Modules for Visual Computing

- Ausgewählte Algorithmen der Computergraphik
- Computational Geometry
- Computer Graphics - an Introduction
- Computer-Assisted Surgery
- Flow Visualization
- Introduction to Computer Graphics
- Medical Visualization
- Narrative Visualization
- Three-Dimensional & Advanced Interaction
- Virtual and Augmented Reality I
- Visual Analytics
- Visual Analytics in Health Care
- Visualization
- Wissenschaftliches Individualprojekt

Ausgewählte Algorithmen der Computergraphik

Winter

(engl. Selected Algorithms in Computer Graphics)

Modulnummer: FIN-INF-120272

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

Link zum LSF:	LSF
Zugang beschränkt:	
Verantwortung:	Christian Rössl
Dozent:in:	Christian Rössl
Lehrveranstaltungen:	• Vorlesung *Ausgewählte Algorithmen der Computergraphik* • Übung *Ausgewählte Algorithmen der Computergraphik*
Verwendbarkeit:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Informatik - M.Sc. VC: Visual Computing

Angestrebte Lernergebnisse:
Die Studierenden

- verstehen grundlegende Konzepte der Linearen Algebra und Numerik
- wenden diese an, um Algorithmen aus dem Bereich der Computergraphik zu implementieren
- erstellen eigene Implementierungen,Tests und Benchmarks
- können geeignete Werkzeuge (z.B. Programmiersprache, Bibliotheken) beurteilen, sinnvoll auswählen und anwenden

- können wissenschaftlichen Artikel im Bereich Computergraphik insbesondere im Hinblick auf mathematische Inhalte verstehen und implementieren

Inhalt:

- Linear least-squares approximation
- Data interpolation and approximation
- Matrix factorization
- Sparse matrices
- Regularization
- Implementation issues
- General applications and case studies
- The specific contents may vary each semester.

Die Veranstaltung kann je Bedarf in englischer oder deutscher Sprache abgehalten werden. Vorlesungsmaterialien stehen auf englisch zur Verfügung.
Arbeitsaufwand:

- 56 h Präsenz
- 124 h 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.	Mündliche Prüfung 20 Minuten	• Vorlesung 2 SWS • Übung 2 SWS

Voraussetzungen nach Prüfungsordnung:	**Empfohlene Voraussetzungen:**

keine	- Vorlesungen im Bereich Computergraphik z.B. - Grundlagen der Computergraphik - CAGD - Mesh Processing - Spaß an mathematischen Aufgabenstellungen und Programmierung - Programmierkenntnisse in C++ oder Julia oder Matlab *und/oder* die Bereitschaft sich schnell und selbständig in neues einzuarbeiten - Grundlegende Kenntnisse der Versionsverwaltung mit Git - Bereitschaft, der Veranstaltung auch in englischer Sprache zu folgen

Medienformen:	**Literatur:**
	Literatur wird in der Vorlesung bekannt gegeben.

Hinweise:

Wir verwenden i.d.R. Julia (https://julialang.org) als Programmiersprache (statt vormals Matlab und GNU Octave) und dazu C++ nach Bedarf. Wo genau der Fokus liegt, tarieren wir soweit möglich in der Veranstaltung je nach Vorkenntnissen und Wünschen aus.

Computational Geometry

Summer

(in German: Computational Geometry)

Module-ID: FIN-INF-102201

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

Link:	LSF
Limited accessability:	
Responsibility:	Prof. Dr. Stefan Schirra
Lecturer:	Prof. Dr. Stefan Schirra
Classes:	Lectures and exercises *Computational Geometry*
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: Data Processing for Data Science - M.Sc. DE: Methoden der Informatik - M.Sc. DE: Informatik Wahlpflicht (SPO 2027) - M.Sc. VC: Visual Computing - M.Sc. VC: Visual Computing (SPO 2027)

Intended learning outcomes:
Students know how to design and analyze algorithms for advanced geometric problems. They understand the basics of combinatorial and algebraic geometry.

Content:

- basics in combinatorial geometry
- basics in algebraic geometry

- duality
- algorithm design paradigms

Workload:
56 h classroom + 124 h independent work

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
active participation	Oral exam	• Lecture and Exercise (4 SWS)

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	Basics in algorithmic geometry (for example, bachelor modul Grundzüge der Algorithmischen Geometrie)

Media:	Literature:
	• de Berg, Cheong, van Kreveld, Overmars; Computational Geometry • Devadoss, O'Rourke; Computational Geometry

Comments:

Computer Graphics - an Introduction

Winter

(in German: Computer Graphics - an Introduction)

Module-ID: FIN-INF-110472

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

Link:	LSF
Limited accessability:	
Responsibility:	Holger Theisel
Lecturer:	Holger Theisel
Classes:	• Lecture *Computer Graphics - an Introduction* • Exercise class *Computer Graphics - an Introduction*
Applicability in curriculum:	- M.Sc. DE: Grundlagen Informatik - M.Sc. VC: Visual Computing

Intended learning outcomes:
The students

- understand the basic concepts of computer graphics
- can apply their knowledge to create their own simple rendering program
- work in groups on exercises and programming tasks
- learn both the theoretical basics and applications of computer graphics
- are able to acquire in-depth knowledge of computer graphics after finishing the course

Content:

- Introduction, history, application areas of Computer graphics
- Modeling and acquisition of graphical data
- Transformations
- Clipping
- Rasterization and antialiasing
- Lighting
- Texturing
- Visibility
- Ray tracing
- Modern concepts of computer graphics at a glance

Workload:

- 56h contact time (lecture + exercise class)
- 94h self study (lecture material, solution of exercises and assignments)

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
• Successful completion of the exercises • Completing a programming task	Exam: Written exam 120 min. Exam certificate: Passing the written exam 120 min.	• Lectures (2 SWS) • Exercises (2 SWS)

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	

Media:	Literature:
	• J.D. Foley, A. van Dam, S.K. Feiner, J.F. Hughes: Computer Graphics – Principles and Practice (second Edition). AddisonWesley Publishing Company, Inc., 1996 • J.Encarnacao, W. D. Salomon: Computer Graphics Geometric Modeling, Springer, 1999A. • Watt: 3D Computer Graphics. Addison-Wesley Publishing Company, Inc., 2000

Comments:
(nur anrechenbar wenn nicht vorher die deutschsprachige Bachelor-LV Computergraphik I belegt

wurde)

Computer-Assisted Surgery

Winter

(in German: Computer-Assisted Surgery)

Module-ID: FIN-INF-120519

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

Link:	LSF
Limited accessability:	
Responsibility:	Christian Hansen
Lecturer:	Christian Hansen
Classes:	• Lecture *Computer-Assisted Surgery* Seminar *Computer-Assisted Surgery* Team project *Computer-Assisted Surgery*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Informatik - M.Sc. VC: Visual Computing

Intended learning outcomes:
Students who complete this module ...

- have an in-depth knowledge of modern surgical and interventional imaging technologies such as iMRI, iCT and IOUS, as well as medical image processing
- understand methods such as surgical tracking, calibration and registration, which are essential for the development and application of surgical assistance systems
- can design and develop surgical planning and navigation systems.
- can write a state of the art report in the field of computer assisted surgery
- can read, analyse and briefly summarise scientific papers in a scientific report.

Within this module students can choose between a seminar or a team project. If students choose to undertake a seminar, they ...

- will be able to read, understand and present scientific publications in the field of computer-assisted surgery
- will understand how to critically analyse scientific publications and improve their ability to present the results of others' research.

If students opt for a team project, they ...

- will develop, test and evaluate a software tool in an interdisciplinary team
- will learn how to deal with conflict in interdisciplinary teams.

Content:
This lecture provides an overview of computer-assisted surgery. After an introduction to the basics, the state of the art in computer-assisted surgery is presented using clinical examples. The following topics will be covered:

- Fundamentals of intra-operative imaging
- Fundamentals of surgical visualisation
- Computer-assisted surgical planning
- Surgical navigation systems
- Surgical Augmented Reality
- Surgeon-Computer Interaction
- Robotic Surgery
- Medical Software Development and Evaluation

Workload:
56 h contact hours + 124 h self study

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
Successful completion of the exercise/seminar	Oral exam	• Lecture (2SWS) • Seminar (2SWS) or team project (2SWS)

Prerequisites according to examination regulations:	Recommended prerequisites:
keine	

Media:	Literature:

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:	
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:

Introduction to Computer Graphics

Winter

(in German: Introduction to Computer Graphics)

Module-ID: FIN-INF-120537

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

Link:	LSF
Limited accessability:	
Responsibility:	Holger Theisel
Lecturer:	Holger Theisel
Classes:	Lecture *Introduction to Computer Graphics* Exercise *Introduction to Computer Graphics*
Applicability in curriculum:	- M.Sc. VC: Visual Computing

Intended learning outcomes:
The students

- understand the basic concepts of computer graphics
- can apply their knowledge to create a rendering program
- work in groups on exercises and programming tasks
- learn both the theoretical basics and applications of computer graphics
- are able to acquire in-depth knowledge of computer graphics after the course

Content:

- Introduction, history, areas of application of computer graphics
- Modeling and acquisition of graphical data
- Graphical application programming
- Transformations
- Clipping
- Rasterization and anti-aliasing
- Lighting
- Texturing
- Visibility
- Ray tracing
- Modern concepts of computer graphics at a glance

Workload:
56h contact time + 94h self study

Pre-examination requirements:	**Type of examination:**	**Teaching method / lecture hours per week (SWS):**
	oral examination	• 2 SWS Lecture • 2 SWS Exercise

Prerequisites according to examination regulations:	**Recommended prerequisites:**
none	Einführung in die Informatik (Introduction to Computer Science)

Media:	**Literature:**
	• J.D. Foley, A. van Dam, S.K. Feiner, J.F. Hughes: Computer Graphics – Principles and Practice (second Edition). AddisonWesley Publishing Company, Inc., 1996 • J. Encarnacao, W. Straßer, R. Klein: Gerätetechnik, Programmierung und Anwendung graphischer Systeme, Teil I und II. Oldenbourg, München, Wien, 1966, 1997 • D. Salomon: Computer Graphics Geometric Modeling, Sprin-ger, 1999 • A. Watt: 3D Computer Graphics. Addison-Wesley Publishing Company, Inc., 2000

Comments:
It is not allowed to take this module and *Computer Graphics - an Introduction* as well.

Medical Visualization

Summer

(in German: Medical Visualization)

Module-ID: FIN-INF-102622

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

Link:	LSF
Limited accessability:	
Responsibility:	Bernhard Preim
Lecturer:	Gabriel Mistelbauer
Classes:	• Lecture *Medical Visualization* • Exercise class *Medical Visualization*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Informatik - M.Sc. VC: Visual Computing

Intended learning outcomes:
Students ...

- are familiar with methods for visualizing three-dimensional medical image data
- can compare and evaluate methods for medical volume visualization
- know selected advanced methods for medical visualization
- can apply interactive methods to medical image data

Content:

- Medical volume visualization
- Visualization of 3D surfaces
- Virtual endoscopy
- Vessel visualization

Workload:
56 contact hours + 124 h 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:
none	Lecture *Visualization*

Media:	Literature:
	• B. Preim und D. Bartz: Visualization in Medicine, Morgan Kaufman, San Francisco, 2006Preim, • Botha: Visual Computing for Medicine, 2nd Edition, , Morgan Kaufman, San Francisco, 2013

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:	
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:

Three-Dimensional & Advanced Interaction

Winter

(in German: Three-Dimensional & Advanced Interaction)

Module-ID: FIN-INF-120286

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

Link:	LSF
Limited accessability:	
Responsibility:	Christian Hansen
Lecturer:	Florian Heinrich
Classes:	• Lecture *Three-Dimensional & Advanced Interaction* • Seminar *Three-Dimensional & Advanced Interaction*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - M.Sc. WIF: Informatik - M.Sc. DKE: Applied Data Science - M.Sc. DE: Methoden der Informatik - M.Sc. VC: Visual Computing

Intended learning outcomes:
Students ...

- understand the nature and importance of future user interfaces and the challenges and problems associated with them
- know, analyze and evaluate technologies, interaction techniques and methods for the development of advanced user interfaces
- are able to select suitable technologies and interaction techniques in the field of three-dimensional and modern Post-WIMP user interfaces
- have the ability to critically analyze scientific literature and knowledge of scientific publishing
- can conduct own research on a postgraduate level in the field of advanced user interfaces

Content:

- Introduction to Post-WIMP and Reality-based User Interfaces
- 3DInteraction: Tasks, Devices, 3D-Widgets,
- 3D UIs Augmented Reality Interaction
- Pen-based Interaction Techniques and Sketching
- Multitouch: Technologies, Gestures, Applications
- Gestural Interaction: Tracking, Freehand Gestures
- Tangible Interaction
- Advanced Topics: Gaze-based Interaction, Organic Interfaces, Everywhere Interfaces

Workload:
56h contact time + 124h self study

Pre-examination requirements:	**Type of examination:**	**Teaching method / lecture hours per week (SWS):**
Successful completion of the seminar (clarified in first lecture)	Written exam	• Lecture (2 SWS) • Exercise class (2 SWS)

Prerequisites according to examination regulations:	**Recommended prerequisites:**
keine	Module *Interactive Systems*

Media:	**Literature:**

	• Bowman, Kruijff, Laviola, Jr., Poupyrev: „3D User Interfaces: Theory and Practice“, Addison-Wesley, 2004 • Müller-Tomfelde (Ed.): „Tabletops – Horizontal Interactive Displays“, Springer, 2010 • Saffer: „Designing Gestural Interfaces“, O'Reilly Media, 2008 • Shaer, Hornecker: „Tangible User Interfaces: Past, Present and Future Directions“. In Foundations and Trends in Human-Computer Interaction, 3 (1), 2010

Comments:

Virtual and Augmented Reality I

Summer

(in German: Virtual and Augmented Reality I)

Module-ID: FIN-INF-120527

Abbreviation	Credit Points	Semester	Term	Duration	Language	Level
VAR1_MA	6	Summer	2.	1 Semester	english	Master

Link:	LSF
Limited accessability:	
Responsibility:	Christian Hansen
Lecturer:	Christian Hansen
Classes:	• Lecture *Virtual and Augmented Reality* • Exercise class *Virtual and Augmented Reality*
Applicability in curriculum:	- M.Sc. VC: Visual Computing

Intended learning outcomes:
Students who complete this module will acquire in-depth knowledge in the areas of human-computer interaction in the context of VR/AR, perceptual aspects of VR/AR, VR/AR and input/output devices. In addition, they will gain an understanding of the technical fundamentals of tracking, VR/AR visualisation/rendering and AR registration. In the associated seminar, students develop, test and evaluate a VR/AR software tool in a team. Students will learn how to design, program and test a VR/AR system. In these team projects, students learn how to solve social and technical conflicts. In addition, students present their project results in an oral presentation and justify the results achieved by their team. Students who complete this module will learn how to supervise an interdisciplinary project team. They will learn how to analyse their role in the team and their

individual contribution to the team's outcome.

Content:
This module covers fundamentals and advanced techniques in the area of VR/AR systems. Students will gain the theoretical foundation needed to design, implement, improve, and evaluate VR/AR systems. In addition, the theoretical foundations can be applied in a team project that accompanies the lecture. Following topics in the field of VR/AR are addressed:

- Introduction to VR/AR systems
- Perceptional aspects
- Input devices
- Output devices
- AR components and types
- Interaction techniques

Workload:
56 contact hours + 124h self study

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

Prerequisites according to examination regulations:	Recommended prerequisites:
	Introduction to Computer Graphics

Media:	Literature:
	Virtual und Augmented Reality (VR/AR) Grundlagen und Methoden der Virtuellen und Augmentierten Realität herausgegeben von: Prof. Dr. Ralf Dörner, Prof. Dr. Wolfgang Broll, Prof. Dr. Paul Grimm, Prof. Dr. Bernhard Jung Verlag: Springer Berlin Heidelberg

Comments:

Visual Analytics

Summer

(in German: Visual Analytics)

Module-ID: FIN-INF-120524

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

Link:	LSF
Limited accessability:	
Responsibility:	Bernhard Preim
Lecturer:	Bernhard Preim
Classes:	• Lecture *Visual Analytics* • Exercise class *Visual Analytics*
Applicability in curriculum:	- M.Sc. INF: Informatik - M.Sc. INGINF: Informatik - 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. VC: Visual Computing

Intended learning outcomes:
Students ...

- know machine learning methods and the visualization of their results
- apply this knowledge to analyse financial and business data
- use statistical methods to improve visual analytics solutions
- can assess and compare clustering methods

Content:

- Introduction: Potential and applications of Visual Analytics
- Visual Analytics based on clustering
- Visual Analytics based on subspace clustering and biclustering
- Visual Analytics with decision trees
- Visual Analytics with association rules
- Scatterplot-based visualizations
- Visual Analytics of events sequences
- Interaktive und Kooperative Methoden von Visual Analytics
- Visual Analytics im Gesundheitswesen

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

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

Prerequisites according to examination regulations:	**Recommended prerequisites:**
none	• Lecture Visualization • Knowledge of Data Analysis, for example Intelligent Data Analysis • Data Mining • Machine Learning • Artificial Intelligence

Media:	**Literature:**

• Powerpoint presentation • Whiteboard • Videos	• J. J. Thomas, K. A. Cook (Hrsg.): Illuminating the path: The research and development agenda for visual analytics. IEEE Computer Society 2005 • D. A. Keim, F. Mansmann, J. Schneidewind, J. Thomas, H. Ziegler: Visual analytics: Scope and challenges. Visual Data Mining, 2008 • Andrienko, N., Andrienko, G., Fuchs, G., Slingsby, A., Turkay, C., & Wrobel, S. (2020). *Visual analytics for data scientists*. Springer Nature. • Kohlhammer, J., Proff, D. U., & Wiener, A. (2018). *Visual business analytics: effektiver Zugang zu Daten und Informationen*. dpunkt. verlag.

Comments:

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:	
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".

Visualization

Winter

(in German: Visualization)

Module-ID: FIN-INF-102812

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

Link:	LSF
Limited accessability:	
Responsibility:	Bernhard Preim
Lecturer:	Bernhard Preim
Classes:	• Lecture *Visualization* • Exercise class *Visualization*
Applicability in curriculum:	- M.Sc. DKE: Applied Data Science - M.Sc. DE: Methoden der Informatik - M.Sc. DE: Informatik Wahlpflicht (SPO 2027) - M.Sc. VC: Visual Computing - M.Sc. VC: Visual Computing (SPO 2027)

Intended learning outcomes:
Students ...

- understand how physiological perception affects visualization effectiveness
- know basic visualization techniques
- can generate appropriate visualizations for business and statistical data
- obtain a dataset with at least 100 observations and 5 attributes, formulate two analytical questions, and create data visualizations to answer these questions.

Content:

- Visualization goals and quality criteria
- Understanding of fundamentals of visual perception
- Overview of data structures in visualization
- Basic algorithms (Isolines, color scales, diagram techniques),
- Direct and indirect visualization of volume data
- map-based visualization
- dashboard design
- Information visualization

Workload:
56h contact time + 124h self study, students have to solve a comprehensive additional task where they analyze and visualize a multi-dimensional dataset

Pre-examination requirements:	Type of examination:	Teaching method / lecture hours per week (SWS):
	Written exam, 2 hours	• 2 SWS Lectures • 2 SWS Exercise classes

Prerequisites according to examination regulations:	Recommended prerequisites:
none	• Module Computer Graphics I • Modules Mathematics I, II and III

Media:	Literature:
• Powerpoint presentation • Sketches • Videos	• P. and M. Keller (1994): Visual Cues, IEEE Computer Society PressT. Munzner (2015). • Visualization Analysis and Design: Principles, Techniques, and Practice, A K Peters • W. Schroeder, K. Martin, B. Lorensen (2001): The Visualization Toolkit: An object-oriented approach to 3d graphics, 3. Aufl. Springer, Heidelberg • A. Telea (2014): Data Visualization: Principles and Practice, Second Edition, AK Peters (2. Auflage) • M. Ward, D. Keim, G. Grinstein (2015): Interactive Data Visualization: Foundations, Techniques, and Applications, Second Edition

Comments:

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.