Module im Bereich: Fachliche Spezialisierung

- ⚠ Hinweise zu Modulen für den Bereich: Fachliche Spezialisierung
- AMS Lab Projects
- Advanced Topics in Databases
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- Applied Discrete Modelling
- Assistenzrobotik
- Clean Code Development
- Data Mining II - Advanced Topics in Data Mining
- Introduction to Data Warehousing
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- Estimation for Autonomous Mobile Robots
- Flow Visualization
- Human-Centred Manufacturing and Usability
- Introduction to Distributed Sensor Data Fusion
- Management of Global Large IT-Systems in International Companies
- Narrative Visualization
- Recent Topics in Business Informatics
- Scientific Project on Databases for Multi-Dimensional Data, Genomics, and modern Hardware

- Scientific Writing
- Scrum-in-Practice
- Sensor Networks Seminar
- Software Defined Networking
- Software-Development for Industrial Robotics
- Swarm Intelligence
- User Experience Design Sprint
- VLBA - Systemarchitekturen
- Visual Analytics in Health Care
- Wissenschaftliches Individualprojekt
- Scientific Teamproject KMD

⚠ Hinweise zu Modulen für den Bereich: Fachliche Spezialisierung

Im Folgenden werden Module aus anderen Fakultäten für den Bereich *Fachliche Spezialisierung* aufgelistet; sie können in den Modulhandbüchern der entsprechenden Fakultäten gefunden werden.

Abweichende Module müssen vom Studiengangsleitenden genehmigt werden.

- Adaptronik (Winter)
- Automatic Speech Recognition Systems (Sommer)
- Computational Fluid Dynamics (Winter, Sommer)
- Crafting Success: The Art of Business Process Management (Winter)
- Einführung in die Medizinische Bildgebung (Winter)
- Fusionsarchitekturen (Winter)
- Kognitive Systeme (Winter)
- Numerische Methoden der Biomechanik / Computational Biomechanics (Winter)
- Sprachverarbeitung/Speech Processing 2
- Theoretische Elektrotechnik (Sommer)
- Transport phenomena in granular, particulate and porous media (Sommer)
- Heterogeneous Computing (Sommer)
- System-on-Chip (Winter)

Modulbeschreibung für Module aus der Fakultät für Maschinenbau sind hier zu finden.

AMS Lab Projects

every

(in German: AMS Lab Projects)

Module-ID: FIN-INF-120503

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
AMS-Lab	6	every	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	false
Responsibility:	Prof. Dr.-Ing. Benjamin Noack
Lecturer:	Prof. Dr.-Ing. Benjamin Noack
Classes:	• *AMS Lab Projects*

Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INF: Schlüssel- und Methodenkompetenzen - M.Sc. INF: Informatik Wahlpflicht (SPO 2027) - M.Sc. INF: Schlüssel- und Methodenkompetenz (SPO 2027) - M.Sc. INF: Projekte (SPO 2027) - M.Sc. INGINF: Informatik - M.Sc. INGINF: Ingenieurinformatik - M.Sc. INGINF: Schlüssel- und Methodenkompetenzen - M.Sc. WIF: Informatik - M.Sc. WIF: Schlüssel- und Methodenkompetenzen - M.Sc. WIF: Informatik Wahlpflicht (SPO 2027) - M.Sc. WIF: Schlüssel- und Methodenkompetenz (SPO 2027) - M.Sc. WIF: Projekte (SPO 2027) - M.Sc. DKE: Applied Data Science - M.Sc. DKE: Projects (SPO 2027) - M.Sc. DE: Interdisziplinäres Team-Projekt - M.Sc. DE: Fachliche Spezialisierung - M.Sc. DE: Digital Engineering-Projekt - M.Sc. DE: Digital Engineering (SPO 2027) - M.Sc. DE: Engineering Specialization (SPO 2027) - M.Sc. DE: Schlüssel- und Methodenkompetenz (SPO 2027) - M.Sc. DE: Projekte (SPO 2027) - M.Sc. VC: Computer Science - M.Sc. VC: Schlüssel- und Methodenkompetenzen - M.Sc. VC: Computer Science (SPO 2027) - M.Sc. VC: Schlüssel- und Methodenkompetenz (SPO 2027)

Intended learning outcomes:
Students who complete the course ...

- can collaborate in teams to solve challenges in technical domains and deepen their technical expertise.
- can manage a project and define goals and milestones
- can acquire the knowledge in a technical domain to derive solutions
- can present and document their work and achievements

Content:
This module offers different team projects and individual projects on current, research-related areas like:

- robotics
- sensor data processing
- navigation and planning
- industrial machine learning
- optimization and control
- and more

Workload:
180 h of individual and team work

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
	Scientific Project (Wissenschaftliches Projekt)	Project (2 SWS)

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	

Media:	Literature:
	Literature will be announced in the lecture.

Comments:

Advanced Topics in Databases

Summer

(in German: Advanced Topics in Databases)

Module-ID: FIN-INF-120277

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
ATDB	6	Summer	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	
Responsibility:	Gunter Saake
Lecturer:	David Broneske
Classes:	• Lecture *Advanced Topics in Databases* • Exercise *Advanced Topics in Databases*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Informatik - M.Sc. DKE: Data Processing for Data Science - M.Sc. DE: Methoden der Informatik - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Computer Science

Intended learning outcomes:
The students ...

- understand selected advanced topics in databases
- know state-of-the-art solutions for current problems in database research

- assess advanced solutions for current database systems
- can apply advanced methods in database implementation techniques

Content:
Topics of the lecture will frequently change in accordance with current research directions in the database community and represent cutting-edge aspects. Current Topics:

- Main-memory database algorithms and techniques
- Heterogeneous processing in database systems
- Advanced indexing ans storage techniques
- Storage techniques for NoSQL database systems

Workload:
56h contact hours + 124h self-study

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
Successful participation in the exercise	Oral exam	• 2 SWS Lecture • 2 SWS Exercise class

Prerequisites according to examination regulations:	Recommended prerequisites:
none	• Knowledge about database foundations and about principles of internal database operations • Basic programming skills

Media:	Literature:

Comments:

Advanced Topics in Networking

Winter

(in German: Advanced Topics in Networking)

Module-ID: FIN-INF-120518

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
ATN	6	Winter	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	false
Responsibility:	David Hausheer
Lecturer:	David Hausheer
Classes:	• Lecture *Advanced Topics in Networking* • Exercise *Advanced Topics in Networking*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Informatik - M.Sc. DE: Methoden der Informatik - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Computer Science

Intended learning outcomes:
Students...

- enhance their competence in the area of networking
- understand advanced networking concepts
- can explain these concepts to other participants

- are able to apply these concepts in theoretical use cases and practical exercises
- gain expertise in practical network applications

Content:
The course deals with advanced topics in the area of networking:

- Overlay networks for content delivery, e.g., P2P, BitTorrent, CDNs, caching, overlay video streaming
- Distributed Hash Tables (DHT), e.g., Kademlia
- Blockchains
- Crypto currencies and Bitcoin
- Ethereum and smart contracts
- Secure network architectures, e.g., SCION
- Congestion Control, e.g., QUIC and Multipath-QUIC

Workload:

- 28h lectures
- 22h theoretical exercises
- 6h practical exercises
- 124h homework (further studies, practical work, preparation for the final exam)

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
Prerequisites for the exam required; details will be announced at the beginning of the semester.	Written exam 120 minutes	• Lecture 2 SWS • Exercise 2 SWS

Prerequisites according to examination regulations:	Recommended prerequisites:
none	Modul *Computernetze*

Media:	Literature:
	Textbooks as indicated. Slides and paper copies as necessary.

Comments:

Applied Discrete Modelling

Winter

(in German: Applied Discrete Modelling)

Module-ID: FIN-INF-120279

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
ADM	6	Winter	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	
Responsibility:	PD Dr. Claudia Krull
Lecturer:	PD Dr. Claudia Krull
Classes:	• Lecture *Applied Discrete Modelling* • Exercise class *Applied Discrete Modelling*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INF: Informatik Wahlpflicht (SPO 2027) - M.Sc. INGINF: Informatik - M.Sc. WIF: Informatik - M.Sc. WIF: Informatik Wahlpflicht (SPO 2027) - M.Sc. DKE: Learning Methods and Models for Data Science - M.Sc. DE: Fachliche Spezialisierung - M.Sc. DE: Informatik Wahlpflicht (SPO 2027) - M.Sc. VC: Computer Science - M.Sc. VC: Computer Science (SPO 2027)

Intended learning outcomes:

- Students understand the basics of Markov chains and know selected applications and solution methods

- Students understand non-Markovian stochastic processes and can model and simulate them in different ways
- Students understand hidden Markovian and non-Markovian processes
- Students know selected research topics of the research group
- Students can implement the models and methods they have learned and apply them to problems from the university's main research areas, in particular medicine and engineering

Content:

- Discrete-time and continuous-time Markov chains
- Applications and implementation of solution methods for Markov chains
- Method of supplementary variables
- Proxel simulation and phase distributions
- Modeling with hidden models
- Programming solution methods for different model classes
- Modeling and solving problems from medicine and engineering

Workload:
56 h lectures and exercise classes
124 h independent work

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
Solutions to Assignments 1-6 need to be handed in before the exam registration.	Oral Exam 30 Minutes	• Lecture 2 SWS • Exercise class 2 SWS

Prerequisites according to examination regulations:	Recommended prerequisites:
none	• Engineering mathematics • Computer programming

Media:	Literature:
recorded lectures and exercises are available	

Comments:

Assistenzrobotik

Sommer

(engl. Assistance robotics)

Modulnummer: FIN-INF-120443

Kürzel	CP	Semester	Fachsem.	Dauer	Sprache	Niveau
AROB	6	Sommer	ab 1.	1 Semester	deutsch	Master

Link zum LSF:	LSF
Zugang beschränkt:	
Verantwortung:	Norbert Elkmann (Fraunhofer IFF)
Dozent:in:	Norbert Elkmann (Fraunhofer IFF)
Lehrveranstaltungen:	• Vorlesung *Assistenzrobotik* • Übung *Assistenzrobotik*
Verwendbarkeit:	- M.Sc. INF: Informatik - M.Sc. INF: Informatik Wahlpflicht (SPO 2027) - M.Sc. INGINF: Informatik - M.Sc. DKE: Applied Data Science - M.Sc. DE: Methoden des Digital Engineering - M.Sc. DE: Methoden der Informatik - M.Sc. DE: Fachliche Spezialisierung - M.Sc. DE: Informatik Wahlpflicht (SPO 2027) - M.Sc. DE: Digital Engineering (SPO 2027) - M.Sc. DE: Engineering Specialization (SPO 2027)

Angestrebte Lernergebnisse:
Absolvent*innen dieses Moduls ...

- kennen mathematische Transformationen zur geometrischen und differentiellen Beschreibung von Roboterkinematiken
- kennen die Bewegungsgleichung von Roboter-Manipulatoren und können sie für Fragestellungen zur kollaborativen Sicherheit anwenden
- kennen die unterschiedlichen Interpolationsarten zum Beschreiben einer Roboterbahn und können eigenständig C^2-Trajektorien generieren

- können die Kinematik von mobilen Robotern modellieren und ihre Position unter Berücksichtigung von Unsicherheiten im Raum bestimmen
- kennen verschiedene Methoden des maschinellen Lernens (unüberwachtes und überwachtes Lernen sowie Deep Learning) und können deren Einsatzmöglichkeiten für die Bildverarbeitung im Kontext der Robotik einordnen
- verstehen die Grundprinzipien des Reinforcement Learnings und wissen, wie damit optimale Handhabungsstrategien für Roboter generiert werden können
- kennen die Grundlagen der Maschinensicherheit (Risikobeurteilung und CE-Kennzeichnung)
- kennen die Sicherheitsbetriebsarten für kollaborative Robotersysteme und können sie anwenden

Inhalt:

- Einführung in die Assistenzrobotik
- Grundlagen der Assistenzrobotik (Modellierung von Roboterkinematiken, Bahnplanung, Bewegungs- und Kraftregelung, Sensoren, mobile Systeme)
- Mensch-Roboter-Kollaboration und Sicherheit: Technologien, Maschinensicherheit, Normen, Rechtslage
- KI-Verfahren in der Robotik

Arbeitsaufwand:
42h Präsenzzeit + 138h selbstständige Arbeit

Prüfungsvorleistungen:	Studien-/Prüfungsleistungen:	Lehrform / SWS:
	Mündliche Prüfung	• 2 SWS Vorlesung • 2 SWS Übung

Voraussetzungen nach Prüfungsordnung:	Empfohlene Voraussetzungen:
keine	• Programmierkenntnisse • Lineare Algebra

Medienformen:	Literatur:

Hinweise:

Clean Code Development

Winter

(in German: Clean Code Development)

Module-ID: FIN-INF-120432

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
CCD	6	Winter	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	true
Responsibility:	Prof. Dr. Frank Ortmeier
Lecturer:	Prof. Dr. Frank Ortmeier
Classes:	• Vorlesung *Clean Code Development* • Übung *Clean Code Development*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INF: Schlüssel- und Methodenkompetenzen - M.Sc. INGINF: Informatik - M.Sc. INGINF: Schlüssel- und Methodenkompetenzen - M.Sc. DKE: Applied Data Science - M.Sc. DE: Methoden des Digital Engineering - M.Sc. DE: Methoden der Informatik - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Computer Science - M.Sc. VC: Schlüssel- und Methodenkompetenzen

Intended learning outcomes:
Students:

- know and understand the principles of Clean Code Development
- are able to apply the associated tools and practices in practice
- learn to independently select and adapt the concepts suitable for a project

- learn to distribute tasks within a team and collaborate in an organized manner

Content:

- Software engineering deals with the creation and development of software, the organization and modeling of related data structures, and the operation of software systems. It thus encompasses software design, implementation, and management.
- The introductory lecture *Software Engineering I* provided the foundational knowledge for designing and writing good software.
- This advanced lecture introduces modern techniques and methods that are commonly used in the development of large software systems.
- We align with the four core values of *Clean Code Development* – evolvability, correctness, production efficiency, and comprehensibility.
- To achieve these goals, a variety of programming principles and practices will be introduced.
- These include, among others, team formation and organization in software development, principles and tools of Clean Code Development, continuous integration and automated build systems, bug tracking, error localization and debugging, automated and model-based testing, code analysis and quality metrics, requirements engineering and tracing, as well as distributed and component-based software architectures.
- The course will offer a high degree of practical engagement with tools and software development techniques, especially in the exercises. The goal is not only to convey abstract knowledge but also to develop hands-on competencies.
- Participation in the exercises is mandatory and will be conducted in groups.

Workload:
56h Präsenszeit + 124h selbständige Arbeit am Projekt

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
Projekt	Mündliche Prüfung	• Vorlesung (2 SWS) • Übung (2 SWS)

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	Software Engineering

Media:	Literature:

Comments:
Enrollment Restriction: Limited number of participants. The selection process will be announced during the first lecture.

Data Mining II - Advanced Topics in Data Mining

Winter

(in German: Data Mining II - Advanced Topics in Data Mining)

Module-ID: FIN-INF-120455

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
DM2	9	Winter	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	false
Responsibility:	Myra Spiliopoulou
Lecturer:	Myra Spiliopoulou
Classes:	Vorlesung DM 2 Übung DM 2 **COURTESY TRANSLATION:** • Lecture class DM2 • Exercise class DM2
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Informatik - M.Sc. DKE: Learning Methods and Models for Data Science - M.Sc. DE: Methoden der Informatik - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Computer Science

Intended learning outcomes:

When successfully completing this module, the students:

- comprehend why temporal data need different learning algorithms and evaluation procedures than used on static data
- comprehend the behaviour of supervised, unsupervised and semi-supervised learning algorithms on temporal data
- can design and apply simple learning algorithms and workflows on temporal data and interpret the induced models
- can evaluate models - once and in continuous evaluation, since both are needed in temporal learning

and have thus acquired skills they need in order to design and evaluate temporal learning algorithms themselves

Content:

Block 1A: Data Streams

- Basics
- Stream classification: learning methods and concept drift detectors; evaluation approaches
- Semi-supervised stream learning: methods and evaluation approaches

Block 1B: Time series

- Basics
- Time series classification
- Time series prediction
- Evaluation of models

Block 2: discussion of papers (inverted classroom) and hands-on of algorithms (in the exercises)

Workload:

- 28 hours - in presence : lecture class (2 hours per week)
- 28 hourse in presence: exercise class (2 hours per week)
- 214 Stunden: Individual working time on
  - Preparation for lectures and exercise classes
  - Reading and understanding the articles (scientific papers) provided for the discussion in the lecture class

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):

Votierung in der Vorlesung und in der Übung (A minimum number of points must be achieved in Block 1 and in Block 2)	Schriftliche Prüfung - Klausur **COURTESY TRANSLATION:** • Written exam of the form 'Klausur' • Prerequisite for the written exam: a minimum number of points must be achieved; this procedure is called 'Votierung'	• Vorlesung (2 SWS) • Übung (2 SWS) **COURTESY TRANSLATION:** • Lecture (2 hours per week of the semester) • Exercise (2 hours per week of the semester)

Prerequisites according to examination regulations:	**Recommended prerequisites:**
keine	• Familiarity with learning algorithms for static tabular data • Familiarity with methods for the evaluation of models induced on static data

Media:	**Literature:**

Comments:
Block 1: Literature on streams and time series; is provided in the elearning page of the module
Block 2: New papers are discussed, every time the course is offered

Introduction to Data Warehousing

Winter

(in German: Data Warehouse Technologies)

Module-ID: FIN-INF-102808

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
DWT	6	Winter	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	
Responsibility:	Gunter Saake
Lecturer:	David Broneske
Classes:	• Lecture *Introduction to Data Warehousing* • Exercise *Introduction to Data Warehousing*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Wirtschaftsinformatik - M.Sc. WIF: Informatik - M.Sc. DKE: Data Processing for Data Science - M.Sc. DE: Fachliche Spezialisierung

Intended learning outcomes:
The students ...

- understand the data warehousing approach
- understand technologies in the field of data warehouses
- can use data warehouse specific DBMS functionalities

- can design and develop data warehouse applications

Content:

- The data warehouse approach
- Architecture and differences to traditional Database Management
- The Extract-Transform-Load process
- OLAP and the Multidimensional data model
- Application of the model in database systems
- Query execution and optimization
- Index and Storage structures for data warehouses
- Buisiness Intelligence on data warehouses

Workload:
56 contact hours + 124 h self study

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
	Written exam (120 min)	• 2 SWS Lecture • 2 SWS Exercise class

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	Modules Datenbanken 1/Database Concepts and Datenbanken 2

Media:	Literature:
	Data Warehouse Technologien. Veit Köppen, Gunter Saake, Kai-Uwe Sattler. 2. Auflage, mitp-Verlag, 2014

Comments:

Distributed Data Management

Winter

(in German: Distributed Data Management)

Module-ID: FIN-INF-102404

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
DDM	6	Winter	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	false
Responsibility:	Gunter Saake
Lecturer:	Eike Schallehn
Classes:	• Lecture *Distributed Data Management* • Exercise *Distributed Data Management*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Informatik - M.Sc. DKE: Data Processing for Data Science - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Computer Science

Intended learning outcomes:
The students ...

- know basic principles and advantages of distributed data management
- can implement distributed databases
- understand query and transaction processing in distributed and parallel database systems

- optimize the run-time performance and satisfy requirements regarding reliability and availability of distributed systems

Content:

- Overview and classification of distributed data management (distributed DBMS, parallel DBMS, fedrated DBMS, P2P)
- Distributed DBMS: architecture, distribution design, distributed query processing and optimization, distributed transactions, and transactional replication
- Parallel DBMS: fundamentals of parallel processing, types of parallelization in DBMS, parallel query processing

Workload:
56 h contact hours + 124 h self-study

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
To be eligible to take the exam, you must have completed certain prerequisites. Further details will be announced in the first lecture.	Written exam (120 min)	• Vorlesung 2 SWS • Übung 2 SWS

Prerequisites according to examination regulations:	Recommended prerequisites:
none	Database introduction course

Media:	Literature:

Comments:

Estimation for Autonomous Mobile Robots

Winter

(in German: Estimation for Autonomous Mobile Robots)

Module-ID: FIN-INF-120485

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
AMR	6	Winter	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	false
Responsibility:	Prof. Dr.-Ing. Benjamin Noack
Lecturer:	Prof. Dr.-Ing. Benjamin Noack
Classes:	• Lecture *Estimation for Autonomous Mobile Robots* • Exercise *Estimation for Autonomous Mobile Robots*

Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INF: Informatik Wahlpflicht (SPO 2027) - M.Sc. INGINF: Informatik - M.Sc. INGINF: Ingenieurinformatik - M.Sc. WIF: Informatik - M.Sc. WIF: Informatik Wahlpflicht (SPO 2027) - M.Sc. DKE: Applied Data Science - M.Sc. DE: Methoden des Digital Engineering - M.Sc. DE: Methoden der Informatik - M.Sc. DE: Fachliche Spezialisierung - M.Sc. DE: Informatik Wahlpflicht (SPO 2027) - M.Sc. DE: Digital Engineering (SPO 2027) - M.Sc. DE: Engineering Specialization (SPO 2027) - M.Sc. VC: Computer Science - M.Sc. VC: Computer Science (SPO 2027)

Intended learning outcomes:
Students who complete the course ...

- have an overview of basic problems and methods in parameter and state estimation for mobile systems.
- understand how to develop kinematic models for mobile robots and how to derive discrete-time prediction models.
- are familiar with the required mathematical tools and can derive and apply least-squares methods for localization and tracking of mobile systems, e.g., based on distance measurements.
- have a deep understanding of Kalman filtering and its nonlinear generalizations for dynamic state estimation and localization of mobile systems.

Content:

- Kinematics, System Models, and Dead Reckoning for Mobile Systems
- Sensor Models and Optimization Methods for Localization and Tracking
- DynamicState Estimation for Real-Time Localization and Tracking
- Linear Kalman Filtering and Nonlinear Generalizations

Workload:
56 h contact time 124 h independent study

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
	Oral exam (30 min)	• Lecture (2 SWS) • Exercise (2 SWS)

Prerequisites according to examination regulations:	Recommended prerequisites:
none	Linear Algebra, Analysis

Media:	Literature:
	Literature will be announced in the lecture.

Comments:

Flow Visualization

Summer

(in German: Flow Visualization)

Module-ID: FIN-INF-120261

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
FlowVis	6	Summer	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	false
Responsibility:	Holger Theisel
Lecturer:	Holger Theisel
Classes:	• Vorlesung *Flow Visualization* • Übung *Flow Visualization*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Informatik - M.Sc. DKE: Applied Data Science - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Visual Computing

Intended learning outcomes:
The students

- understand the basic concepts of Flow Visualization in the broader context of Visualization
- are able to create their own visualization projects
- learn both the theoretical basics and applications of Flow Visualization
- are able to acquire in-depth knowledge of Flow Visualization after finishing the course

Content:

- Mathematical principles of vector and tensor fields
- Obtaining flow data
- Direct methods for flow visualization
- Texture-based methods for flow visualization
- Geometry-based methods for flow visualization
- Feature-based methods for flow visualization
- Topological methods for flow visualization
- Finite Time Lyapunov exponents
- objective methods for flow visualization

Workload:
56 contact hours + 124h self study

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
	oral exam	• 2 SWS lecture • 2 SWS exercise class

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	Einführung in die Computergraphik oder Computer Graphics - an Introduction

Media:	Literature:

Comments:

Human-Centred Manufacturing and Usability

Sommer

HCAMU

(in German: Human-Centred Manufacturing and Usability)

Module-ID: FIN-INF-120512

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
HCMU	6	Sommer	2.	1 Semester	english	Master

Link:	LSF
Limited accessability:	
Responsibility:	Ernesto William De Luca
Lecturer:	Marianna Ciccarelli
Classes:	Lecture/Exercise: *Human-Centred Manufacturing and Usability*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Informatik - M.Sc. DKE: Applied Data Science - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Computer Science

Intended learning outcomes:
The students ...

- have theoretical and practical skills for the evaluation and design of safe, efficient, and human-centered work environments
- can apply principles of Human-Centered Design and Human-Centered Manufacturing

- understand risk assessment methodologies

Content:
The course aims to provide both theoretical and practical skills for the evaluation and design of safe, efficient, and human-centered work environments. It will cover key concepts related to health and safety in industrial settings, with a particular focus on risk prevention and the integration of human resources into Industry 4.0 processes. Special attention will be given to the principles of Human-Centered Design and Human-Centered Manufacturing, with an introduction to occupational ergonomics and methods for analyzing physical and cognitive ergonomics. The course will also explore risk assessment methodologies, including applications in human-robot collaboration, as well as user-machine interaction paradigms and usability concepts. Learning activities are supported by hands-on exercises in ergonomic analysis and usability testing.

Workload:

- block course
- 40 contact hours + 140 hours self study

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
	Written report (Hausarbeit)	4 SWS Lecture/Exercise

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	

Media:	Literature:

Comments:

Introduction to Distributed Sensor Data Fusion

Summer

(in German: Introduction to Distributed Sensor Data Fusion)

Module-ID: FIN-INF-120497

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
SDF	6	Summer	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	
Responsibility:	Prof. Dr.-Ing. Benjamin Noack
Lecturer:	Prof. Dr.-Ing. Benjamin Noack
Classes:	• Lecture *Introduction to Distributed Sensor Data Fusion* • Exercise *Introduction to Distributed Sensor Data Fusion*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INF: Informatik Wahlpflicht (SPO 2027) - M.Sc. INGINF: Informatik - M.Sc. INGINF: Ingenieurinformatik - M.Sc. WIF: Informatik - M.Sc. WIF: Informatik Wahlpflicht (SPO 2027) - M.Sc. DKE: Applied Data Science - M.Sc. DE: Methoden des Digital Engineering - M.Sc. DE: Methoden der Informatik - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Computer Science - M.Sc. VC: Computer Science (SPO 2027)

Intended learning outcomes:
Students who complete the course ...

- have an overview of basic problems and methods in designing distributed sensor systems and their applications.
- understand how to process data in a network of sensors, what requirements the infrastructure must meet, and how to model and describe errors like measurement noise.
- are familiar with the mathematical tools and can apply them.
- can analyze, compare, and evaluate different approaches to information processing of sensor data.

Content:
This lecture introduces basic principles, requirements, and methods of sensor data processing. Since data are more often gathered by networked sensor systems, this lecture places particular emphasis on distributed sensor data fusion methods. We will start by discussing the technical specifications of a sensor system and the basics of digital sensor data processing. Our study includes sampling theorems, compressive sensing, and signal matching. We will consider the required infrastructure to processing sensor data in networked systems, i.e., sensor networks. Based on this infrastructure, we can apply methods for multisensor data fusion to spatially distributed sensors and can monitor spatio-temporal processes.

Workload:
56 h contact time 124 h independent study

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
	Oral exam (30 min)	• Lecture (2 SWS) • Exercise (2 SWS)

Prerequisites according to examination regulations:	Recommended prerequisites:
none	

Media:	Literature:
	Literature will be announced in the lecture.

Comments:

Management of Global Large IT-Systems in International Companies

Summer

(in German: Management of Global Large IT-Systems in International Companies)

Module-ID: FIN-INF-120315

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
MGLIIC	6	Summer	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	
Responsibility:	Gunter Saake
Lecturer:	Karl-Albert Bebber, Wolfgang Stockhausen
Classes:	• Block lecture *Management of Global Large IT-Systems in International Companies* • Block Exercise class *Management of Global Large IT-Systems in International Companies*

Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Wirtschaftsinformatik - M.Sc. DKE: Applied Data Science - M.Sc. DE: Human Factors - M.Sc. DE: Methoden der Informatik - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Computer Science

Intended learning outcomes:
Students are able to …

- understand the fundamentals of IT strategy and analyze its significance for businesses.
- describe methods for developing and implementing IT strategies.
- apply project management methodologies such as PRINCE2 and agile approaches in IT projects.
- understand multi-project management, program management and portfolio management in corporate environments.
- apply change management models such as ADKAR to manage organizational transformations.
- understand the importance of IT governance and compliance for corporate structures and regulatory requirements.
- describe stakeholder management and intercultural communication in global IT projects.
- identify risks and quality requirements in IT projects and develop appropriate control measures.
- explain data governance concepts and assess their significance for data protection, IT security, and regulatory compliance.
- describe the role of data quality, metadata management and master data management (MDM) in corporate IT.
- model, analyze, and optimize IT-supported business processes, particularly through the use of BPMN.
- understand Identity & Access Management (IAM) and evaluate its implementation in enterprises.
- explain security aspects such as authentication, authorization, Single Sign-On (SSO), and two-factor authentication (2FA), as well as best practices in enterprise security management.
- assess IT security strategies and cybersecurity measures, including risk mitigation techniques.
- understand the importance of reference data management and data integration for corporate processes.
- evaluate agile methodologies such as Scrum in IT transformation projects and compare them with traditional waterfall approaches.
- understand risk and quality management processes in IT environments, including testing methodologies, compliance frameworks, and risk mitigation strategies.
- analyze and apply IT service delivery models in Shared Service Centers.

Content:

- Business Process Management and Modeling
- Process Analysis and Optimization/Standardization
- Identity and Access Management (IAM)
- Quality and Risk Management in IT Operations
- Testing and Software Quality Assurance, including Documentation
- Agile vs. Waterfall Project Management in IT
- IT Service Delivery and Shared Service Center Management
- Project and Program Management (PRINCE2 i. a.)
- Stakeholder Management in IT Projects
- Change Management (ADKAR, Organizational and Employee Transformation)
- Data Governance (Strategy, Policies, Processes and Data Quality)
- IT Strategy – Business as a Driver for IT (Balanced Scorecard)
- IT Investments and Business Decision-Making
- Insights from Ongoing IT Projects by Public Accountants and IT Project Leads from Major International Companies

Workload:
56 contact hours + 124 h self study

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
Requirements for exam admission will be announced in the first lecture	Written Exam (120 min)	• 2 SWS Blockvorlesung • 2 SWS Blockübung

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	Knowledge about IT-Systems and Business administration

Media:	Literature:

Comments:

Narrative Visualization

Summer

(in German: Narrative Visualization)

Module-ID: FIN-INF-120523

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
NarVis	3	Summer	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	true
Responsibility:	Bernhard Preim
Lecturer:	Bernhard Preim
Classes:	Seminar *Narrative Visualization*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Informatik - M.Sc. DKE: Applied Data Science - M.Sc. DE: Human Factors - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Visual Computing

Intended learning outcomes:
Students ...

- can apply methods of narrative visualization for Science communication
- can design and present topics of Science communication

Content:

- Overview of Narrative Visualization
- Concepts and Tools for Story Generation

- Applications in climate research, molecular research and astronomy
- Applications in business and finance

Workload:
28 h contact hours + 152 h self study

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
	Referat	2 SWS Seminar

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	Module *Visualization*

Media:	Literature:

Comments:

Recent Topics in Business Informatics

every

(in German: Recent Topics in Business Informatics)

Module-ID: FIN-INF-120318

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
RTBI	6	every	2.	1 Semester	english	Master

Link:	LSF
Limited accessability:	false
Responsibility:	Prof. Dr. Klaus Turowski
Lecturer:	Dr. Daniel Staegemann , Abdulrahman Nahhas
Classes:	Seminar *RTBI*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INF: Schlüssel- und Methodenkompetenzen - M.Sc. INGINF: Informatik - M.Sc. WIF: Wirtschaftsinformatik - M.Sc. WIF: Schlüssel- und Methodenkompetenzen - M.Sc. DKE: Applied Data Science - M.Sc. DE: Human Factors - M.Sc. DE: Methoden der Informatik - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Computer Science

Intended learning outcomes:
Students ...

- can acquire new knowledge independently through self-sufficient research and consultation of thematically relevant scientific literature and make it usable for

themselves.
- can write a scientific paper almost independently and with only a small amount of support and present the final result.
- can convey knowledge from a subject area of their choice as part of a specialist presentation, explain the research results they have achieved and defend the arguments they have put forward in a scientific discussion.
- know the steps involved in writing a scientific paper, from finding a specific topic to presenting it at a conference.
- have carried out the necessary steps for crafting a scientific publication themselves and have developed an understanding of them.

Content:

- Research, Literature Search, Citation & Plagiarism
- Scientific methods
- Hands-On-Guidance
- Introduction to selected Business Informatics topics

Workload:
presence = 40 hr.:

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40 h lecture with integrated exercise
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independent work = 140 hr:

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Follow-up of the lecture, write paper and review, and present paper.
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Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
	Referat	Seminar (4SWS)

Prerequisites according to examination regulations:	Recommended prerequisites:
none	Basics of scientific writing

Media:	Literature:

Comments:

Scientific Project on Databases for Multi-Dimensional Data, Genomics, and modern Hardware

every

(in German: Scientific Project on Databases for Multi-Dimensional Data, Genomics, and modern Hardware)

Module-ID: FIN-INF-120507

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
SPDB	6	every	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	true
Responsibility:	Gunter Saake
Lecturer:	Gunter Saake
Classes:	Lecture *Scientific Project on Databases for Multi-Dimensional Data, Genomics, and modern Hardware*

Applicability in curriculum:	- M.Sc. INF: Schlüssel- und Methodenkompetenzen - M.Sc. INGINF: Schlüssel- und Methodenkompetenzen - M.Sc. WIF: Schlüssel- und Methodenkompetenzen - M.Sc. DKE: Applied Data Science - M.Sc. DE: Interdisziplinäres Team-Projekt - M.Sc. DE: Fachliche Spezialisierung

Intended learning outcomes:
The students ...

- work and coordinate in a team
- write academic papers
- present scientific results
- acquire knowledge of an advanced research topic on their own
- self-sufficiently develop solutions on selected topics of databases or their applications
- assess their own work critically

Content:

- Scientific writing
- Survey of research literature
- Advanced research topics in the area of databases, genomics and modern hardware

Workload:
contact hours: 14h lectures + 8h presentations + 14h consultations
self study: 60h implementation + 24h presentations + 30h papers

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
	Seminar paper (Referat)	• Lecture (2 SWS) • Supervision (2 SWS)

Prerequisites according to examination regulations:	Recommended prerequisites:
none	Programming Knowledge in C++, Python, Java or Rust

Media:	Literature:

Comments:

Requirement: Passing an initial programming test

Scientific Writing

Winter

(in German: Scientific Writing)

Module-ID: FIN-INF-120511

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
SciWri	6	Winter	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	true
Responsibility:	PD Dr. Claudia Krull
Lecturer:	Temitope Ibidunni Akinloye
Classes:	Seminar *Scientific Writing*
Applicability in curriculum:	- M.Sc. INF: Schlüssel- und Methodenkompetenzen - M.Sc. INF: Schlüssel- und Methodenkompetenz (SPO 2027) - M.Sc. INGINF: Schlüssel- und Methodenkompetenzen - M.Sc. WIF: Schlüssel- und Methodenkompetenzen - M.Sc. WIF: Schlüssel- und Methodenkompetenz (SPO 2027) - M.Sc. DKE: Applied Data Science - M.Sc. DE: Human Factors - M.Sc. DE: Fachliche Spezialisierung - M.Sc. DE: Schlüssel- und Methodenkompetenz (SPO 2027) - M.Sc. VC: Schlüssel- und Methodenkompetenzen - M.Sc. VC: Schlüssel- und Methodenkompetenz (SPO 2027)

Intended learning outcomes:

- Students are able to conduct a literature research in order to gain an overview of an area of interest.

- Students can identify open research questions based on a literature research.
- Students are able to identify and formulate research hypothesis
- Students understand how a scientific publication is structured, can read it and extract the important information.
- Students are able to write a research proposal on a selected topic in the form of a scientific publication.
- Students are able to identify and select possible solution methods for a scientific question.
- Students are able to prepare a presentation to explain and defend their research proposal.
- Students understand how to present a research topic proposal on a selected topic.
- Students are able to evaluate the quality of others scientific work

Content:

- Literature citation and paraphrasing
- Presentations Review scientific articles
- Argument formation
- Knowledge and application of academic writing styles
- Peer review assessment

Workload:

- 28h Seminar
- 152h independent work

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
participation in all classes completion of assignments keeping all deadlines	Seminar paper (Paper + Reviews) Presentation	Seminar (2 SWS)

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	

Media:	Literature:

Comments:
participation is limited to 40

Scrum-in-Practice

Winter

(engl. Scrum-in-Practice)

Modulnummer: FIN-INF-120438

Kürzel	CP	Semester	Fachsem.	Dauer	Sprache	Niveau
SIP	6	Winter	ab 1.	1 Semester	deutsch	Master

Link zum LSF:	LSF
Zugang beschränkt:	true
Verantwortung:	Prof. Dr. Frank Ortmeier
Dozent:in:	Prof. Dr. Frank Ortmeier
Lehrveranstaltungen:	• Vorlesung *Scrum-in-Practice* • Übung *Scrum-in-Practice* Die Lehrveranstaltungen finden zum Teil im Blockformat statt.
Verwendbarkeit:	- M.Sc. INF: Informatik - M.Sc. INF: Schlüssel- und Methodenkompetenzen - M.Sc. INGINF: Informatik - M.Sc. INGINF: Schlüssel- und Methodenkompetenzen - M.Sc. DKE: Applied Data Science - M.Sc. DE: Methoden der Informatik - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Computer Science - M.Sc. VC: Schlüssel- und Methodenkompetenzen

Angestrebte Lernergebnisse:
Die Studierenden ...

- kennen die Projektmanagementmethode Scrum
- wenden agile Softwareentwicklungsmethoden praktisch an
- gewinnen praktische Erfahrungen mittels Durchführung eines Projektes
- reflektieren ihr Selbst- und Projektmanagement

Inhalt:

- In diesem Modul werden theoretische Kenntnisse und praktische Kompetenzen im Umgang mit Scrum vermittelt.
- Die Veranstaltung besteht aus drei Teilen.
- In einem Einführungsteil werden in zwei Vorlesungen die notwendigen Konzepte des Scrum-ProzessModells vorgestellt und die zur erfolgreichen Projektdurchführung notwendigen Technologien aufgelistet.
- Im Hauptteil der Veranstaltung wird in einer 1-wöchigen Blockveranstaltung ein Projekt mittels Scrum umgesetzt. Diese erfolgt in Projektteams von 4-5 Teilnehmern.
- Während dieser Phase finden 2mal täglich Scrum-Meetings mit den Betreuern statt. Als Ergebnis lernen die Teilnehmer zielgerichtet und effizient nach diesem Entwicklungsmodell zu entwickeln.
- Die Blockveranstaltung findet in einer Woche während der Vorlesungsfreien Zeit. Hier besteht natürlich Anwesenheitspflicht.
- Zur erfolgreichen Durchführung in der Projektarbeit wird von jedem Teilnehmer ein sorgfältiges Einarbeiten in die notwendigen Technologien erwartet.
- Nach Abschluss der Projektwoche reflektieren die Teilnehmer Ihre Erfahrungen und fassen diese zusammen. Diese Ergebnisse werden dann in einer gemeinsamen Abschlussveranstaltung diskutiert.

Arbeitsaufwand:
180h = 56h Präsenszeit + 124h selbständige Arbeit am Projekt

Prüfungsvorleistungen:	Studien-/Prüfungsleistungen:	Lehrform / SWS:
Projekt + Ausarbeitung	mündliche Prürfung	Blockseminar / Projektarbeit

Voraussetzungen nach Prüfungsordnung:	Empfohlene Voraussetzungen:
keine	Software Engineering

Medienformen:	Literatur:

Hinweise:
Zuangsbeschränkung: Limitierte Teilnehmerzahl. Auswahlverfahren wird in erster Vorlesung bekannt gegeben

Sensor Networks Seminar

Winter

(in German: Sensor Networks Seminar)

Module-ID: FIN-INF-120514

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
SN	6	Winter	ab 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	true
Responsibility:	Prof. Dr.-Ing. Benjamin Noack
Lecturer:	Prof. Dr.-Ing. Benjamin Noack
Classes:	Seminar *Sensor Networks*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INF: Schlüssel- und Methodenkompetenzen - M.Sc. INF: Informatik Wahlpflicht (SPO 2027) - M.Sc. INF: Schlüssel- und Methodenkompetenz (SPO 2027) - M.Sc. INGINF: Informatik - M.Sc. INGINF: Schlüssel- und Methodenkompetenzen - M.Sc. WIF: Informatik - M.Sc. WIF: Schlüssel- und Methodenkompetenzen - M.Sc. WIF: Informatik Wahlpflicht (SPO 2027) - M.Sc. WIF: Schlüssel- und Methodenkompetenz (SPO 2027) - M.Sc. DKE: Applied Data Science - M.Sc. DE: Methoden des Digital Engineering - M.Sc. DE: Methoden der Informatik - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Schlüssel- und Methodenkompetenzen - M.Sc. VC: Schlüssel- und Methodenkompetenz (SPO 2027)

Intended learning outcomes:
Students who complete the course ...

- can independently research complex topics
- write clear scientific articles
- present informative and understandable scientific talks
- understand challenges and methods in sensor networks
- understand how to these challenges are addressed in practical applications of sensor networks

Content:
In this seminar, the participants will learn about

- challenges and methods used in sensor networks
- the variety of applications and application-specific sensor network design

Workload:
28 h in presence (consultation meetings, presentations) + 156 h self study

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
	• Presentation • Discussion • Scientific Article (Referat und Hausarbeit)	Seminar (2 SWS)

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	• Lecture *Introduction to Distributed Sensor Data Fusion* • Learning algorithms • Underpinnings of engineering sciences and/or business informatics (some topics only) • Principles of scientific writing

Media:	Literature:
	Literature depends on topic assignment and is given to each student together with the assignment

Comments:

Software Defined Networking

Summer

(in German: Software Defined Networking)

Module-ID: FIN-INF-120460

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
SDN	6	Summer	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	false
Responsibility:	David Hausheer
Lecturer:	David Hausheer
Classes:	• Lecture *Software Defined Networking* • Exercise *Software Defined Networking*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Informatik - M.Sc. DE: Methoden der Informatik - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Computer Science

Intended learning outcomes:
Students...

- gain competence in the area of software defined networking
- understand software defined networking concepts
- can explain these concepts to other participants

- are able to apply these concepts in theoretical use cases and practical exercises
- gain expertise in practical network applications

Content:
The course deals with topics in the area of software defined networking:

- SDN Architecture (Application, Control, Infrastructure Layer)
- SDN Interfaces (North/South-bound vs. East/West-bound interface)
- SDN Applications and Use Cases (e.g. Multicasting)
- Network Virtualization and Slicing (e.g. FlowVisor)
- Network Function Virtualization (NFV) and Network Service Chaining
- SDN Security
- Network Operating Systems and Languages
- OpenFlow Controller (e.g. NOX, Beacon, etc.)
- Hardware Switches (e.g. NEC IP8800, Pronto) vs. Software Switches (e.g. NetFPGA, OpenVSwitch)
- SDN in Wireless Networks (e.g. OpenWRT)

Workload:

- 28h lectures
- 22h theoretical exercises
- 6h practical exercises
- 124h homework (further studies, practical work, preparation for the final exam)

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
Prerequisites for the exam required; details will be announced at the beginning of the semester.	Written exam 120 minutes	• 2 SWS lecture • 2 SWS exercise

Prerequisites according to examination regulations:	Recommended prerequisites:
none	Modul *Computernetze*

Media:	Literature:
	Textbooks as indicated. Slides and paper copies as necessary.

Comments:

Software-Development for Industrial Robotics

Winter

(engl. Software-Development for Industrial Robotics)

Modulnummer: FIN-INF-120432

Kürzel	CP	Semester	Fachsem.	Dauer	Sprache	Niveau
SDIR	6	Winter	ab 1.	1 Semester	deutsch	Master

Link zum LSF:	LSF
Zugang beschränkt:	true
Verantwortung:	Prof. Dr. Frank Ortmeier
Dozent:in:	Prof. Dr. Frank Ortmeier
Lehrveranstaltungen:	• Vorlesung *Software-Development for Industrial Robotics* • Übung *Software-Development for Industrial Robotics*
Verwendbarkeit:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. INGINF: Ingenieurinformatik - M.Sc. WIF: Informatik - M.Sc. DKE: Applied Data Science - M.Sc. DE: Methoden des Digital Engineering - M.Sc. DE: Methoden der Informatik - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Computer Science

Angestrebte Lernergebnisse:
The students have ...

- Understanding of problems in the robotics domain
- Understanding and applicability of the mathematical background

- Practical experience in programming industrial robots on the basis of various tasks

Inhalt:
The use of industrial robots is increasing rapidly these days. In 2014, the expected number of industrial robots increased by 27% compared to the previous year. The main reason is their flexibility, especially their ability to perform a wide range of tasks. In the lecture “Software Development for Industrial Robotics” an overview of this domain is given as well as the mathematical background. The latter deals in particular with the idea of forward and inverse kinematics, point-to-point movements, linear movements, trajectory planning, recognition of singularities, Denavit-Hartenberg convention, rotation and translation matrices. The final project deals with control using a collision-free path planner, KUKA youBot kinematics, numerical approaches to solving inverse kinematics, etc.

Arbeitsaufwand:
180h = 56h attendance time + 124h independent work

Prüfungsvorleistungen:	Studien-/Prüfungsleistungen:	Lehrform / SWS:
Projekt	mündliche Prüfung	• Lecture (2 SWS) • Exercise (2 SWS)

Voraussetzungen nach Prüfungsordnung:	Empfohlene Voraussetzungen:
none	

Medienformen:	Literatur:

Hinweise:
Zuangsbeschränkung: Limitierte Teilnehmerzahl. Auswahlverfahren wird in erster Vorlesung bekannt gegeben

Swarm Intelligence

Winter

(in German: Swarm Intelligence)

Module-ID: FIN-INF-102419

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
SI	6	Winter	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	true
Responsibility:	Sanaz Mostaghim
Lecturer:	Sanaz Mostaghim
Classes:	• Vorlesung *Swarm Intelligence* • Übung *Swarm Intelligence*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Informatik - M.Sc. DKE: Learning Methods and Models for Data Science - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Computer Science

Intended learning outcomes:
The students will get an understanding about Swarm Intelligence and its definitions. They will get the ability to develop swarm intelligence algorithms such as swarm aggregation, swarm movements, tracking, tracing and optimization. In addition, they learn the foundations in collective decision-making and their applications. The students can implement, analyse and evaluate swarm algorithms on several applications.

Content:
This course provides in-depth knowledge about swarm intelligence in technical systems. In swarm intelligence, we deal with a group of simple and usually homogenous individuals with simple rules. Usually, swarms can achieve a complex and intelligent behaviour using local interactions between its members. This collective property can be used in technical systems. One advanced application of swarm intelligence is in swarm robotics, in which simple small robots can collectively learn to achieve some predefined complex tasks. During this course, the algorithms of swarm intelligence are presented, analysed and compared. The following topics will be covered: Part 1: Fundamentals of swarm intelligence

- Swarm stability and stability analysis
- Swarm aggregation
- Swarm in known environments
- Swarm in unknown environments: Particle Swarm Optimization
- Dynamic Optimization
- Multi-Objective Particle Swarm Optimization

Part 2: Swarm and multiagent systems
- Division of labour and task allocation
- Swarm clustering and sorting
- Ant systems and optimization

Part 3: Applications
- Swarm localization and display
- Swarm robotics

Workload:
Präsenzzeit: 2 SWS Vorlesung 2 SWS Übungen Selbstständige Arbeit: Bearbeiten von Übungs- und Programmieraufgaben 180 h = 56 h Präsenzzeit + 124 h selbstständige Arbeit

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
All students that participate can take the exam.	Written Exam (120 min)	Vorlesung (2 SWS) Übung (2 SWS)

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	Informatik (Algorithmen und Datenstrukturen, Maschinelles Lernen)

Media:	Literature:

	Eric Bonabeau, Marco Dorigo and Guy Theraulaz, Swarm In-telligence: From Natural to Artificial Systems, Oxford University Press, 1999Andries Engelbrecht, Fundamentals of Computational Swarm Intelligence, Wiley 2006 James Kennedy and Russel Eberhart, Swarm Intelligence, Morgan Kaufmann, 2001 Zbigniew Michalewicz and David Fogel, How to solve it: Modern Heuristics, Springer, 2001 Veysel Gazi, Stability Analysis of Swarms, The Ohio State University, 2002 Marco Dorigo and Thomas Stützle, Ant Colony Optimization, The MIT Press, 2004 C. Solnon: Ant Colony Optimization and Constraint Program-ming. Wiley 2010 Gerhard Weiss, Multiagent Systems: A modern approach to distributed artificial systems, The MIT Press, 2000 Christian Müller-Schloer, Hartmut Schmeck and Theo Ungerer, Organic Computing – A Paradigm Shift for Complex Systems, Springer, 2011

Comments:

Enrollment is limited to a maximum number of participants. If necessary, students will be selected based on a statement of purpose submitted at the beginning of the semester.

User Experience Design Sprint

Winter

(engl. User Experience Design Sprint)

Modulnummer: FIN-INF-120510

Kürzel	CP	Semester	Fachsem.	Dauer	Sprache	Niveau
UEDS	6	Winter	ab 1.	1 Semester	deutsch	Master

Link zum LSF:	LSF
Zugang beschränkt:	
Verantwortung:	Hans-Knud Arndt
Dozent:in:	Hans-Knud Arndt
Lehrveranstaltungen:	Seminar *User Experience Design Sprint*
Verwendbarkeit:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Wirtschaftsinformatik - M.Sc. WIF: Informatik - M.Sc. DKE: Applied Data Science - M.Sc. DE: Fachliche Spezialisierung

Angestrebte Lernergebnisse:
Die Absolvent*innen dieses Moduls...

- erlernen ein grundlegendes Verständnis des Ansatzes User Experience Design Sprint kennen
- lernen und testen die Anwendung von Design Thinking Methoden im praktischen Kontext
- erstellen im Rahmen der Veranstaltung UX-Prototypen
- erlenren und wenden Präsentationskompetenz für UX-Design-Projekte an

Inhalt:
Die Teilnehmer*innen simulieren im Rahmen der Lehrveranstaltung einen in der Unternehmenspraxis immer wichtiger werdenden User Experience Design Sprint. Ein solcher dient der ersten Durchdringung von Problemstellungen und der sich anschließenden Ideenfindung. Hierbei werden innovative Methoden des Design Thinking sowie weitere Ansätze zur Verbesserung der Usability und User Experience von Produkten bzw. Dienstleistungen angewendet.

Arbeitsaufwand:
180h = 40h (Blockveranstaltung) + 140h selbstständige Arbeit

Prüfungsvorleistungen:	Studien-/Prüfungsleistungen:	Lehrform / SWS:
Um an der Prüfung teilnehmen zu können, sind Prüfungsvorleistungen erforderlich. Details werden in der ersten Vorlesung bekannt gegeben.	Hausarbeit	Seminar (3 SWS)

Voraussetzungen nach Prüfungsordnung:	Empfohlene Voraussetzungen:
keine	

Medienformen:	Literatur:

Hinweise:

VLBA - Systemarchitekturen

Sommer

(engl. VLBA: Systemarchitectures)

Modulnummer: FIN-INF-120252

Kürzel	CP	Semester	Fachsem.	Dauer	Sprache	Niveau
VLBA-SysA	9	Sommer	ab 1.	1 Semester	deutsch	Master

Link zum LSF:	LSF
Zugang beschränkt:	true
Verantwortung:	Prof. Dr. Klaus Turowski
Dozent:in:	Prof. Dr. Klaus Turowski
Lehrveranstaltungen:	• Vorlesung *VLBA: Systemarchitekturen* • Übung *VLBA: Systemarchitekturen*
Verwendbarkeit:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Wirtschaftsinformatik - M.Sc. DKE: Applied Data Science - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Computer Science

Angestrebte Lernergebnisse:
Die Studierenden ...

- sammeln Know-how über die Architektur von Systemlandschaften.
- wissen wie Geschäftsprozesse und IT-Ressourcen miteinander verbunden werden können (Wie spiegelt sich dies in der (System-)Architektur wider).
- kennen die Unterschiede zwischen monolithischen und serviceorientierten Architekturen bei der Entwicklung und Integration von Anwendungssystemen für Unternehmen.
- wissen, wie man Anwendungskomponenten zur Unterstützung verschiedener Geschäftsprozesse ableitet.
- wissen wie Komponenten und Dienste als Elemente einer Systemarchitektur systematisch identifiziert werden.

- wissen wie Cloud Computing-Technologien zur Unterstützung von Geschäftsprozessen genutzt werden können.
- kennen die Unterschiede zwischen den verschiedenen Cloud- Patterns und den Cloud-Service-Modellen.
- lernen die Cloud Application Architecture kennen und erfahren, wie die Microservice-Architektur die klassische serviceorientierte Architektur in Cloud-Umgebungen ergänzt.
- können sich selbstständig neues Wissen aneignen und für sich nutzbar machen.
- können bei ungewohnten Aufgabenstellungen eigene Ideen einbringen und Entscheidungen treffen.
- können für neue Aufgabenstellungen geeignete Lösungen auswählen, anwenden und anschließend bewerten.
- können die Ergebnisse wissenschaftlich in einem Referat präsentieren und sich einer Diskussion stellen.

Inhalt:

- Theorie der komponentenbasierten Systementwicklung
- Fachkomponenten,
- Frameworks,
- Komponenten-Lebenszyklen,
- CoBCoM-Architektur
- Architekturen von Systemlandschaften
- Pattern-Sprachen und Architektur-Pattern
- Service-orientierte Architektur (SoA)
- Web-Services
- Mediatoren
- Fallstudien
- Personal Information
- GuideShared ERP Architecture
- Inhaltsverzeichnis Teil A (Winter) Seite 250 – Teil A Inhaltsverzeichnis Teil B (Gesamt)
- S4/Hana und SAP Datasphere
- Prototypische Realisierung eines interorganisationalen Informationssystems auf Grundlage der CoBCoM-Architektur und SoA

Arbeitsaufwand:
Präsenzzeiten:

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28 h Vorlesung / 28 h Übung
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Selbstständiges Arbeiten:

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1. Vor- und Nachbereitung Vorlesung
2. Entwicklung einer auf maschinellem Lernen basierenden Lösung unter Anwendung von MLOps-Praktiken zur Lösung betriebswirtschaftlicher Probleme
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9 x30h (56 h Präsenzzeit + 214 h selbstständige Arbeit)

Prüfungsvorleistungen:	Studien-/Prüfungsleistungen:	Lehrform / SWS:
	Referat	• Vorlesung (2 SWS) • Übung (2 SWS)

Voraussetzungen nach Prüfungsordnung:	Empfohlene Voraussetzungen:
Version control systems, DevOps practicies (CI/CD), Containerization technologies, and python.	Version control systems, DevOps practicies (CI/CD), Containerization technologies, and python.

Medienformen:	Literatur:
	• Turowski, K.: Fachkomponenten. Aachen 2002. • Herden, S., Marx Gómez, J., Rautenstrauch, C., Zwanziger, A.: Softwarearchitekturen für E-Business-Systeme, Berlin, Heidelberg u. a., 2006.

Hinweise:

Visual Analytics in Health Care

Winter

(in German: Visual Analytics in Health Care)

Module-ID: FIN-INF-120476

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
VAHC	3	Winter	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	true
Responsibility:	Bernhard Preim
Lecturer:	Bernhard Preim
Classes:	'- Seminar *Visual Analytics in Health Care*
Applicability in curriculum:	- M.Sc. INGINF: Informatik - M.Sc. WIF: Informatik - M.Sc. DKE: Applied Data Science - M.Sc. DE: Methoden der Informatik - M.Sc. DE: Fachliche Spezialisierung - M.Sc. VC: Visual Computing

Intended learning outcomes:
The students ...

- know specific visual analytics solutions that are used in public healthcare applications
- can interpret and evaluate public healthcare data
- present and explain visual analytics solutions in healthcare scenarios

Content:

- Overview: Potential and applications of Visual Analytics in Healthcare
- Visual Analytics in Public Health
- Visual Analytics in Clinical Medicine
- Visual Analytics for Detecting Adverse Drug Effects
- Visual Analytics in Epidemiology

Workload:
3 credit points = 90 h (28 h attendance time + 62 h independent work), grading scale according to examination regulations

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
	Examinations: student talk, seminar paper (10 pages)	Seminar (3 SWS)

Prerequisites according to examination regulations:	Recommended prerequisites:
none	Visualization, Data Mining, Visual Analytics or Information Visualization

Media:	Literature:
PowerPoint presentation, use of whiteboard, videos	Workshop volumes of the IEEE Workshop Visual Analytics in Healthcare (since 2010), selected publications of other conferences / magazines in the fields of data analysis and visualization

Comments:
Auch anrechenbar für Studierende des Masterstudiengangs "Medical Systems Engineering".

Wissenschaftliches Individualprojekt

jedes

(engl. Individual Scientific Project)

Modulnummer: FIN-INF-120301

Kürzel	CP	Semester	Fachsem.	Dauer	Sprache	Niveau
WIP	6	jedes	ab 1.	1 Semester	deutsch	Master

Link zum LSF:	LSF
Zugang beschränkt:	
Verantwortung:	Studiendekan:in der FIN
Dozent:in:	Alle Dozenten der FIN
Lehrveranstaltungen:	keine

Verwendbarkeit:	- M.Sc. INF: Informatik - M.Sc. INF: Schlüssel- und Methodenkompetenz (SPO 2027) - M.Sc. INF: Projekte (SPO 2027) - M.Sc. INGINF: Informatik - M.Sc. INGINF: Ingenieurinformatik - M.Sc. WIF: Wirtschaftsinformatik - M.Sc. WIF: Informatik - M.Sc. WIF: Schlüssel- und Methodenkompetenz (SPO 2027) - M.Sc. WIF: Projekte (SPO 2027) - M.Sc. DKE: Learning Methods and Models for Data Science - M.Sc. DKE: Data Processing for Data Science - M.Sc. DKE: Applied Data Science - M.Sc. DKE: Projects (SPO 2027) - M.Sc. DE: Human Factors - M.Sc. DE: Methoden des Digital Engineering - M.Sc. DE: Methoden der Informatik - M.Sc. DE: Fachliche Spezialisierung - M.Sc. DE: Schlüssel- und Methodenkompetenz (SPO 2027) - M.Sc. DE: Projekte (SPO 2027) - M.Sc. VC: Visual Computing - M.Sc. VC: Computer Science - M.Sc. VC: Schlüssel- und Methodenkompetenz (SPO 2027) - M.Sc. VC: Projekte (SPO 2027)

Angestrebte Lernergebnisse:
Die Studierenden ...

- arbeiten selbstständig an einer wissenschaftlichen Fragestellung
- arbeiten sich selbstständig in ein wissenschaftliches Spezialgebiet ein
- erarbeiten vertiefte Kenntnisse auf einem wissenschaftlichen Spezialgebiet
- präsentieren und interpretieren ihre Ergebnisse in mündlicher und/oder schriftlicher Form
- können ihren Erfolg und die Bedeutung ihrer Ergebnisse einschätzen
- beschreiben die Auswirkungen ihrer Entscheidungen auf den Verlauf und die Ergebnisse des Projektes

Inhalt:
Die Studierenden bearbeiten in selbstständiger Arbeit eine individuell vereinbarte, wissenschaftliche Fragestellung unter Anleitung eines Hochschullehrers. Im Projekt entwickeln die Studierenden eine eigenständige Informatik-Lösung. Dadurch erwerben sie ein detailliertes und kritisches Verständnis in einem Spezialbereich der Informatik. Dieses Modul wird von unterschiedlichen Hochschullehrern implementiert. Die fachlichen Inhalte sind daher angebotsspezifisch.

Arbeitsaufwand:
180h selbstständige Arbeit

Prüfungsvorleistungen:	Studien-/Prüfungsleistungen:	Lehrform / SWS:
	Wissenschaftliches Projekt	Angeleitetes wissenschaftliches Individualprojekt

Voraussetzungen nach Prüfungsordnung:	Empfohlene Voraussetzungen:
keine	

Medienformen:	Literatur:

Hinweise:
Projekte außerhalb der FIN müssen von Studiengangsleiter abgesegnet werden.

Scientific Teamproject KMD

every

(in German: Wissenschaftliches Teamprojekt KMD)

Module-ID: FIN-INF-120528

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
Teamproj_KMD	6	every	starting at 1.	1 Semester	english	Master

Link:	LSF
Limited accessability:	false
Responsibility:	Myra Spiliopoulou
Lecturer:	Myra Spiliopoulou
Classes:	Teamproj_KMD
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INF: Schlüssel- und Methodenkompetenzen - M.Sc. INGINF: Informatik - M.Sc. INGINF: Schlüssel- und Methodenkompetenzen - M.Sc. WIF: Wirtschaftsinformatik - M.Sc. WIF: Informatik - M.Sc. WIF: Schlüssel- und Methodenkompetenzen - M.Sc. DKE: Applied Data Science - M.Sc. DE: Interdisziplinäres Team-Projekt - M.Sc. DE: Fachliche Spezialisierung - M.Sc. DE: Digital Engineering-Projekt - M.Sc. VC: Computer Science - M.Sc. VC: Schlüssel- und Methodenkompetenzen

Intended learning outcomes:
When completing this module successfully, the students can: * solve a realistic data mining and data engineering task in teamwork * assess the business implications (costs and benefits) of a solution they propose * built-up a team and organize themselves in it, distributing subtasks among themselves according to their competences, setting milestones and pursuing a joint schedule *

search for scientific papers of relevance * search appropriate libraries for data preparation, learning and visualization * design a learning workflow, apply AI methods and evaluate the induced models * develop a software solution jointly, using public domain tools * justify their design decisions and software suite selections * present their work as a team * write a joint report where they summarize and justify their approachBitte nachtragen nach neuen Constructive Alignment Vorgaben.

Content:
CONTENT: Assignment in the form of a realistic task that involves the analysis of static or dynamic, structured or unstructured data with mining methods, including supervised, unsupervised and semi-supervised methods, stream miners, forecasters and elaborate AI tools. The assignment involves design, development and evaluation of a software solution in teamwork. **STRUCTURE:** The assignment is for a team of students, typically three; for larger teams, the assignment is extended to ensure that the effort of each student is 6 ECTS. The students are called to solve the task as a team. The task involves understanding a realistic problem, designing, developing and evaluating a solution for it, presenting this solution to the class, defending it and documenting it on paper.

Workload:
For each team member: 28 h in class (including meetings) + 124 h self-study The teamproject is typically for three students. For larger teams, the assignments is extended to ensure that the effort of each team member is as above.

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
	• Wissenschaftliches Projekt, implementiert als eine Hausarbeit, die ein Referat beinhaltet **COURTESY TRANSLATION:** This module implements the exam form 'Wissenschaftliches Projekt' as a 'Hausarbeit' which incorporates a 'Referat'.	Wissenschaftliches Teamprojekt (2 SWS)

Prerequisites according to examination regulations:	Recommended prerequisites:

keine	• Familiarity with advanced mining methods for static data and (for some assignments) for streams • Familiarity with software development and software libraries • Underpinnings of project management

Media:	**Literature:**
	Literature depends on topic assignment and is given to each team together with the assignment

Comments:
Als Implementierung des generischen **PFLICHTMODULS** "Wissenschaftliches Teamprojekt" entsprechend anrechenbar. **COURTESY TRANSLATION:** This module implements the **COMPULSORY** generic module 'Wissenschaftliches Teamprojekt'.