar include: representing word,
The number of participants is limited		
•	is are able to independently develop, analy chniques and technologies in the field of en	•
topic in a clear and comprehensible challenging topics from the aforeme	gy, communication skills and ability to use a manner, both verbally and in writing, and t entioned field in a critical and argumentative easoning and argumentation and use them	o discuss and evaluate scientifically manner. They will also be able to
essential messages and convey the apply chains of argumentation and s present themselves and how to dea	ation in a clear and comprehensible way a orm in a comprehensible way, even in the ca solution strategies in the event of disruption I confidently with common presentation me specific target group and to motivate the list eration techniques.	ase of complex content. They skilfully as. The students understand how to dia and to use them interactively. They
methodical competence; Scientific r confident and convincing (written ar for their documentation; Skill in logic	arch; Independent work with English-langu nethodology; Principles of good scientific p nd oral) presentation of (practical or theoret cal, abstract, analytical and conceptual thin unication skills; Time management; Evalua ifferent points of view.	ractice; Skill in the comprehensible, ical) ideas, concepts and results and king and formal argumentation; Quality
Remarks: The course will be taught by Dr. Jak	ob Prange, who will join the department in	October.
Workload: Total: 120 h 30 h seminar (attendance) 90 h preparation of written term pap	ers (self-study)	
Conditions:		Credit Requirements:
none		Presentation and term paper
Frequency: each semester	Recommended Semester: 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours:	Repeat Exams Permitted:	
	according to the examination	
2		

regulations of the study program

Parts of the Module

Part of the Module: Seminar Natural Language Understanding (Master)

Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

Contents:

In the seminar, topics from the field of embedded systems will be covered. Each seminar participant receives individual literature references, which are then to be supplemented in the course of the seminar by further independently compiled references. The seminar will end with a written paper and a presentation on the topic covered.

Literature:

given individually and self research

Assigned Courses:

Seminar Natural Language Understanding (Master) (seminar)

**

Examination

Seminar Natural Language Understanding (Master)

written/oral exam, graded

Test Frequency:

Communication Networks	r Networked Systems and (Master) nd Kommunikationsnetze (Master)	4 ECTS/LF
Version 1.0.0 (since WS23/24)		
Person responsible for module Prof. Dr. Michael Seufert		
Learning Outcomes / Compe	tences:	
	urs sind die Studierenden in der Lage, weiter	führende Problemstellungen,
	n, Techniken und Technologien auf dem Ge	
Kommunikationsnetze selbstst	ändig zu erarbeiten, zu analysieren und bezo	ogen auf das individuelle Seminarthema
aus dem genannten Gebiet zu	bewerten.	
Sie verfügen über die wissenso	chaftliche Methodik, Kommunikationsfähigke	it und Fähigkeit zum Einsatz
entsprechender Medien, um ei	n spezielles Thema in Wort und Schrift klar u	ind verständlich zu präsentieren und
wissenschaftlich anspruchsvoll	e Themenstellungen aus dem genannten Ge	ebiet kritisch und argumentativ zu
	ußerdem können sie die logischen Strukture	en des Denkens und Argumentierens
erkennen und zielführend einse		
	ar und verständlich formulieren und Fachinha	
U U	ar zu strukturieren und auch bei komplexen l	C C
	diese verständlich zu vermitteln. Argumentat	ionsketten und Lösungsstrategien bei
Ctämunanan uuran dan ala maluanni	top	
Die Studierenden verstehen es	s, präsent aufzutreten und souverän mit gäng	
Die Studierenden verstehen es und diese interaktiv einzusetze	s, präsent aufzutreten und souverän mit gäng n. Sie schaffen es, einen Vortrag auf eine be	estimmte Zielgruppe auszurichten und der
Die Studierenden verstehen es und diese interaktiv einzusetze	s, präsent aufzutreten und souverän mit gäng	estimmte Zielgruppe auszurichten und der
Die Studierenden verstehen es und diese interaktiv einzusetze Zuhörer auch bei längeren Vor	s, präsent aufzutreten und souverän mit gäng n. Sie schaffen es, einen Vortrag auf eine be	estimmte Zielgruppe auszurichten und der Moderationstechniken anzuwenden.
Die Studierenden verstehen es und diese interaktiv einzusetze Zuhörer auch bei längeren Vor Schlüsselqualifikationen: Lite	s, präsent aufzutreten und souverän mit gäng n. Sie schaffen es, einen Vortrag auf eine be tragsdauern zu motivieren und verschiedene	estimmte Zielgruppe auszurichten und der Moderationstechniken anzuwenden. t englischsprachiger Fachliteratur;
Die Studierenden verstehen es und diese interaktiv einzusetze Zuhörer auch bei längeren Vor Schlüsselqualifikationen: Lite Analytisch-methodische Kompe	s, präsent aufzutreten und souverän mit gäng n. Sie schaffen es, einen Vortrag auf eine be tragsdauern zu motivieren und verschiedene eraturrecherche; Eigenständiges Arbeiten mi	estimmte Zielgruppe auszurichten und der Moderationstechniken anzuwenden. t englischsprachiger Fachliteratur; tze guter wissenschaftlicher Praxis;
Die Studierenden verstehen es und diese interaktiv einzusetze Zuhörer auch bei längeren Vor Schlüsselqualifikationen: Lite Analytisch-methodische Kompe Fertigkeit der verständlichen, s	s, präsent aufzutreten und souverän mit gäng n. Sie schaffen es, einen Vortrag auf eine be tragsdauern zu motivieren und verschiedene eraturrecherche; Eigenständiges Arbeiten mi etenz; Wissenschaftliche Methodik; Grundsä	estimmte Zielgruppe auszurichten und der Moderationstechniken anzuwenden. t englischsprachiger Fachliteratur; tze guter wissenschaftlicher Praxis; nd mündlichen) Darstellung von
Die Studierenden verstehen es und diese interaktiv einzusetze Zuhörer auch bei längeren Vor Schlüsselqualifikationen: Lite Analytisch-methodische Kompe Fertigkeit der verständlichen, s (praktischen oder theoretischer logischen, abstrakten, analytisc	s, präsent aufzutreten und souverän mit gäng n. Sie schaffen es, einen Vortrag auf eine be tragsdauern zu motivieren und verschiedene eraturrecherche; Eigenständiges Arbeiten mi etenz; Wissenschaftliche Methodik; Grundsä icheren und überzeugenden (schriftlichen ur n) Ideen, Konzepten und Ergebnissen und zu chen und konzeptionellen Denken und forma	estimmte Zielgruppe auszurichten und der Moderationstechniken anzuwenden. t englischsprachiger Fachliteratur; tze guter wissenschaftlicher Praxis; nd mündlichen) Darstellung von u deren Dokumentation; Fertigkeit zum iler Argumentation; Qualitätsbewußtsein,
Die Studierenden verstehen es und diese interaktiv einzusetze Zuhörer auch bei längeren Vor Schlüsselqualifikationen: Lite Analytisch-methodische Kompe Fertigkeit der verständlichen, s (praktischen oder theoretischer logischen, abstrakten, analytisc Akribie; Kommunikationsfähigk	e, präsent aufzutreten und souverän mit gäng n. Sie schaffen es, einen Vortrag auf eine be tragsdauern zu motivieren und verschiedene eraturrecherche; Eigenständiges Arbeiten mi etenz; Wissenschaftliche Methodik; Grundsä icheren und überzeugenden (schriftlichen ur n) Ideen, Konzepten und Ergebnissen und zu chen und konzeptionellen Denken und forma eit; Zeitmanagement; Bewertung von Lösung	estimmte Zielgruppe auszurichten und der Moderationstechniken anzuwenden. t englischsprachiger Fachliteratur; tze guter wissenschaftlicher Praxis; nd mündlichen) Darstellung von u deren Dokumentation; Fertigkeit zum iler Argumentation; Qualitätsbewußtsein,
und diese interaktiv einzusetze Zuhörer auch bei längeren Vor Schlüsselqualifikationen: Lite Analytisch-methodische Kompe Fertigkeit der verständlichen, s (praktischen oder theoretischer logischen, abstrakten, analytisc	e, präsent aufzutreten und souverän mit gäng n. Sie schaffen es, einen Vortrag auf eine be tragsdauern zu motivieren und verschiedene eraturrecherche; Eigenständiges Arbeiten mi etenz; Wissenschaftliche Methodik; Grundsä icheren und überzeugenden (schriftlichen ur n) Ideen, Konzepten und Ergebnissen und zu chen und konzeptionellen Denken und forma eit; Zeitmanagement; Bewertung von Lösung	estimmte Zielgruppe auszurichten und der Moderationstechniken anzuwenden. t englischsprachiger Fachliteratur; tze guter wissenschaftlicher Praxis; nd mündlichen) Darstellung von u deren Dokumentation; Fertigkeit zum iler Argumentation; Qualitätsbewußtsein,
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Parts of the Module

Part of the Module: Seminar Vernetzte Systeme und Kommunikationsnetze (Master) Mode of Instruction: seminar Language: German Contact Hours: 2

Contents:

Die Themen des Seminars werden jedes Jahr neu festgelegt und aktuellen Entwicklungen, Herausforderungen und Lösungen im Bereich der vernetzten Systeme und Kommunikationsnetze angepasst.

Literature:

individuell gegeben und Selbstrecherche

Assigned Courses:

Seminar Vernetzte Systeme und Kommunikationsnetze (Master) (seminar)

**

Examination

Seminar Vernetzte Systeme und Kommunikationsnetze (Master)

written/oral exam, graded

Test Frequency:

Module INF-0479: Seminar Current Topics in Embodied Artificial Intelligence and Computer Vision Seminar Current Topics in Embodied Artificial Intelligence and Computer	4 ECTS/LP
Vision	
Version 1.0.0 (since WS23/24)	,
Person responsible for module: Prof. Dr. Jörg-Dieter Stückler	
Learning Outcomes / Competences: After attending the seminar, the students are able to work out, analyze and evalumethods, techniques and technologies in the field of embodied artificial intelligent procedures, techniques and technologies in the field of Embodied Artificial Intelligent procedures, techniques and technologies in the field of Embodied Artificial Intelligent procedures, techniques and technology, communication to the individual seminar of the possess the scientific methodology, communication skills and ability to use specific topic in a clear and comprehensible manner, both verbally and in writint discuss and evaluate scientifically challenging topics from the named field. In a structures of thought and argumentation and use them in a goal-oriented manner clearly and comprehensibly and present scientific content freely. They understate clearly and comprehensibly and, even with complex content, how to focus the proceed and convey them in a comprehensible manner. The students understand how the confidently with common presentation media and to use them interactively. The specific target group, to motivate the listener and to apply various moderation to the specific target group, to motivate the listener and to apply various moderation to the specific target group, to motivate the listener and to apply various moderation to the specific target group.	ence and computer vision, methods, lligence and Computer Vision topic from the mentioned field. The appropriate media to present a g, and critically and argumentatively ddition, they can recognize the logical er. Participants are able to formulate and how to structure a presentation presentation on essential messages o present themselves and how to deal ey manage to gear a presentation to a
Key qualifications: Literature research; independent work with English-languar methodical competence; Scientific methodology; Principles of good scientific pri comprehensible, confident and convincing (written and oral); presentation of (p and results and to document them; ability to logical, abstract, analytical and cor quality consciousness, meticulousness; communication skills; time management procedures, techniques and technologies from different points of view.	actice; Ability to present ractical or theoretical) ideas, concepts, nceptual thinking and formal reasoning;
Workload: Total: 120 h 30 h seminar (attendance)	

90 h preparation of written term papers (self-study)

Conditions: none		Credit Requirements: Passing the module exam
Frequency: irregular	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 2	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Seminar Current Topics in Embodied Artificial Intelligence and Computer Vision

Mode of Instruction: seminar

Language: English / German

Contact Hours: 2

Contents:

The seminar will cover current research topics in the field of Embodied Artificial Intelligence and Computer Vision. Each seminar participant will be assigned individual literature references, which will then be supplemented in the course of the seminar by further independently compiled references. The seminar will end with a written report and a presentation on the topic covered.

I

Literature:

Scientific literature announced in the kick-off meeting and self research

Examination

Seminar Current Topics in Embodied Artificial Intelligence and Computer Vision

written/oral exam, graded

Test Frequency:

Seminar zur digitalen Regelungs	on Digital Control Engineering stechnik	4 ECTS/LI
Version 1.0.0 (since WS23/24) Person responsible for module:	Prof. Dr. Christoph Ament	
Methoden, Verfahren, Techniker erarbeiten, zu analysieren und b Sie verfügen über die wissensch entsprechender Medien, um ein	s sind die Studierenden in der Lage, weiterfü n und Technologien auf dem Gebiet der Reg ezogen auf das individuelle Seminarthema naftliche Methodik, Kommunikationsfähigkeit spezielles Thema in Wort und Schrift klar u	elungstechnik selbstständig zu aus dem genannten Gebiet zu bewerten. und Fähigkeit zum Einsatz nd verständlich zu präsentieren und
	Themenstellungen aus dem genannten Gel ßerdem können sie die logischen Strukturer	_
Die Teilnehmenden können klar Vortrag klar und nachvollziehbar	und verständlich formulieren und Fachinhal r zu strukturieren und auch bei komplexen Ir ese verständlich zu vermitteln. Argumentatio	halten den Vortrag auf wesentliche
Die Studierenden verstehen es	präsent aufzutreten und souverän mit gängi	gen Präsentationsmedien umzugehen
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Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

ECTS Credits: 4.0

Contents:

Können Sie auf Basis Ihrer bisher im Studium erworbenen Kenntnisse aktuelle Veröffentlichungen auf dem Gebiet der Ingenierinformatik oder den Ingenieurswissenschaften erschließen und einordnen? Das gehen wir im Seminar an!

Wir widmen uns einem Schwerpunktthema der System- und Regelungstechnik, das Sie jeweils zu Beginn des Semesters der Webseite des Lehrstuhls entnehmen können. Wir verschaffen uns einen Überblick über aktuelle Veröffentlichungen. Ihre Aufgabe ist es, einen ausgewählten Beitrag zu bearbeiten und in einem kurzen Vortrag vorzustellen.

Literature:

abhängig vom jeweiligen Thema

Assigned Courses:

Seminar zur digitalen Regelungstechnik (seminar)

Examination Seminar zur digitalen Regelungstechnik

written/oral exam, graded

Test Frequency:

Module INF-0484: Seminar Seminar zur nichtlinearen Regel	on Nonlinear Control Engineering	4 ECTS/L
Version 1.0.0 (since WS23/24) Person responsible for module: I		
Learning Outcomes / Competer Nach dem Besuch des Seminars Methoden, Verfahren, Techniker erarbeiten, zu analysieren und b	· · · · · · · · · · · · · · · · · · ·	lungstechnik selbstständig zu us dem genannten Gebiet zu bewerten.
wissenschaftlich anspruchsvolle	spezielles Thema in Wort und Schrift klar un Themenstellungen aus dem genannten Geb ßerdem können sie die logischen Strukturen zen.	et kritisch und argumentativ zu
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und diese interaktiv einzusetzen Zuhörer auch bei längeren Vortra	. Sie schaffen es, einen Vortrag auf eine bes agsdauern zu motivieren und verschiedene N	immte Zielgruppe auszurichten und der Ioderationstechniken anzuwenden.
und diese interaktiv einzusetzen Zuhörer auch bei längeren Vortra Schlüsselqualifikationen: Liter Analytisch-methodische Kompet Fertigkeit der verständlichen, sic (praktischen oder theoretischen) logischen, abstrakten, analytisch Akribie; Kommunikationsfähigke	. Sie schaffen es, einen Vortrag auf eine bes agsdauern zu motivieren und verschiedene M raturrecherche; Eigenständiges Arbeiten mit e renz; Wissenschaftliche Methodik; Grundsätz sheren und überzeugenden (schriftlichen und I deen, Konzepten und Ergebnissen und zu hen und konzeptionellen Denken und formale it; Zeitmanagement; Bewertung von Lösungs	immte Zielgruppe auszurichten und der Ioderationstechniken anzuwenden. englischsprachiger Fachliteratur; e guter wissenschaftlicher Praxis; mündlichen) Darstellung von leren Dokumentation; Fertigkeit zum r Argumentation; Qualitätsbewußtsein,
und diese interaktiv einzusetzen Zuhörer auch bei längeren Vortra Schlüsselqualifikationen: Liter Analytisch-methodische Kompet Fertigkeit der verständlichen, sic (praktischen oder theoretischen) logischen, abstrakten, analytisch Akribie; Kommunikationsfähigke Technologien unter unterschiedl	. Sie schaffen es, einen Vortrag auf eine bes agsdauern zu motivieren und verschiedene M aturrecherche; Eigenständiges Arbeiten mit e enz; Wissenschaftliche Methodik; Grundsätz cheren und überzeugenden (schriftlichen und I deen, Konzepten und Ergebnissen und zu e hen und konzeptionellen Denken und formale it; Zeitmanagement; Bewertung von Lösungs ichen Gesichtspunkten;	immte Zielgruppe auszurichten und der Ioderationstechniken anzuwenden. englischsprachiger Fachliteratur; e guter wissenschaftlicher Praxis; mündlichen) Darstellung von leren Dokumentation; Fertigkeit zum r Argumentation; Qualitätsbewußtsein,
und diese interaktiv einzusetzen Zuhörer auch bei längeren Vortra Schlüsselqualifikationen: Liter Analytisch-methodische Kompet Fertigkeit der verständlichen, sic (praktischen oder theoretischen) logischen, abstrakten, analytisch Akribie; Kommunikationsfähigke Technologien unter unterschiedl Workload: Total: 120 h 90 h preparation of written term 30 h seminar (attendance) Conditions: Grundkenntnisse auf dem Gebie	. Sie schaffen es, einen Vortrag auf eine bes agsdauern zu motivieren und verschiedene M aturrecherche; Eigenständiges Arbeiten mit e enz; Wissenschaftliche Methodik; Grundsätz cheren und überzeugenden (schriftlichen und I deen, Konzepten und Ergebnissen und zu e hen und konzeptionellen Denken und formale it; Zeitmanagement; Bewertung von Lösungs ichen Gesichtspunkten;	immte Zielgruppe auszurichten und der Ioderationstechniken anzuwenden. englischsprachiger Fachliteratur; e guter wissenschaftlicher Praxis; mündlichen) Darstellung von leren Dokumentation; Fertigkeit zum r Argumentation; Qualitätsbewußtsein,
und diese interaktiv einzusetzen Zuhörer auch bei längeren Vortra Schlüsselqualifikationen: Liter Analytisch-methodische Kompet Fertigkeit der verständlichen, sic (praktischen oder theoretischen) logischen, abstrakten, analytisch Akribie; Kommunikationsfähigke Technologien unter unterschiedl Workload: Total: 120 h 90 h preparation of written term p 30 h seminar (attendance) Conditions: Grundkenntnisse auf dem Gebie Bachelor-Studium.	. Sie schaffen es, einen Vortrag auf eine bes agsdauern zu motivieren und verschiedene M aturrecherche; Eigenständiges Arbeiten mit e enz; Wissenschaftliche Methodik; Grundsätz cheren und überzeugenden (schriftlichen und bldeen, Konzepten und Ergebnissen und zu e nen und konzeptionellen Denken und formale it; Zeitmanagement; Bewertung von Lösungs ichen Gesichtspunkten;	immte Zielgruppe auszurichten und der Ioderationstechniken anzuwenden. englischsprachiger Fachliteratur; e guter wissenschaftlicher Praxis; mündlichen) Darstellung von leren Dokumentation; Fertigkeit zum r Argumentation; Qualitätsbewußtsein,
Zuhörer auch bei längeren Vortra Schlüsselqualifikationen: Liter Analytisch-methodische Kompet Fertigkeit der verständlichen, sic (praktischen oder theoretischen) logischen, abstrakten, analytisch Akribie; Kommunikationsfähigke Technologien unter unterschiedl Workload: Total: 120 h 90 h preparation of written term p 30 h seminar (attendance) Conditions:	. Sie schaffen es, einen Vortrag auf eine bes agsdauern zu motivieren und verschiedene M aturrecherche; Eigenständiges Arbeiten mit e enz; Wissenschaftliche Methodik; Grundsätz cheren und überzeugenden (schriftlichen und I deen, Konzepten und Ergebnissen und zu e hen und konzeptionellen Denken und formale it; Zeitmanagement; Bewertung von Lösungs ichen Gesichtspunkten; papers (self-study) et der Regelungstechnik z.B. aus dem Recommended Semester:	immte Zielgruppe auszurichten und der Ioderationstechniken anzuwenden. englischsprachiger Fachliteratur; e guter wissenschaftlicher Praxis; mündlichen) Darstellung von leren Dokumentation; Fertigkeit zum r Argumentation; Qualitätsbewußtsein, ansätzen, Verfahren, Techniken und

Mode of Instruction: seminar

Language: German / English

Contact Hours: 2

ECTS Credits: 4.0

Contents:

Können Sie auf Basis Ihrer bisher im Studium erworbenen Kenntnisse aktuelle Veröffentlichungen auf dem Gebiet der Ingenierinformatik oder den Ingenieurswissenschaften erschließen und einordnen? Das gehen wir im Seminar an!

Wir widmen uns einem Schwerpunktthema der System- und Regelungstechnik, das Sie jeweils zu Beginn des Semesters der Webseite des Lehrstuhls entnehmen können. Wir verschaffen uns einen Überblick über aktuelle Veröffentlichungen. Ihre Aufgabe ist es, einen ausgewählten Beitrag zu bearbeiten und in einem kurzen Vortrag vorzustellen.

Literature:

abhängig vom jeweiligen Thema

Assigned Courses:

Seminar zur nichtlinearen Regelungstechnik (seminar)

**

Examination

Seminar zur nichtlinearen Regelungstechnik

written/oral exam, graded

Test Frequency:

Module INF-0042: Project Module Software Methodologies for Distributed Systems Projektmodul Softwaremethodiken für verteilte Systeme	10 ECTS/LP
Version 1.0.0 (since SoSe13) Person responsible for module: Prof. Dr. Bernhard Bauer	
Learning Outcomes / Competences: After participating in the project module, students understand problems of high methodologies for distributed systems and have in-depth specialist knowledge develop concepts, methods, procedures, techniques, and technologies of the n are able to apply innovative approaches in solving problems. This enables then	and skills there. They are able to nentioned field in research projects and

the ability to research literature and the scientific methodology to discuss problems in the area, define intermediate goals, and critically evaluate, classify, combine and present intermediate results and innovative ideas.

Key qualifications: Ability to think logically, analytically, and conceptually; Independent work with literature; Understandable, confident, and convincing presentation of ideas, concepts, and results; Quality awareness; Communication skills; Skill of working in teams and understanding team processes; Principles of good scientific practice; Project management skills; Scientific methodology;

and make their scientific contribution to the field. In addition, students have the teamwork and communication skills,

Workload:

Total: 300 h

15 h seminar (attendance)

285 h internship / practical course (self-study)

Conditions:		
none		
Frequency: each semester	Recommended Semester: 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours:	Repeat Exams Permitted:	
1	according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Projektmodul Softwaremethodiken für verteilte Systeme

Mode of Instruction: internship

Language: German / English

Contact Hours: 1

Contents:

Current research topics at the Software Methodology for Distributed Systems Lab

Literature:

Provided for the respective topics.

Assigned Courses:

Oberseminar zu Softwaremethodik für verteilte Systeme

**

Examination

Project acceptance, presentation, final report

internship, graded

Test Frequency:

Module INF-0059: Project M Projektmodul Theoretische Inform	odule Theoretical Computer Science matik	10 ECTS/LF
Version 1.0.0 (since SoSe13)		
Person responsible for module: F	Prof. Dr. Torben Hagerup	
Learning Outcomes / Compete	nces:	
complexity in the field of Theoret procedures, and techniques in re way, the students acquire good p Furthermore, they will be able to	he project module, the students will be able to ical Computer Science. They will possess the search projects, and to apply innovative meth prerequisites for autonomous scientific work a communicate and conduct literature research uses of Theoretical Computer Science; they ca	skills to develop concepts, methods, ods in solving arising problems. In this nd for linking to international research. and have a scientific methodology
Key Qualifications: Logical, analytical, and conceptu management; self-contained liter	present own approaches. al competence; quality awareness; meticulous ature research; work with English technical lit	
Key Qualifications: Logical, analytical, and conceptu management; self-contained liter practice.	al competence; quality awareness; meticulous	
Key Qualifications: Logical, analytical, and conceptu management; self-contained liter practice. Workload:	al competence; quality awareness; meticulous	
Key Qualifications: Logical, analytical, and conceptu management; self-contained liter practice. Workload: Total: 300 h	al competence; quality awareness; meticulous ature research; work with English technical lit	
management; self-contained liter practice. Workload: Total: 300 h 285 h internship / practical cours	al competence; quality awareness; meticulous ature research; work with English technical lit	
Key Qualifications: Logical, analytical, and conceptu management; self-contained liter practice. Workload: Total: 300 h 285 h internship / practical cours 15 h seminar (attendance)	al competence; quality awareness; meticulous ature research; work with English technical lit	
Key Qualifications: Logical, analytical, and conceptu management; self-contained liter practice. Workload: Total: 300 h	al competence; quality awareness; meticulous ature research; work with English technical lit	· · ·
Key Qualifications: Logical, analytical, and conceptu management; self-contained liter practice. Workload: Total: 300 h 285 h internship / practical cours 15 h seminar (attendance) Conditions: none	al competence; quality awareness; meticulous ature research; work with English technical lit	· · ·
Key Qualifications: Logical, analytical, and conceptu management; self-contained liter practice. Workload: Total: 300 h 285 h internship / practical cours 15 h seminar (attendance) Conditions:	al competence; quality awareness; meticulous rature research; work with English technical lit e (self-study) Recommended Semester:	erature; fundamentals of good scientific
Key Qualifications: Logical, analytical, and conceptu management; self-contained liter practice. Workload: Total: 300 h 285 h internship / practical cours 15 h seminar (attendance) Conditions: none Frequency: each semester	al competence; quality awareness; meticulous rature research; work with English technical lit e (self-study) Recommended Semester: from 1.	erature; fundamentals of good scientific

Part of the Module: Project Module Theoretical Computer Science

Mode of Instruction: internship

Language: German

Contact Hours: 1

Contents:

Collaboration on current research topics.

Literature:

Scientific papers, manuals.

Assigned Courses:

Oberseminar Theoretische Informatik

*(online/digital) *

Examination

Oral presentation and written paper.

internship, graded

Test Frequency:

Projektmodul Organic Computing	dule Organic Computing	10 ECTS/LP
Version 1.0.0 (since SoSe14) Person responsible for module: Pro	of. Dr. Jörg Hähner	
Computing" and have deeper spec procedures, techniques and technor methods in solving problems. This contribution to the field. In addition literature and the scientific method	ces: odule, the students understand problems of ialist knowledge and skills in this area. The ologies of the mentioned field in research enables them to connect to international r , students have the teamwork and commu- ology to discuss problems in the field, defi- esent intermediate results and innovative i	bey can develop concepts, methods, projects and are able to apply innovative research and make their own scientific unication skills, the ability to research ine intermediate goals, and critically
English. Understandable, confident	logically, analytically and conceptually; In t and convincing presentation of ideas, co ing in teams and understanding team proc s; Scientific methodology.	ncepts and results; Quality awareness;
Workload: Total: 300 h 285 h internship / practical course 15 h seminar (attendance)	(self-study)	
Conditions: none		
Frequency: each semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 1	Repeat Exams Permitted: according to the examination regulations of the study program	
	regulations of the study program	

Language: German / English

Contact Hours: 1

Contents:

Collaboration on current research topics.

Literature:

Depending on the topic to be worked on:

- Paper
- Book
- Handbook

Assigned Courses:

Oberseminar Organic Computing

*(online/digital) *

Examination Presentation and final report. internship, graded Test Frequency: when a course is offered

Module INF-0080: Project Modu	le Databases and Information	10 ECTS/LP
Systems Projektmodul Datenbanken und Inform	mationssysteme	
Version 1.6.0 (since SoSe14)		<u> </u>
Person responsible for module: Prof.	Dr. Peter Michael Fischer	
databases and information systems a develop concepts, methods, procedur are able to apply innovative methods make their own scientific contribution the ability to research literature and th goals, and critically evaluate, classify, Key Skills: Skill in logical, analytical, a Intelligible, confident, and persuasive	le, students understand problems of higher nd have deeper professional knowledge a res, techniques and technologies of the m in solving problems. This enables them to to the field. In addition, students have the scientific methodology to discuss proble combine and present intermediate result and conceptual thinking; Independent work presentation of ideas, concepts, and result adderstanding team processes; Principles of	and skills there. They are able to entioned field in research projects and o connect to international research and teamwork and communication skills, ems in the field, define intermediate s and innovative ideas. k with English-language literature; ilts; Quality awareness; Communication
Workload: Total: 300 h 15 h seminar (attendance) 285 h internship / practical course (se	lf-study)	
Conditions: Module Database Systems (INF-0073 Module Search Engines (INF-0077) - Module Analyzing Massive Data Sets	recommended	
Frequency: each semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 1	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		-
Mode of Instruction: internship Language: German / English Contact Hours: 1	atenbanken und Informationssysteme	
Contents: Work on current research topics		
Literature: Current research articles on Manuals 	the topic of databases and Big Data	
Assigned Courses:		
Oberseminar Datenbanken und Info	ormationssysteme	

**

Examination

Software acceptance, presentation, final report

internship, graded

Test Frequency:

Projektmodul Multimedia Comput	odule Multimedia Computing	10 ECTS/LP
Version 1.0.0 (since SoSe14)		
Person responsible for module: P	Prof. Dr. Rainer Lienhart	
Learning Outcomes / Competer	nces:	
After participating in this project n	nodule, students understand problems of h	gher complexity in the field of multimedia
computing (e.g. image, video, and	d audio processing as well as image, video	, and audio search) and computer vision
	n, human pose estimation) and have more	
	s, methods, procedures, techniques, and te	-
	nnovative methods in solving problems. Th	
	c contribution to the field. In addition, stude	
-	ture, the scientific methodology to discuss	
	sify, combine, and present intermediate re	
	k logically, analytically and conceptually; Ir	
i amproponsible contident and c		
	onvincing presentation of ideas, concepts,	-
Communication skills; Ability to w	ork in teams and understand team process	-
Communication skills; Ability to w Project management skills; Scien	ork in teams and understand team process	-
Communication skills; Ability to w Project management skills; Scien Workload:	ork in teams and understand team process	-
Communication skills; Ability to w Project management skills; Scien Workload: Total: 300 h	ork in teams and understand team process tific methodology.	-
Communication skills; Ability to w Project management skills; Scien Workload:	ork in teams and understand team process tific methodology.	-
Communication skills; Ability to w Project management skills; Scien Workload: Total: 300 h 285 h internship / practical course	ork in teams and understand team process tific methodology.	-
Communication skills; Ability to w Project management skills; Scien Workload: Total: 300 h 285 h internship / practical course 15 h seminar (attendance) Conditions:	ork in teams and understand team process tific methodology.	-
Communication skills; Ability to w Project management skills; Scien Workload: Total: 300 h 285 h internship / practical course 15 h seminar (attendance)	ork in teams and understand team process tific methodology.	-
Communication skills; Ability to w Project management skills; Scien Workload: Total: 300 h 285 h internship / practical course 15 h seminar (attendance) Conditions: none	rork in teams and understand team process tific methodology. e (self-study)	es; Principles of good scientific practise;
Communication skills; Ability to w Project management skills; Scien Workload: Total: 300 h 285 h internship / practical course 15 h seminar (attendance) Conditions: none	rork in teams and understand team process tific methodology. e (self-study) Recommended Semester:	Minimal Duration of the Module:
Communication skills; Ability to w Project management skills; Scien Workload: Total: 300 h 285 h internship / practical course 15 h seminar (attendance) Conditions: none Frequency: each semester	e (self-study) Recommended Semester: from 1.	Minimal Duration of the Module:
Communication skills; Ability to w Project management skills; Scien Workload: Total: 300 h 285 h internship / practical course 15 h seminar (attendance) Conditions: none Frequency: each semester Contact Hours:	e (self-study) Recommended Semester: from 1. Repeat Exams Permitted:	Minimal Duration of the Module:

Part of the Module: Project Module Multimedia Computing

Mode of Instruction: internship

Language: German

Frequency: as needed

Contact Hours: 1

Contents:

The specific task from the wide-ranging field of multimedia and machine vision (image, video and audio processing, object recognition, search in image, video and audio material) is designed individually for each student every year.

Literature:

Literature references will be announced at the beginning of the course.

Assigned Courses:

Oberseminar Multimedia Computing

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Examination

Software presentation; elaboration with software documentation; explanation of source code (code review) internship, graded

Test Frequency:

Module INF-0108: Project Module Teaching Professorship Informatics Projektmodul Lehrprofessur für Informatik	10 ECTS/LP
Version 1.0.0 (since SoSe14)	
Person responsible for module: Prof. Dr. Robert Lorenz	

Learning Outcomes / Competences:

After participating in this project module, students understand problems of higher complexity in the fields of *concurrent systems*, *petri nets* or *process mining* and have more in-depth specialist knowledge and skills there. They can develop concepts, methods, procedures, techniques, and technologies in the mentioned field in research projects and can apply innovative methods in solving problems. This enables them to connect to international research and make their scientific contribution to the field. In addition, students have teamwork and communication skills, the ability to research literature, the scientific methodology to discuss problems in the field, define intermediate goals, and critically evaluate, classify, combine, and present intermediate results and innovative ideas.

Key qualifications: Ability to think logically, analytically and conceptually; Independent work with specialist literature; Comprehensible, confident and convincing presentation of ideas, concepts, and results; Quality awareness; Communication skills; Ability to work in teams and understand team processes; Principles of good scientific practise; Project management skills; Scientific methodology.

Workload:

Total: 300 h 15 h seminar (attendance) 285 h internship / practical course (self-study)

Conditions: Basic knowledge in the research fields <i>nets</i> or <i>process mining</i>	of concurrent systems, petri	
Frequency: each semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 1	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Projektmodul Lehrprofessur für Informatik

Mode of Instruction: internship

Language: German / English

Contact Hours: 1

Contents:

Collaboration on current research topics of the group

Literature:

- J. Desel, W. Reisig, G. Rozenberg: Lectures on Concurrency and Petri Nets, Springer, Lecture Notes in Computer Science 3098, 2004
- Wil M. P. van der Aalst: Process Mining. Data Science in Action. Springer, 2016.

Assigned Courses:

Oberseminar zu Lehrprofessur für Informatik

**

Examination

Projektmodul Lehrprofessur für Informatik

practical exam, graded

Test Frequency:

Module INF-0137: Project Module Software- and Systems Engineering	10 ECTS/LP
Projektmodul Software- und Systems Engineering	
Version 1.1.0 (since SoSe14)	

Person responsible for module: Prof. Dr. Wolfgang Reif

Learning Outcomes / Competences:

After participating in the project module, students understand problems of higher complexity from the field of software and systems engineering and have more in-depth knowledge and skills. They are able to develop concepts, methods, techniques and technologies of the mentioned field in research projects and are able to apply innovative methods in solving problems. This enables them to connect to international research and make their own scientific contribution to the field. In addition, students have teamwork and communication skills, the ability to research literature and the scientific methodology to discuss problems in the field, define intermediate goals, and critically evaluate, classify, combine and present intermediate results and innovative ideas.

Soft Skills:

- Skill in logical, analytical and conceptual thinking.
- · Ability to work independently with technical literature, including English literature
- Clear, confident and convincing presentation of ideas, concepts and results
- Awareness for quality aspects
- · Communication skills
- · Ability to work in teams and understand team processes
- · Principles of good scientific practice
- · Competencies in project management
- Research methodology

Workload:

Total: 300 h 285 h internship / practical course (self-study) 15 h seminar (attendance)

Conditions: none		
Frequency: each semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 1	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Project Module Software- and Systems Engineering

Mode of Instruction: internship

Language: German / English

Contact Hours: 1

Contents:

Contribution to current research projects of the chair for Software Engineering

Literature:

Depends on the project: Scientific papers, system documentation, books, ...

Assigned Courses:

Oberseminar Software- und Systems Engineering

*(online/digital) *

Examination

Project Module Software- and Systems Engineering Project Presentation

practical exam / work period for assignment: 2 months, graded

Test Frequency:

Module INF-0170: Project Mo Projektmodul Human-Centered M	odule Human-Centered Multimedia Iultimedia	10 ECTS/LF
Version 1.0.0 (since SoSe13) Person responsible for module: P	rof. Dr. Elisabeth André	
Centered Multimedia" and have d procedures, techniques and techr methods in solving problems. This contribution to the field. In addition literature and the scientific metho	nces: nodule, students understand problems of hig leeper expertise and skills there. They are al nologies of the mentioned field in research p s enables them to connect to international re n, students have the teamwork and commun dology to discuss problems in the field, defin resent intermediate results and innovative ic	ble to develop concepts, methods, rojects and are able to apply innovative search and make their own scientific lication skills, the ability to research e intermediate goals, and critically
	al, analytical, and conceptual thinking; Independent of persuasive presentation of ideas, concep	
Communication skills; Skill in wor	king in teams and understanding team proce	•
Communication skills; Skill in wor practice; Project management ski Workload: Total: 300 h 15 h seminar (attendance)	king in teams and understanding team proce ills; Scientific methodology;	•
• •	king in teams and understanding team proce ills; Scientific methodology;	•
Communication skills; Skill in wor practice; Project management ski Workload: Total: 300 h 15 h seminar (attendance) 285 h internship / practical course Conditions:	king in teams and understanding team proce ills; Scientific methodology;	•

Part of the Module: Project Module Human-Centered Multimedia

Mode of Instruction: internship

Language: German

Contact Hours: 1

Contents:

Collaborate on current research topics.

Literature:

Literature references will be given at the beginning of the module depending on the topic.

Assigned Courses:

Oberseminar Human-Centered Multimedia

*(online/digital) *

Examination

Project Module Human-Centered Multimedia

practical exam, graded

Test Frequency:

Health Care and Wellbeing	odule Embedded Intelligence for	10 ECTS/LF
Version 1.1.0 (since WS17/18) Person responsible for module: F	Prof. Dr. Björn Schuller	/
embedded systems and intelliger have in-depth specialist knowledg and technologies in the area mer problems. This enables them to t In addition, the students have the methodology to discuss problems combine and present intermediat Key Qualifications: Ability to this	nodule, the students understand problems of at signal analysis, especially for applications ge and skills there. They can develop conce- ntioned in research projects and are able to ie in with international research and make t e team and communication skills, the ability is in the field, to define intermediate goals, a e results and innovative ideas. nk logically, analytically and conceptually; In	s in medical and sports informatics, and epts, methods, procedures, techniques apply innovative methods to solve heir own scientific contribution in this field to research literature and the scientific is well as to critically evaluate, classify, independent work with English-language
communication skills; team collab	ble and convincing presentation of ideas, co poration skills and understanding of team pr ills; scientific methodology; software develo	rocesses; principles of good scientific
Workload: Total: 300 h 285 h internship / practical course 15 h seminar (attendance)	e (self-study)	
Conditions: none		Credit Requirements: Bestehen der Modulprüfung
	Recommended Semester: from 1.	-

Parts of the Module

Part of the Module: Projektmodul Embedded Intelligence for Health Care and Wellbeing

Mode of Instruction: internship

Language: German / English

Contact Hours: 1

Contents:

Autonomous collaboration on current research topics.

Literature:

Scientific publications; manuals; is provided by the chair.

Assigned Courses:

Oberseminar Embedded Intelligence for Health Care and Wellbeing

*(online/digital) *

Examination

Projektmodul Embedded Intelligence for Health Care and Wellbeing

practical exam, graded

Test Frequency:

Module INF-0319: Interdisc Informatics Praktikum Interdisziplinäres Pro	iplinary Project Engineering	6 ECTS/LP
Version 1.0.0 (since WS19/20) Person responsible for module: Prof. DrIng. Lars Mikelsons, P	÷ .	
mechatronics. They use complet in the individual lectures. The p Trophy or the James Dyson Aw transfer of concepts and methor The timeline for this practicum v prerequisites and faculty particin Key Qualifications: Teamwork a problem solving, result evaluation	disciplinary task from the field of production i ex processes and techniques, some of which ractical project is based on a student challer ard, and is worked on in small groups. The ds as well as their interdisciplinary combinat will be announced in Digicampus, as will the pation.	have already been covered theoretically ge, such as the Sioux Mechatronics use case requires the evaluation and on. specific challenge assignment, including scientious work, application-oriented
Workload: Total: 180 h 120 h studying of course conter 60 h internship / practical cours	nt through exercises / case studies (self-stud e (attendance)	у)
Conditions: none		Credit Requirements: Passing the module exam
Frequency: irregular	Recommended Semester:	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 4	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Interdisci Mode of Instruction: internship Language: German	plinary Project Engineering Informatics	

Contact Hours: 4

ECTS Credits: 6.0

Contents:

Students work in small groups on application-oriented tasks on topics in the industrial environment.

Literature:

Will be announced in the respective semester.

Examination

Interdisciplinary Project Engineering Informatics

practical exam, graded

Test Frequency:

Module INF-0328: Project Module Information Systems Projektmodul IT-Infrastrukturen in der		10 ECTS/LP
Version 1.0.0 (since WS19/20) Person responsible for module: Prof. D	Dr. Frank Kramer	
infrastructures in translational medical concepts, methods, procedures, techn to apply innovative methods in solving problems. This enables them to conne field. In addition, students have the tea scientific methodology to discuss probl combine and present intermediate resu Key Skills: Skill in logical, analytical, ar Intelligible, confident, and persuasive p	e, students understand problems of high research and have deeper expertise and iques and technologies of the mentioned ct to international research and make the amwork and communication skills, the ab lems in the field, define intermediate goa ults and innovative ideas. Ind conceptual thinking; Independent wor presentation of ideas, concepts, and resu derstanding team processes; Principles of	d skills there. They are able to develop I field in research projects and are able eir own scientific contribution to the ility to research literature and the Is, and critically evaluate, classify, k with English-language literature; ilts; Quality awareness; Communication
Workload: Total: 300 h 285 h internship / practical course (self 15 h seminar (attendance)	f-study)	
Conditions: none		Credit Requirements: Passing the module examination
Frequency: each semester	Recommended Semester: from 2.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 1	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Project Module I Mode of Instruction: internship Language: German / English Contact Hours: 1 ECTS Credits: 10.0	IT Infrastructure in Medical Informatio	n Systems
Contents: Current research topics in the field	of IT infrastructures in translational medi	ical research.
Literature: scientific essays, manuals		

Oberseminar IT-Infrastrukturen für die Translationale Medizinische Forschung

*(online/digital) *

Examination

Project Module IT Infrastructure in Medical Information Systems

practical exam, graded

Test Frequency:

Module INF-0340: Project Modu Projektmodul Embedded Systems	ule Embedded Systems	10 ECTS/LF
Version 1.0.0 (since SoSe20)		
Person responsible for module: Prof.	Dr. Sebastian Altmeyer	
Learning Outcomes / Competence	es:	
systems and have more in-depth spectrocedures, techniques and technoloc methods in solving problems. This er contribution to the field. In addition, se iterature and the scientific methodoloc evaluate, classify, combine and prese Key qualifications: Skill in logical, a iterature; Intelligible, confident, and p Communication skills; Skill in working practice; Project management skills; Workload: Total: 300 h	ecialist knowledge and skills there. They ogies of the mentioned field in research hables them to connect to international students have the teamwork and commu- ogy to discuss problems in the field, def ent intermediate results and innovative analytical, and conceptual thinking; Inde persuasive presentation of ideas, conce g in teams and understanding team pro Scientific methodology.	unication skills, the ability to research fine intermediate goals, and critically ideas. pendent work with English-language epts, and results; Quality awareness;
285 h internship / practical course (so 15 h seminar (attendance)	elf-study)	
Conditions:		
Frequency: each semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours:	Repeat Exams Permitted:	
1	according to the examination regulations of the study program	

Mode of Instruction: internship

Language: German / English

Contact Hours: 1

Contents:

Autonomous collaboration on current research topics.

Literature:

scientific papers, handbooks

Assigned Courses:

Oberseminar Embedded Systems

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Examination

Projektmodul Embedded Systems

practical exam, graded

Test Frequency:

Module INF-0374: Project M Projektmodul Resource Aware A	odule Resource Aware Algorithmics	10 ECTS/LP
Version 1.0.0 (since WS20/21) Person responsible for module: F	Prof. Dr. Tobias Mömke	
medium difficulty in the area of red date topics within the area and c deep concepts, methods, tools a	dule, the students are able to understand alg esource aware algorithmics.They have acqui an actively participate in research projects. F nd technologies and can apply the acquired heir team and communication skills, the abil	ired a detailed understanding of up-to- Furthermore, they understand some knowledge in research projects. Besides
English language; ability to prese	rform analytical and logic thinking; self-suffic ent results and ideas in form of understandal on skills; ability to work with a team and to u	ble and inspiring presentations; aim for
Workload: Total: 300 h 285 h internship / practical cours 15 h seminar (attendance)	e (self-study)	
Conditions: none		Credit Requirements: Bestehen der Modulprüfung
Frequency: each semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 1	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Projekt Mo Mode of Instruction: internship Language: German / English	dule Resource Aware Algorithmics	

Contact Hours: 1

Contents:

Autonome Mitarbeit an aktuelle Forschungsthemen.

Literature:

wissenschaftliche Papiere, Handbücher

Assigned Courses:

Oberseminar Resource Aware Algorithmics

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Examination

Projekt Module Resource Aware Algorithmics

portfolio exam, graded

Test Frequency:

Module INF-0436: Project Mo Projektmodul Quantenalgorithme	-	10 ECTS/LP
Version 1.0.0 (since SoSe23) Person responsible for module: P		
Learning Outcomes / Competer	nces:	
Gebiet der Quantenalgorithmen u Konzepte, Methoden, Verfahren, entwickeln und sind fähig, innovat möglich, an die internationale For Gebiet zu leisten. Darüber hinaus Fähigkeit zur Literaturrecherche u	odul verstehen die Studierenden Problems nd verfügen dort über tiefergehende Fachl Techniken und Technologien des genannte ive Methoden bei der Lösung von Problem schung anzuknüpfen und ihren eigenen wi verfügen die Studierenden über die Team nd die wissenschaftliche Methodik, um Pro nieren, sowie Zwischenergebnisse und inr zu präsentieren.	kenntnisse und Fähigkeiten. Sie können en Gebiets in Forschungsprojekten nen anzuwenden. Dadurch ist es ihnen issenschaftlichen Beitrag auf diesem n- und Kommunikationsfähigkeit, die oblemstellungen auf dem Gebiet zu
mit englischsprachiger Fachliterat und Ergebnissen; Qualitätsbewuß	keit zum logischen, analytischen und konz ur; Verständliche, sichere und überzeugen tsein; Kommunikationsfähigkeit; Fertigkeit Grundsätze guter wissenschaftlicher Praxis	nde Präsentation von Ideen, Konzepten der Zusammenarbeit in Teams und
Workload: Total: 300 h 15 h seminar (attendance) 285 h internship / practical course	(self-study)	
Conditions:		Credit Requirements: Bestehen der Modulprüfung
Frequency: as needed	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 1	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Projektmod Mode of Instruction: internship Language: English / German	ul Quantenalgorithmen	
Contents: Mitarbeit an aktuellen Forschu	ngsthemen	
Literature: Aktuelle Forschungsbeiträge		

Aktuelle Forschungsbeiträge

Assigned Courses:

Oberseminar Quantenalgorithmik

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Examination

Projektmodul Quantenalgorithmen

practical exam, graded

Test Frequency:

Module INF-0455: Project Modu Projektmodul Diagnostische Sensorik		10 ECTS/LP
Version 1.0.0 (since SoSe23)		
Person responsible for module: Prof.	Dr. Sebastian Zaunseder	_
sensing and have deeper expertise a techniques and technologies of the m solving problems. This enables them the field. In addition, students have th the scientific methodology to discuss combine and present intermediate res Key Skills : Skill in logical, analytical, Intelligible, confident, and persuasive	le, students understand problems of high nd skills there. They are able to develop of entioned field in research projects and are to connect to international research and r e teamwork and communication skills, the problems in the field, define intermediate	concepts, methods, procedures, e able to apply innovative methods in nake their own scientific contribution to e ability to research the literature and goals, and critically evaluate, classify, rk with English-language literature; ults; Quality awareness; Communication
management skills; Scientific method Workload: Total: 300 h 285 h internship / practical course (se 15 h seminar (attendance)		
Conditions: none		Credit Requirements: Passing the module examination
Frequency: each semester	Recommended Semester:	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 1	Repeat Exams Permitted: according to the examination regulations of the study program	
Parts of the Module		
Part of the Module: Projektmodul E Mode of Instruction: internship Language: German / English Contact Hours: 1 Contents:	Diagnostic Sensing	
Current research topics		
Literature: Scientific articles		

Assigned Courses:

Oberseminar Diagnostische Sensorik

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Examination

Projektmodul Diagnostic Sensing

practical exam, graded

Test Frequency:

Module INF-0474: Project Module Networked Systems and Communication Networks Projektmodul Vernetzte Systeme und Kommunikationsnetze	10 ECTS/LP
Version 1.0.0 (since WS23/24) Person responsible for module: Prof. Dr. Michael Seufert	
Learning Outcomes / Competences: Nach der Teilnahme am Projektmodul verstehen die Studierenden Pro Gebiet der vernetzten Systeme und Kommunikationsnetze und verfüge und Fähigkeiten. Sie können Konzepte, Methoden, Verfahren, Technik Gebiets in Forschungsprojekten entwickeln und sind fähig, innovative I anzuwenden. Dadurch ist es ihnen möglich, an die internationale Forsc wissenschaftlichen Beitrag auf diesem Gebiet zu leisten. Darüber hina Team- und Kommunikationsfähigkeit, die Fähigkeit zur Literaturrechere Problemstellungen auf dem Gebiet zu diskutieren, Zwischenziele zu de innovative Ideen kritisch zu bewerten, einzuordnen, zu kombinieren un	en dort über tiefergehende Fachkenntnisse en und Technologien des genannten Methoden bei der Lösung von Problemen chung anzuknüpfen und ihren eigenen us verfügen die Studierenden über die che und die wissenschaftliche Methodik, um efinieren, sowie Zwischenergebnisse und
Schlüsselqualifikationen: Fertigkeit zum logischen, analytischen und mit englischsprachiger Fachliteratur; Verständliche, sichere und überze und Ergebnissen; Qualitätsbewußtsein; Kommunikationsfähigkeit; Fert Verstehen von Teamprozessen; Grundsätze guter wissenschaftlicher F Wissenschaftliche Methodik	eugende Präsentation von Ideen, Konzepten igkeit der Zusammenarbeit in Teams und
Workload: Total: 300 h 285 h internship / practical course (self-study) 15 h seminar (attendance)	
Conditions:	Credit Requirements: Bestehen der Modulprüfung

none		Bestehen der Modulprüfung
Frequency: each semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 1	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Projektmodul Vernetzte Systeme und Kommunikationsnetze

Mode of Instruction: internship

Language: English / German

Contact Hours: 1

Contents:

Autonome Mitarbeit an aktuelle Forschungsthemen.

Literature:

wissenschaftliche Papiere, Handbücher

Assigned Courses:

Oberseminar Vernetzte Systeme und Kommunikationsnetze

*(online/digital) *

Examination

Projektmodul Vernetzte Systeme und Kommunikationsnetze

practical exam, graded

Test Frequency:

Module INF-0481: Project Module Intelligent Perception in	10 ECTS/LP
Technical Systems Projektmodul Intelligente Perzeption in Technischen Systemen	
Version 1.0.0 (since WS23/24)	

Person responsible for module: Prof. Dr. Jörg-Dieter Stückler

Learning Outcomes / Competences:

After participating in the project module, students understand problems of higher complexity in the field of intelligent perception in technical systems and have deeper expertise and skills there. They are able to develop concepts, methods, procedures, techniques and technologies of the mentioned field in research projects and are able to apply innovative methods in solving problems. This enables them to connect to international research and make their own scientific contribution to the field. In addition, students have the teamwork and communication skills, the ability to research literature and the scientific methodology to discuss problems in the field, define intermediate goals, and critically evaluate, classify, combine and present intermediate results and innovative ideas.

Key qualifications: Ability to think logically, analytically and conceptually; Independent work with English-language scientific literature; Understandable, confident and convincing presentation of ideas, concepts and results; Quality awareness; Communication skills; Skill of working in teams and understanding team processes; Principles of good scientific practice; Project management skills; Scientific methodology.

Workload:

Total: 300 h

285 h internship / practical course (self-study)

15 h seminar (attendance)

Conditions: none		Credit Requirements: Passing the module exam
Frequency: each semester	Recommended Semester: from 1.	Minimal Duration of the Module: 1 semester[s]
Contact Hours: 1	Repeat Exams Permitted: according to the examination regulations of the study program	

Parts of the Module

Part of the Module: Project Module Intelligent Perception in Technical Systems

Mode of Instruction: internship

Language: English / German

Contact Hours: 1

Contents:

Current research topics.

Literature:

Scientific papers, manuals

Assigned Courses:

Oberseminar Intelligente Perzeption in Technischen Systemen

**

Examination

Project Module Intelligent Perception in Technical Systems

practical exam, graded

Test Frequency: