

## **Vorlesungsverzeichnis**

M.Sc. Human-Computer Interaction

SoSe 2019

Stand 16.04.2019

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**M.Sc. Human-Computer Interaction****Faculty Welcome for Master's Students Computer Science and Media**

Monday, 1<sup>st</sup> April 2019, 11.00 a.m., room 014, Bauhausstraße 11

**Project fair**

Monday, 1<sup>st</sup> April 2019, 5 p.m., Lecture Hall A, Marienstraße 13C

**Advanced HCI****4556216 Advanced Human-Computer Interaction: Ubiquitous Computing**

**E. Hornecker, H. Waldschütz**

Veranst. SWS: 3

Vorlesung

Mi, wöch., 11:00 - 12:30, Bauhausstraße 11 - Seminarraum 015, Lab, ab 03.04.2019

Mo, wöch., 13:30 - 15:00, Bauhausstraße 11 - Seminarraum 015, Lecture, ab 08.04.2019

**engl. Beschreibung/ Kurzkomentar**

Advanced Human-Computer Interaction: Ubiquitous Computing

The course will explore advanced topics in HCI, presenting and reflecting on the concerns, perspectives and interdisciplinary nature of this area. We will look at new and emerging technologies and the issues they entail. These technologies move beyond more 'traditional' computing concerns, in particular by going from the desktop into the world [ubiquitous computing], moving from the workplace to the home and other settings [e.g., domestic, public spaces], from purely functional to ludic concerns [e.g. home entertainment, pervasive games], and from digital to digital-physical systems[tangible computing].

The course will cover technical aspects as well as user-centered design and evaluation methods relevant for Ubiquitous Computing, and a discussion of broader societal and value-related concerns (e.g. privacy, user agency versus ambient intelligence).

Successful students should be able to

- discuss the diverse and emergent areas within UbiComp technologies and the issues they entail
- be able to reflect on practical experiences engaging with some of these technologies from a user-centred perspective
- understand the technical functioning of example UbiComp technologies and to build small-scale UbiComp systems (e.g. Arduino, Microsoft Gadgeteer)
- choose and give a rationale for appropriate user-centered design methods for example application problems.

**Bemerkung**

Takes place bi-annual / every 2 years

**Leistungsnachweis**

practical assignments, individual and in group work

**Electives**

**301013 Advanced Modelling – Calculation/CAE****K. Gürlebeck, D. Legatiuk**

Veranst. SWS: 4

Vorlesung

Di, wöch., 09:15 - 12:30, Coudraystraße 13 B - Seminarraum 210

**Beschreibung**

Scientifically orientated education in mathematical modelling and computer science in view of a complex interdisciplinary and networked field of work and research, modelling and simulation. Students will have experience in Computer Aided Engineering (CAE) by establishing a problem specific model on the basis of a mathematical formulation, an applicable solution technique, design of efficient data structures and software implementation.

Numerical and analytical solution of partial differential equations, series expansions, integral representations, finite difference methods, description of heat flow, diffusion, wave propagation and elastostatic problems. The topics are discussed theoretically and then implemented. Convergence, stability and error analysis of finite difference methods (FDM). Modelling of steady and unsteady heat conduction problems, wave propagation and vibrations and problems from linear thermo-elasticity in 2D and 3D. After considering the mathematical basis, the students will work on individual projects passing all levels of work (engineering model, mathematical model, numerical model, computer model, simulation, evaluation). The solution methods will be implemented by help of MAPLE or MATLAB.

**Bemerkung**

This lecture replaces "Advanced Analysis". It is therefore not possible to receive credits for both courses.

Die Veranstaltung ersetzt "Advanced Analysis" und kann daher nicht gemeinsam mit dieser Veranstaltung angerechnet werden.

**Leistungsnachweis**

1 exam (written or oral)

**417290001 Search-Based Software Engineering****N. Siegmund**

Veranst. SWS: 3

Vorlesung

Di, wöch., 11:00 - 12:30, Bauhausstraße 11 - Seminarraum 014, Lab class, ab 02.04.2019

Mo, wöch., 09:15 - 10:45, Bauhausstraße 11 - Seminarraum 015, Lecture, ab 08.04.2019

**engl. Beschreibung/ Kurzkomentar**

Search-Based Software Engineering

Search-Based Software Engineering is about learning and optimizing complex tasks that are computationally intractable for exact methods. The goal of this course is to understand the principles of meta-heuristics in optimization as well as on handling constraints and dimensionality.

Students should understand the following techniques and theories:

- Problem space exploration and search-based optimization
- Meta-heuristics for single and multiple objective optimization
- Relationship between biological learning and optimization with algorithms
- Dimensionality-reduction techniques
- Constraint resolution

Students should be able to apply the above theories for solving concrete learning and optimization problems. Furthermore, they should appreciate the limits and constraints of the individual methods above.

Students should be able formalize and generalize their own solutions using the above concepts and implement them in a specified language (preferable in Python).

Students should master concepts and approaches such as

- Simulated annealing
- Swarm optimization
- Ant colonization
- Evolutionary algorithms
- Dimensionality Reduction (PCA + Feature Subset Selection)
- Constraint Satisfaction Problem Solving

in order to tackle problems learning and optimizing huge problems, which are inherent to Digital Media. They should also be able to implement the algorithms and techniques in Python and be able to understand a proposed problem, to compare different approaches and techniques regarding applicability and accuracy, to make well-informed decisions about the preferred solution and, if necessary, to find their own solutions.

Students should develop an understanding of the current state of research in optimization and learning. With appropriate supervision, students should be able to tackle new research problems, especially in the area of search-based software engineering.

#### Bemerkung

**Ehemals "Machine Learning for Software Engineering". Dieser Kurs kann daher nur belegt werden, wenn der Kurs "Machine Learning for Software Engineering (417130002)" noch nicht erfolgreich abgeschlossen wurde.**

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**Formely known as "Machine Learning for Software Engineering". Therefore the class can only be taken, if the class "Machine Learning for Software Engineering (417130002)" has not yet been successfully completed.**

#### Voraussetzungen

BSc in a relevant study field

#### Leistungsnachweis

Written or oral examination. Participation requires the successful completion of the course labs (tasks over the semester). Digital Engineering students will be required to successfully complete an additional project.

### 418120019 Software Product Line Engineering

**N. Siegmund, N. Ruckel**

Veranst. SWS: 3

Vorlesung

Mi, wöch., 09:15 - 10:45, Karl-Haußknecht-Straße 7 - Seminarraum (IT-AP) 001, Lecture, ab 03.04.2019

Fr, wöch., 11:00 - 12:30, Karl-Haußknecht-Straße 7 - Seminarraum (IT-AP) 001, Lab class, ab 05.04.2019

**Beschreibung**

Softwareproduktlinien und konfigurierbare Softwaresysteme bilden eine Schlüsseltechnologie für die Massenproduktion individuell angepasster Software. Ziel ist es bei der Entwicklung maßgeschneiderter Software, die Codebasis weiterhin wartbar zu halten sowie gleichzeitig die Produktionskosten zu reduzieren. Die Veranstaltung vermittelt die wichtigsten Kenntnisse und Fähigkeiten, um dieses Ziel zu erreichen:

- Die Studierenden kennen die Vorteile und Nachteile des Produktlinienansatzes sowie klassischer und moderner Programmiermethoden wie z.B. Präprozessoren, Versionsverwaltungssysteme, Komponenten, Frameworks, Feature-Orientierung, Aspekt-Orientierung.
- Die Studierenden haben die Befähigung zur Bewertung, Auswahl und Anwendung moderner Programmierparadigmen, Techniken, Methoden und Werkzeuge erlangt, insbesondere in Hinblick auf die Entwicklung von Kompetenzen im Bereich der Softwareproduktlinien.
- Die Studierenden erwerben Urteilsvermögen über den Einsatz von Programmiermethoden für die Entwicklung von Softwareproduktlinien.

Folgender Inhalt wird bei der Lehrveranstaltung vermittelt:

- Einführung in die Problematik der Entwicklung komplexer, maßgeschneiderter Softwaresysteme am Beispiel von eingebetteten Datenbankmanagementsystemen
- Modellierung und Implementierung von Programmfamilien, Produktlinien und domänenspezifischen Generatoren
- Wiederholung von Grundkonzepten der Software-Technik (Kohäsion, Scattering und Tangling, Information Hiding, Modularisierung)
- Einführung in verschiedene klassische und moderne Sprachen und Werkzeuge zur Entwicklung von Softwareproduktlinien u.a. Präprozessoren, Frameworks, Komponenten, Feature-Module, Aspekte, Kollaborationen, Rollen, etc.
- Vergleich grundlegender Konzepte, Methoden, Techniken und Werkzeuge der vorgestellten Ansätze
- Kritische Diskussion von Vor- und Nachteilen der einzelnen Ansätze sowie ihrer Beziehung untereinander
- Weiterführende Themen: Nicht-funktionale Eigenschaften, Analyse von Produktlinien, Featureinteraktionen,

Aktuelle Forschungsergebnisse des Lehrstuhls werden in der Veranstaltung besprochen, angewendet und diskutiert

**engl. Beschreibung/ Kurzkomentar**

## Software Product Line Engineering

Software product lines and configurable software systems are the main driving factor for mass customization, tailor-made products, and product diversity while keeping a maintainable code base and saving development time. The lecture will teach about central elements of product line modelling and development.

Students should understand the following techniques and theories:

- Configuration management and variability modeling
- Classic and modern programming techniques, such as preprocessors, version control systems, components, frameworks, aspect-oriented programming, and feature-oriented programming
- Feature interactions and virtual separation of concerns

Students should be able to apply the above theories and concepts to judge points in favour and against a certain technique depending on the application scenario at hand. Hence, the students will be able to decide which techniques, tools, and methods to use.

Students should master concepts and approaches such as

- The exponential complexity of variability spaces

- Modelling and implementation of program families, product lines, and domain specific generators
- Basic concepts of software engineering (e.g., cohesion, scattering, tangling, information hiding)
- Classic and modern concepts, such as preprocessors, plug-in systems, feature modules, collaborations, aspects, and roles
- Critical discussion about pros and cons of the above techniques and concepts
- Feature interactions, non-functional properties, product line analysis

Students will implement these concepts in Java.

Students should develop an understanding of the current state of research in software product lines. With appropriate supervision, students should be able to tackle new research problems, especially in the area of product line development and optimization.

#### **Voraussetzungen**

BSc in a relevant study field; Software Engineering course for Digital Engineering students

#### **Leistungsnachweis**

Written or oral examination. Participation requires the successful completion of the course labs. Digital Engineering students will be required to successfully complete an additional project / course lab

### **4336010 Image analysis and object recognition**

**V. Rodehorst, M. Kaisheva**

Veranst. SWS: 3

Vorlesung

Di, wöch., 09:15 - 10:45, Marienstraße 13 C - Hörsaal C, Lecture, ab 02.04.2019

Do, unger. Wo, 11:00 - 12:30, Marienstraße 13 C - Hörsaal A, Lab, ab 11.04.2019

#### **Beschreibung**

Bildanalyse und Objekterkennung

Die Vorlesung gibt eine Einführung in die Grundlagen der Mustererkennung und Bildanalyse. Behandelt werden unter anderem die Bildverbesserung, lokale und morphologische Operatoren, Kantenerkennung, Bilddarstellung im Frequenzraum, Fourier-Transformation, Hough-Transformation, Segmentierung, Skelettierung, Objektklassifizierung und maschinelles Lernen zur visuellen Objekterkennung.

#### **engl. Beschreibung/ Kurzkomentar**

Image analysis and object recognition

The lecture gives an introduction to the basic concepts of pattern recognition and image analysis. It covers topics as image enhancement, local and morphological operators, edge detection, image representation in frequency domain, Fourier transform, Hough transform, segmentation, thinning, object categorization and machine learning for visual object recognition.

#### **Bemerkung**

Digital Engineering: 4 SWS

#### **Leistungsnachweis**

Erfolgreiche Bearbeitung der Übungen (sowie des Projekts) und Klausur

## 4345550 Cryptographic Hash Functions

**S. Lucks**

Veranst. SWS: 3

Vorlesung

Mi, wöch., 11:00 - 12:30, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Lecture, ab 03.04.2019

Do, wöch., 11:00 - 12:30, Bauhausstraße 11 - Seminarraum 013, Lab class, ab 04.04.2019

### Beschreibung

#### engl. Beschreibung/ Kurzkomentar

Cryptographic Hash Functions

Cryptographic hash functions are often considered the "workhorses", the "swiss army knife" and the "duct tape" for the design of complex cryptographic systems and protocols.

This lecture introduces some general design approaches for cryptographic hash functions, such as the Merkle-Damgaard design and the Sponge approach, and general attack techniques, such as cycle finding and distinguished points. This lecture continues by introducing some specific hash functions, such as MD4, MD5, SHA-1, Skein and Keccak, and presents attacks on some of them. Finally, this lecture presents applications of cryptographic hash functions, such as password hashing and blockchains.

#### Voraussetzungen

Zulassungsvoraussetzung: Eine vorausgegangene Einführung in die Kryptographie, z.B. "Kryptographie und Mediensicherheit", "Modern Cryptography", oder ein entsprechender Kurs einer anderen Hochschule. Studierende, die die Einführung an einer anderen Hochschule besucht haben, müssen diese Voraussetzung bei der Anmeldung zur Prüfung anhand ihres "Transcript of Records" nachweisen.)

#### Leistungsnachweis

mündliche Prüfung

## 4345560 Mobile Information Systems

**F. Echtler, C. Getschmann**

Veranst. SWS: 3

Vorlesung

Mi, wöch., 09:15 - 10:45, Bauhausstraße 11 - Seminarraum 014, Lecture, ab 03.04.2019

Fr, wöch., 09:15 - 10:45, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Lab, ab 05.04.2019

#### engl. Beschreibung/ Kurzkomentar

Mobile Information Systems

The lecture "Mobile Information Systems" focuses on the topics and issues surrounding modern mobile devices, their software and hardware and the structure of the associated networks.

Preliminary list of topics:

Overview: history & current state of mobile devices  
– Hardware & related issues (power consumption)



– Software & major OSs: Android & iOS

Architecture of Mobile Networks

- 3G (UMTS) Network
- SS7 Backend Network
- Location Discovery & Queries

Service Discovery & ad-hoc networking

- „Big brother“ issues
- Decentralization/P2P

Dealing with Limited Bandwidth & Connectivity

- Distributed Filesystems (Case Study: Dropbox)
- „rsync“ rolling checksum algorithm
- Background: distributed databases (CAP theorem)

Exercises: Development of Android apps with advanced features (P2P networking, location features, NFC, ...)

### Leistungsnachweis

Projektarbeit (50%) + Klausur (50%)

## 4445203 Randomized Algorithms

**A. Jakoby**

Veranst. SWS: 3

Vorlesung

Do, gerade Wo, 09:15 - 10:45, Bauhausstraße 11 - Seminarraum 015, ab 04.04.2019  
Mo, wöch., 17:00 - 18:30, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), ab 08.04.2019

### Beschreibung

Randomisierte Algorithmen

Für viele Probleme stellen randomisierte Algorithmen die einzigen bekannten effizienten Lösungsverfahren dar. Für manches andere Problem erhalten wir mit einem solchen Verfahren Algorithmen, die um vieles einfacher und verständlicher sind als alle bekannten deterministischen Verfahren. Es ist daher nicht verwunderlich, dass wir randomisierte Algorithmen in viele Anwendungsgebieten finden, wie z.B. in

- Datenstrukturen,
- Graphenalgorithmen,
- parallelen und verteilten Systemen,
- Online-Algorithmen,
- Zahlentheorie und
- geometrische Algorithmen.

In der Vorlesung *Randomisierte Algorithmen* werden wir Verfahren aus einigen dieser Gebiete und grundlegende Techniken für randomisierte Algorithmen vorstellen und analysieren.

Darüber hinaus werden grundlegende probabilistische Methoden zur Analyse von Algorithmen vorgestellt.

### engl. Beschreibung/ Kurzkomentar

Randomized Algorithms

For many problems randomized algorithms are the only known efficient solution method. For some other problem we can find randomized algorithms that are much simpler and more understandable than any known deterministic method. It is therefore not surprising that we find randomized algorithms in many areas, such as in

- data structures,
- graph algorithms,
- parallel and distributed systems,
- on-line algorithms,
- number theory, and
- geometric algorithms.

In the lecture Randomized Algorithms, we will present and analyze randomized algorithms and basic methods from some of these areas. Furthermore, basic probabilistic methods for the analysis of algorithms are presented.

### Voraussetzungen

Bsc in a relevant study field

### Leistungsnachweis

oral examination

## 4447556 Digital Watermarking and Steganography

### A. Jakoby

Veranst. SWS: 3

Vorlesung

Do, wöch., 15:15 - 16:45, Bauhausstraße 11 - Seminarraum 015, Lecture, ab 04.04.2019

Do, unger. Wo, 09:15 - 10:45, Bauhausstraße 11 - Seminarraum 015, lab class, ab 11.04.2019

### Beschreibung

Digitale Wasserzeichen und Steganography

Digitale Wasserzeichen dienen dazu Nachrichten zu einer Bild-, Audio- oder Videodatei innerhalb dieser Datei selber abzulegen. Ein zentrales Ziel der hierzu verwendeten Verfahren ist es, sicherzustellen, dass die eingebetteten Informationen nicht wieder entfernt werden können. Solche Nachricht können dazu herangezogen werden, um zusätzliche Informationen über den Inhalt der Medien selbst zu liefern, so zum Beispiel bestehende Urheberrechte. Digitale Wasserzeichen sollen daher lesbarer oder zumindest nachweisbar sein. Jedoch sollen sie nur mit erheblichen Aufwand wieder zu entfernen sein.

In der Steganographie untersuchen wir Systeme, in denen die eingebetteten Informationen vollständig für Unbefugte versteckt werden soll. Selbst die Tatsache, dass eine Mediendatei eine versteckte Botschaft enthält, soll für Unbefugte nicht zu beobachten sein. Somit ist es durch Verwendung eines solchen Systems möglich, dass zwei Personen Informationen austauschen, ohne dass eine dritte Person die Kommunikation detektieren kann.

In dieser Vorlesung werden wir grundlegende Konzepte, Methoden und Anwendungen der digitalen Wasserzeichen und Steganographie vorstellen und analysieren.

### engl. Beschreibung/ Kurzkomentar

Digital Watermarking and Steganography

Digital watermarking is the practice of hiding a message about an image, audio clip, video clip, or other work of media within that work itself. One goal of the used methods is to ensure that the message cannot be removed after it is embedded in the media. Thus, systems can use such a message to provide additional information of the content

of the media itself, e.g. copyrights. Digital watermarks have to be readable or detectable, but they should be hard to remove from the content.

In steganography we investigate systems where the embedded information is completely hidden for unauthorized parties. Even the fact that a media file contains a hidden message should be hidden. Thus, by using such a system two parties can communicate in such a way that a third party cannot detect the communication.

In this lecture we will introduce some basic concepts, methods and applications of digital watermarking and steganography.

#### **Voraussetzungen**

BSc in a relevant study field

#### **Leistungsnachweis**

oral examination

### **4526501 Academic English Part One**

#### **H. Atkinson**

Veranst. SWS: 2

Kurs

Mi, wöch., 17:00 - 18:30, Bauhausstraße 11 - Seminarraum 015, ab 24.04.2019

#### **engl. Beschreibung/ Kurzkomentar**

Academic English Part One

This is the first part of a two-part course which aims to improve your ability to express yourself clearly in written English and to develop a suitably coherent academic writing style. Part One concentrates mainly on structure in writing academic articles, essays and reports. We begin by examining the structure of individual paragraphs and move on to extended texts of various types (e.g. process essays, cause/effect, comparison/contrast, etc.). Particular attention is paid to connectives, i.e. transitional phrases and constructions which help you link ideas and paragraphs in a logical, systematic way.

#### **Bemerkung**

You are advised to take Part One first, although it is possible to take both parts concurrently (i.e. in the same semester) or in reverse order.

#### **Voraussetzungen**

Registration

All students must register. First time participants are required to present the B2 English Level Certificate before the beginning of the course.

Howard Atkinson therefore offers the following consultation hours:

17. April 2019, 16:00-18:00 p.m., room 001, Bauhausstraße 11

18. April 2019, 10:00-12:00 a.m., room 001, Bauhausstraße 11

#### **Leistungsnachweis**

written examination

**4526502 Academic English Part Two****H. Atkinson**

Veranst. SWS: 2

Kurs

Do, wöch., 17:00 - 18:30, Bauhausstraße 11 - Seminarraum 015, ab 25.04.2019

**engl. Beschreibung/ Kurzkomentar**

Academical English Part Two

Part Two of the Academic English course concentrates on improving and refining aspects of academic style. It includes sections on clause and sentence structure, punctuation rules and how to incorporate quotations, statistics and footnotes into academic texts. Students will be encouraged to bring along examples of their own written work, which the class can then correct and improve together in a constructive, mutually supportive atmosphere.

**Bemerkung**

You are advised to take Part One first, although it is possible to take both parts concurrently (i.e. in the same semester) or in reverse order.

If you wish to take Part Two first, it is necessary to take a placement test.

**Voraussetzungen**

Registration

All students must register. First time participants are required to present the B2 English Level Certificate before the beginning of the course.

Howard Atkinson therefore offers the following consultation hours:

17. April 2019, 16:00-18:00 p.m., room 001, Bauhausstraße 11

18. April 2019, 10:00-12:00 a.m., room 001, Bauhausstraße 11

**Leistungsnachweis**

written examination

**4556105 Advanced Numerical Mathematics****K. Gürlebeck, D. Legatiuk, S. Bock**

Veranst. SWS: 4

Vorlesung

Mo, wöch., 11:00 - 12:30, Coudraystraße 13 A - Hörsaal 2, ab 08.04.2019

Mo, wöch., 15:15 - 16:45, Coudraystraße 13 A - Hörsaal 2, ab 08.04.2019

**Beschreibung**

Höhere Numerik

Effiziente Lösung linearer und nichtlinearer Gleichungssysteme;

- Diskretisierungsmethoden für verschiedene Typen partieller Differentialgleichungen
- Projektionsverfahren, Stabilität, Konvergenz und Konditionszahl
- Direkte Löser für schwach besetzte Systemmatrizen
- Fixpunktsatz, iterative Löser, Gesamtschrittverfahren, Einzelschrittverfahren, Gradientenverfahren, Relaxationsverfahren, Multiskalenmethoden und Überblick über andere Zugänge
- Eigenwertprobleme, iterative Löser
- Gebietszerlegungsverfahren

**engl. Beschreibung/ Kurzkomentar**

## Advanced Numerical Mathematics

Efficient solution of linear and non-linear systems of algebraic equations;

- Discretization methods for different types of partial differential equations
- Projection methods, stability and convergence, condition number
- Direct solvers for sparse systems
- Fixed-point theorem, iterative solvers: Total step method, single step method, gradient methods, relaxation methods, multiscale methods and a survey on other approaches
- Eigenvalue problems, iterative solvers
- Domain decomposition methods

**Voraussetzungen**

Courses in Linear Algebra, Analysis

**Leistungsnachweis**

Project

**4556216    Advanced Human-Computer Interaction: Ubiquitous Computing**

**E. Hornecker, H. Waldschütz**

Veranst. SWS:        3

Vorlesung

Mi, wöch., 11:00 - 12:30, Bauhausstraße 11 - Seminarraum 015, Lab, ab 03.04.2019

Mo, wöch., 13:30 - 15:00, Bauhausstraße 11 - Seminarraum 015, Lecture, ab 08.04.2019

**engl. Beschreibung/ Kurzkomentar**

Advanced Human-Computer Interaction: Ubiquitous Computing

The course will explore advanced topics in HCI, presenting and reflecting on the concerns, perspectives and interdisciplinary nature of this area. We will look at new and emerging technologies and the issues they entail. These technologies move beyond more 'traditional' computing concerns, in particular by going from the desktop into the world [ubiquitous computing], moving from the workplace to the home and other settings [e.g., domestic, public spaces], from purely functional to ludic concerns [e.g. home entertainment, pervasive games], and from digital to digital-physical systems[tangible computing].

The course will cover technical aspects as well as user-centered design and evaluation methods relevant for Ubiquitous Computing, and a discussion of broader societal and value-related concerns (e.g. privacy, user agency versus ambient intelligence).

Successful students should be able to

- discuss the diverse and emergent areas within UbiComp technologies and the issues they entail
- be able to reflect on practical experiences engaging with some of these technologies from a user-centred perspective
- understand the technical functioning of example UbiComp technologies and to build small-scale UbiComp systems (e.g. Arduino, Microsoft Gadgeteer)
- choose and give a rationale for appropriate user-centered design methods for example application problems.

**Bemerkung**

Takes place bi-annual / every 2 years

**Leistungsnachweis**

practical assignments, individual and in group work

### 4556233 Computer Graphics II: Fundamentals of Imaging

**C. Wüthrich, B. Azari**

Veranst. SWS: 3

Vorlesung

Fr, wöch., 11:00 - 12:30, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Übung, ab 05.04.2019

Di, wöch., 13:30 - 15:00, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Vorlesung, ab 09.04.2019

#### Beschreibung

Algorithmen und Datenstrukturen

#### engl. Beschreibung/ Kurzkomentar

Computer Graphcs II: Fundamentals of Imaging

In Computer Graphics, and also in Image processing and in Design, professionals are used to speak about "better" or "worse" quality for pictures. Contrary to popular belief, however, there is no general method for analyzing the quality of picture. The course will start with a wide introduction to light transport and reflection theory, continue with a trip through digital and analogue image capture and reproduction and a survey of image compression methods. In its last part the course will focus on methods for evaluating the quality of pictures and of animated sequences, revealing advantages and disadvantages of different display and printing techniques and of the differnt compression methods.

#### Leistungsnachweis

Beleg, Klausur

### Cognitive Theories in HCI

**E. Hornecker, A. Kulik**

Veranst. SWS: 3

Seminar

Mo, Einzel, 11:00 - 12:30, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Einführungsvortrag, Themenvergabe, etc., 08.04.2019 - 08.04.2019

Sa, Einzel, 09:30 - 16:30, 27.04.2019 - 27.04.2019

Sa, Einzel, 09:30 - 16:30, 18.05.2019 - 18.05.2019

#### Beschreibung

Termine:

- Einführung und Themenvergabe: 08.04.2019: Mo. 11:00 bis 12:30
- Zwei Blockseminare am 27. April und 18. May, 9:30-16:30

#### engl. Beschreibung/ Kurzkomentar

The design of tools, objects and interaction techniques is often led by concepts such as metaphor and affordance. However, the underlying cognitive theories are typically not well understood. We often argue that something is intuitive, but what does this actually mean and what kind of theories can we use to make our argument more precise?

This seminar will introduce students to such foundational concepts and their theoretic background, ranging from theories on stimulus-response compatibility and the close coupling of perception and action, over the bodily basis of meaning and reasoning (image schemas) to the variability of object affordances.

We will discuss the presented concepts, theories, and examples with respect to their relevance for HCI and in relation to the other presented topics. This exchange will allow us to identify overlaps and conflicts between these independent theories.

Beside of engaging with the topics of the seminar, this seminar gives opportunity to train and improve presentation skills. Participants will individually study relevant literature and present their findings in two 20 minute talks. The first series of talks will take place at the first block seminar. Based on the discussion and group feedback, they will deepen or broaden their reading and improve the presentation for the second block seminar.

Each student will finally submit a survey paper on their selected topic that also reflects the discussions with the group.

Dates:

- Application via e-mail (kulik@uni-weimar.de) until April 2<sup>nd</sup>
- Introduction and allocation of topics: 08.04.2019: Mo. 11:00 bis 12:30
- Two block seminars on April 27<sup>th</sup> and May 18<sup>th</sup>, 9:30-16:30

Deliverables:

- Two presentations on the results of individual literature reviews on one of the provided topics (each ~20 min) with explicit handouts
- Survey paper about the selected topic (~6 pages in ACM format)

**Bemerkung**

Time and place will be announced separately.

**Leistungsnachweis**

Presence for all dates of the seminar, active participation, two presentations, written essay/report

## Information Proc. & Pres.

4555262 Visualisierung

**B. Fröhlich, P. Riehmann, C. Matthes**

Veranst. SWS: 3

Vorlesung

Do, wöch., 13:30 - 15:00, Marienstraße 13 C - Hörsaal C, Vorlesung/Lecture, ab 04.04.2019

Di, wöch., 11:00 - 12:30, Bauhausstraße 11 - Pool-Raum 128, Übung (Bachelor), ab 09.04.2019

Di, wöch., 17:00 - 20:00, Bauhausstraße 11 - Pool-Raum 128, Übung /Lab class (Master), ab 09.04.2019

**Beschreibung**

Im ersten Teil der Veranstaltung werden die wichtigsten Verfahren und Techniken aus dem Bereich der Informationsvisualisierung für folgende Datentypen vorgestellt: multi-dimensionale und hierarchische Daten, Graphen, Zeitreihen, kartographische und kategorische Daten. Der zweite Teil beschäftigt sich mit verschiedenen Ansätzen und Algorithmen zur Visualisierung volumetrischer und vektorieller Simulations- und Messdaten. Die Veranstaltung wird englischsprachig angeboten.

**engl. Beschreibung/ Kurzkomentar**

## Visualization

The first part of this course presents fundamental and advanced information visualization techniques for multi-dimensional and hierarchical data, graphs, time-series data, cartographic and categorical data. During the second half, algorithms and models for the scientific visualization of volumetric and vector-based data as well as corresponding out-of-core and level-of-detail techniques for handling very large datasets are introduced.

Various approaches presented in lectures will be studied, in part practically through labs and assignments, and with case studies. Lab classes focus on implementing, testing and evaluating the visualization approaches presented during the lectures. This course will be taught in English.

### Bemerkung

Die Veranstaltung wird englischsprachig angeboten.

### Voraussetzungen

Fundamental programming skills are required. Java and basic GLSL programming will be used in the lab classes. Basic computer graphics knowledge is helpful, e.g. the computer graphics course of the Medieninformatik Bachelor programme.

### Leistungsnachweis

Vorlesungsbegleitende Übungen, Abschlussprojekt, mündliche oder schriftliche Prüfung

## Mobile HCI

### 4345560 Mobile Information Systems

**F. Echtler, C. Getschmann**

Veranst. SWS: 3

Vorlesung

Mi, wöch., 09:15 - 10:45, Bauhausstraße 11 - Seminarraum 014, Lecture, ab 03.04.2019

Fr, wöch., 09:15 - 10:45, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Lab, ab 05.04.2019

### engl. Beschreibung/ Kurzkomentar

Mobile Information Systems

The lecture "Mobile Information Systems" focuses on the topics and issues surrounding modern mobile devices, their software and hardware and the structure of the associated networks.

Preliminary list of topics:

Overview: history & current state of mobile devices

- Hardware & related issues (power consumption)
- Software & major OSs: Android & iOS

Architecture of Mobile Networks

- 3G (UMTS) Network
- SS7 Backend Network
- Location Discovery & Queries

Service Discovery & ad-hoc networking

- „Big brother“ issues
- Decentralization/P2P

Dealing with Limited Bandwidth & Connectivity

- Distributed Filesystems (Case Study: Dropbox)
- „rsync“ rolling checksum algorithm
- Background: distributed databases (CAP theorem)



Exercises: Development of Android apps with advanced features (P2P networking, location features, NFC, ...)

### Leistungsnachweis

Projektarbeit (50%) + Klausur (50%)

## Projects

### 418110007 2D Localization and Tracking for Everyday Objects

**F. Echtler, C. Getschmann**

Veranst. SWS: 10

Projekt

### Bemerkung

Time and place will be announced at the project fair.

### 419110008 Beyond Smart: Tangible, connected home technologies

**E. Hornecker, N.N.**

Veranst. SWS: 10

Projekt

### engl. Beschreibung/ Kurzkomentar

Increasingly, technologies are connected and there is a rising number of Internet of Thing devices. Some of these are embedded into the domestic environment for so-called smart homes. These applications have focused almost entirely on efficiency and usefulness and their number and application is low. Controls are still limited to apps on smart phones or tablet computers or voice-control. But what are the opportunities of tangible, interactive devices in the domestic space? And what do people want or imagine having in their home, beyond efficiency and pure utility?

In this project we will develop so-called 'speculative prototypes' of tangible controls that explore potential applications for smart solutions in the home. We will make enquiries into people's perceptions of what they are looking for in the home and then design for these qualities. The focus of this project is not on making a complete, technically functioning prototype, but on showing how people would interact with these. This could either be in form of a tangible prototype that has some functionality, but could also be shown via a fictional scenario, drawings and collages, a short video, or a combination of the above.

In the early stages of this project we will plan and undertake a small qualitative user research project to learn about qualities people value about their home. We will develop a study protocol that includes methods such as interviews, focus groups, cultural probes or design workshops and use it to gather data about participants' needs and wishes. We will analyse the data to distill design ideas and functionalities that are based in people's understandings and wishes.

In a second step we will turn this research into a range of speculative prototypes that will respond to these ideas and perceptions and provide tangible controls for a connected home that is beyond smart.

A focus of this project is in gaining experience with various user research methods and alternative prototyping methods. On the technical side, we might be using Arduino, Raspberry Pie, Makey-Makey, RFID, Amazon Dash button, etc. to create simple prototypes, depending on the concepts we come up with.

### Bemerkung

Ort und Zeit werden zur Projektbörse bekannt gegeben.

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Time and place will be announced at the project fair.

### SWS / ECTS:

10 SWS / 15 ECTS für B. Sc. Medieninformatik, M.Sc. Medieninformatik, Computer Science and Media, Computer Science for Digital Media

12 SWS / 18 ECTS für MediaArchitecture, BA + MA Produkt-Design

### Participants:

2 Studenten HCI Master

2 Studenten B.Sc. MI, CS&M / CS4DM

2 Studenten Produkt-Design / MediaArchitecture

### Voraussetzungen

Participants should have basic knowledge or experience of user-centered methods (user studies, interviewing etc.) and ideally some experience in prototyping techniques. Moreover, all participants should enjoy working in an interdisciplinary team, want to be creative and be able to converse in English.

### Leistungsnachweis

Active participation and interim presentations, user research, technical or design work, exhibition at Summaery, documentation as written (scientific) report

## „Lie to me” – Evaluation of true and false statements on basis of real-time pupillary feedback

**J. Ehlers**  
Projekt

Veranst. SWS: 10

### engl. Beschreibung/ Kurzkomentar

Pupil diameter serves as an indicator of our bodily arousal and is usually applied to determine mental workload or affective reactions. An increase in physiologic activation is accompanied by an enlargement of pupil diameter, whereas low autonomic arousal correlates with small pupil sizes. Biofeedback scenarios externalize these activation patterns (e.g. via real-time feedback on a computer screen) and enable participants to voluntary control the associated dynamics.

The current project pursues two objectives. Firstly, determining to what extent evaluators (project members) are able to differentiate between true and false statements on basis of real-time pupillary feedback of a participant. And, secondly, whether participants are able to voluntary control their pupil dynamics and thereby mask the truthfulness of their statements.

The project promises insights into the methods of eye-tracking and pupillometry. In addition, basics of empirical designs are provided. Programming work has almost been done; however, particular aspects still need to be implemented. A draft of the experimental design has been worked out but can be modified according to ideas and suggestions of the project members.

#### Bemerkung

Ort und Zeit werden zur Projektbörse bekannt gegeben.

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Time and place will be announced at the project fair.

#### Voraussetzungen

We assume you are interested in carrying out an empirical study on the possibilities and limitations of verifying the accuracy of statements on basis of physiological indicators. Programming skills in python are an advantage.

#### Leistungsnachweis

Active participation during preparation, processing, analysis and documentation of an empirical study.

### 8-Bit of Bauhaus

**C. Wüthrich, G. Pandolfo, W. Kissel**

Veranst. SWS: 10

Projekt

Mi, Einzel, 13:30 - 16:00, Bauhausstraße 11 - Seminarraum 013, Einführungsveranstaltung, 10.04.2019 - 10.04.2019

#### Beschreibung

"8-Bit of Bauhaus" ist ein interdisziplinäres Projekt zwischen Studierende der Fakultät K&G und der Medieninformatik, das sich in diesem Jahr mit der praktischen Entwicklung von Computerspielen rund um das Thema Bauhaus befasst. Studierende der Medieninformatik sollten Programmierkenntnisse mitbringen. Studierende der Fakultät K&G hingegen Erfahrungen im Bereich Sounddesign, Illustration, Animation, 3D-Modelling oder Storytelling.

#### engl. Beschreibung/ Kurzkomentar

"8-Bit of Bauhaus" is an interdisciplinary project between students of Computer Science & Media and Art & Design. This year it will be a practical journey into Gamedevelopment to Bauhaus related topics. CSM students should have basic programming knowledge. A&D students should have knowledge in sounddesign, illustration, animation, 3D-modeling or storytelling. Time and place will be announced at the project fair (CS4M). Students of the faculty A&D will receive an email.

This is an Interdisciplinary Project, open to Medieninformatik/Computer Science and Media students, as well as to students in the Media Arts and Design Bachelor/Master Study Course.

#### Bemerkung

Ort und Zeit werden zur Projektbörse (Medieninformatik) bekannt gegeben /Time and place will be announced at the project fair (CS4DM).

Studierende der Fakultät K&G werden per Email benachrichtigt / Students of the faculty A&D will receive an email.

Anrechnung für MK/MG: 16 SWS, 18ECTS

#### Voraussetzungen

Für Studierende der Fak. K&G: Motivationsschreiben an [gianluca.pandolfo@uni-weimar.de](mailto:gianluca.pandolfo@uni-weimar.de)

#### Leistungsnachweis

Abschlusspräsentation, fertiges Spiel.

### Augmented Writing Platform for Blog Posts

**B. Stein, K. Al Khatib, R. El Baff**  
Projekt

Veranst. SWS: 10

#### Beschreibung

"it's easy to forget that the words we choose can change how people react... and change the future" - textio. This project aims at developing a working prototype for an intelligent writing assistant platform. The platform targets blog writers who are eager to attract various types of readers by writing engaging and interesting content. The platform helps writers to see how their text will affect people with different profiles (e.g. different personalities, political orientations, ?). In addition, it provides several suggestions to the writer in order to boost the content impact on the target readers (e.g., replacing or adding powerful words) . The project will concentrate on (1) developing an effective and easy to use GUI, and (2) integrating different related approaches that the group already has successfully developed. Examples for augmented writing

tools: <https://textio.com>, <https://www.boostlinguistics.com>, <https://www.grammarly.com>.

#### Bemerkung

Ort und Zeit werden zur Projektbörse bekannt gegeben.

#### Voraussetzungen

Programming: Golang, Java or Python. At least basic knowledge in WebApp development

#### Leistungsnachweis

Abschlusspräsentation und Ausarbeitung

### Automated Software Engineering

**N. Siegmund, A. Karge**  
Projekt

Veranst. SWS: 10

#### Beschreibung

#### Automatisiertes Software Engineering

  
Software Engineering wird zunehmend automatisiert. In diesem Projekt werden Verfahren entwickelt, die dieser Automatisierung Rechnung tragen. Insbesondere ist der Bereich der automatisierten Code-Vervollständigung, das automatisierte Bug Fixen oder die automatisierte Performance-Verbesserung von Interesse. Die Studierenden werden sich in ein komplexes Themengebiet im Schnittstellenbereich des Software Engineerings, maschinellen Lernens und Information Retrieval einarbeiten und den Stand der Forschung aufarbeiten. Darauf ableitend wird ein neuer, innovativerer Ansatz der Automatisierung entworfen und implementiert. Schließlich wird mittels wissenschaftlich akkuraten Methoden das Verfahren evaluiert, dokumentiert und verteidigt.

#### engl. Beschreibung/ Kurzkomentar

Software Engineering becomes increasingly automated. In this project, we will address this automation in the area of code completion, automated bug fixing, or automated performance improvement.

Students will learn how to acquire in depth knowledge in a complex topic on the interface of software engineering, machine learning, and information retrieval. They will learn how to assess the state of the art, develop novel techniques on top of it, and implement and evaluate them in a scientific accurate manner.

#### Bemerkung

Ort und Zeit werden zur Projektbörse bekannt gegeben.

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Time and place will be announced at the project fair.

#### Voraussetzungen

Lecture: Software Engineering, Information Retrieval or Introduction to Machine Learning

#### Leistungsnachweis

Presentation of project phases, literature analysis, implemented software, written summary of the project

### Conversational News

**B. Stein, Y. Ajjour, R. El Baff, J. Kiesel**  
Projekt

Veranst. SWS: 10

#### Beschreibung

Smart speakers like Google Home and Amazon Alexa already made their way into millions of households and present themselves as a new medium for news consumption. For example, big news publishers like the New York Times or CNN already produce daily flash briefings just for such devices. This project wants to develop a system to enable even small publishers to publish their written news articles on smart speakers in an engaging manner. The system will tackle these three main problems: the article structure has to be simplified to be more understandable through listening; the output of the speech synthesizer has to sound more natural and less boring; the possibility to ask for more information (like links to related articles or encyclopedic knowledge of mentioned person, places, or organizations) has to be added. The system will allow publishers to bootstrap their own smart speaker application and to quickly add articles to it.

#### Bemerkung

Ort und Zeit werden zur Projektbörse bekannt gegeben.

#### Voraussetzungen

Programming: Java.

#### Leistungsnachweis

Abschlusspräsentation und Ausarbeitung

### Error detection in gaze-based interaction concepts

**J. Ehlers**  
Projekt

Veranst. SWS: 10

#### engl. Beschreibung/ Kurzkomentar

Gaze-based interaction enables users to communicate with a system via eye movements. To select a target or to enter text, current approaches usually apply a so called "dwell-time". Thereby, participants need to fixate an item or a letter for a certain period to select it. According to recent studies, experienced users are able to work sufficiently well with dwell-times of only 300 milliseconds. However, errors still occur and reduce the overall interaction accuracy.

Pupil diameter serves as an indicator of our bodily arousal. An increase in physiologic activation is usually accompanied by an enlargement of pupil size. The current project aims to improve dwell-time based interaction by applying pupil diameter as a mechanism for real-time error monitoring. Assuming false-positive input to briefly increase physiologic arousal (and enlarge diameter), we should be able to adjust incorrect entries automatically and further improve interaction accuracy.

The project promises insights into the methods of eye-tracking and pupillometry. In addition, basics of empirical designs are provided.

#### **Bemerkung**

Ort und Zeit werden zur Projektbörse bekannt gegeben.

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Time and place will be announced at the project fair.

#### **Voraussetzungen**

We assume you are interested in designing and carrying out an empirical study on gaze-based interaction. The central question addresses whether accuracy rates can be improved via pupillary signals. Basic programming skills in python are a precondition for participation.

#### **Leistungsnachweis**

Designing and carrying out an empirical study; analysis and documentation of results.

### **HMD Eyes**

**B. Fröhlich, S. Beck, A. Kreskowski, A. Kulik, A. Kunert, C. Matthes, P. Riehm, T. Weißker**    Veranstr. SWS:    10  
Projekt

#### **Beschreibung**

Wir sind überzeugt, dass Virtual Reality ein soziales Medium ist. Ein Medium, welches Menschen ermöglicht, sich in gemeinsamen virtuellen Welten zu treffen und zusammenzuarbeiten. Um sich dabei gegenseitig zu sehen, werden HMD-Anwender oft als stilisierte oder computergenerierte (CG) Avatare dargestellt. In einigen Anwendungen sind solche Darstellungen sicherlich ausreichend. Allerdings können CG-Avatare die Körpersprache und Mimik einer Person nicht besonders gut vermitteln. Im Gegensatz dazu, werden die Anwender moderner Telepresence-Systeme dreidimensional in Echtzeit erfasst, rekonstruiert und als realistische 3D-Video-Avatare live dargestellt. Tatsächlich fühlt sich die Begegnung mit dem 3D-Video-Avatar einer Person in einem Telepresence-System fast so an als würde man die Person real treffen.

In diesem Projekt ermöglichen wir es HMD-Anwendern, sich selbst und einander als 3D-Video-Avatare zu sehen. Um dies zu erreichen, werden wir HMDs mit Farb- und Tiefensensoren (RGBD-Sensoren) ausstatten. Die RGBD-Sensoren werden somit zu zusätzlichen Augen des HMD-Anwenders, und ermöglichen es ihm andere Personen oder seinen eigenen Körper, live zu erfassen und in seine virtuelle Sicht zu integrieren.

Wir beginnen mit einer Literaturrecherche und Präsentationen und werden wir die vorhandenen Virtual-Reality-Technologien in unseren Laboren kennenlernen und verstehen. Anschließend werden wir RGBD-Sensoren an Head-Mounted-Displays anbringen und als System kalibrieren. Im Kern des Projektes werden wir werden eine 3D-Rekonstruktions-Pipeline implementieren mit der wir konsistent verortete 3D-Rekonstruktionen der Umgebung in Echtzeit erstellen können. Außerdem werden wir unsere Pipeline an ein Geometrie-Streaming-Modul anbinden,

welches die 3D-Video-Avatare an unser Virtual-Reality-Framework Avango/Guacamole sendet. In Avango/Guacamole werden die 3D-Video-Avatare dann automatisch in die virtuelle Szene integriert und im HMD dargestellt.

**Lerninhalte:**

- Kollaborative virtuelle Realität und Telepresence-Technologie
- Aufbau und Kalibrierung von 3D-Sensor-Systemen mit quelloffenen Softwarewerkzeugen
- Entwurf und Implementierung einer echtzeitfähigen Processing-Pipeline für die Rekonstruktion von 3D-Video-Avataren aus RGBD-Bildströmen
- Entwurf und Implementierung eines Server-Modules welches 3D-Video-Avatar-Geometrien an Avango/Guacamole sendet

**Anforderungen:**

- Erfahrung in der Softwareentwicklung mit C++ und Python
- Grundlagen der Computergrafik

**engl. Beschreibung/ Kurzkomentar**

Virtual reality is nowadays often associated with users wearing head mounted displays (HMDs). When observing such fully immersed HMD users, one often wonders what they perceive. What do they explore? Which virtual world are they navigating through? To really understand their experience, the best way is to meet them in the same virtual environment.

We are convinced, that virtual reality is a social medium that enables people to meet and collaborate in shared virtual worlds. In collocated settings, HMD users are often represented as stylized or computer generated (CG) avatars in order to see each other. Being represented as CG avatar might be sufficient in some applications. However, such representations cannot convey body language or facial expressions well. Instead of representing users as CG avatars, modern telepresence systems use real-time 3D capturing and reconstruction technology and represent the users as realistic 3D video avatars. In fact, meeting a user's 3D video avatar inside a telepresence system almost feels like meeting the person in reality. Consequently, HMD users should be represented using similar technology in collaborative applications.

In this project, we will allow collocated HMD users to see themselves and each other inside shared virtual environments as 3D video avatars using lightweight 3D capturing technology. To achieve this, we will equip HMDs with color and depth (RGBD) sensors. Thus, letting the RGBD-sensors become a user's additional eyes that enable other users standing next them to be captured and integrated into his vision.

We will start with a literature research and presentations. Next, we will learn about virtual reality technology available in our labs. Eventually, we will get to the implementation. We will mount RGBD-sensors for 3D capturing onto the HMDs and calibrate them using our open source calibration frameworks. These lightweight 3D capturing systems will allow us to create spatially consistent 3D reconstructions of the physical environment in real-time. In particular, we will design and implement a novel 3D reconstruction processing pipeline that creates 3D video avatars of the captured collocated persons using our 3D capturing setups. We will then connect our pipeline to our existing geometry streaming module which sends the 3D video avatars to our virtual reality software Avango/Guacamole. In Avango/Guacamole, the 3D video avatars will then be automatically integrated into the virtual scene and displayed in stereoscopic 3D on the HMD.

**You will learn about and work on the following topics:**

- Collaborative virtual reality and telepresence technology

- Setup and calibration of 3D capturing systems using open source frameworks
- Design and implementation of a real-time 3D reconstruction pipeline that creates 3D video avatars from RGBD-sensor streams
- Design and implementation of a streaming server which interfaces our existing geometry streaming module

#### Requirements:

- Proficient programming skills in C++ (e.g. successful completion of the course on programming languages)
- Solid understanding of computer graphics (e.g. successful completion of the course on computer graphics)

#### Assessment:

active participation in the project, active participation in software development, development of a functional prototype, two presentations, final presentation, written documentation

#### Bemerkung

Ort und Zeit werden zur Projektbörse bekannt gegeben.

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Time and place will be announced at the project fair.

#### Voraussetzungen

Erfolgreicher Abschluss der Vorlesung Computergrafik (oder einer vergleichbaren Veranstaltung), nachweisbare Kenntnisse in C++, hilfreich sind grundlegende Kenntnisse in OpenGL und OpenCV

#### Leistungsnachweis

aktive Mitarbeit im Projekt, aktive Beteiligung an der Softwareentwicklung, Entwicklung eines funktionsfähigen Prototypen, zwei Vorträge, Abschlusspräsentation, schriftliche Dokumentation

### Image-based anomaly detection

**V. Rodehorst, C. Benz**

Veranst. SWS: 10

Projekt

#### Beschreibung

Die Teilnehmer werden an ein aktuelles forschungs- oder industrierelevantes Thema herangeführt. Es ist nicht beabsichtigt einen festgelegten Bereich in voller Breite zu explorieren. Stattdessen werden die Teilnehmer mit der vollen Komplexität eines begrenzten Themas konfrontiert und die Eigeninitiative gefördert. Es ermöglicht einen Einblick in die Forschungs- und Entwicklungsprojekte des Fachgebiets.

#### engl. Beschreibung/ Kurzkomentar

Detecting cracks and other anomalies in images of concrete surfaces for building survey

#### Bemerkung

Ort und Zeit werden zur Projektbörse bekannt gegeben.

Time and place will be announced at the project fair.

#### Voraussetzungen



Gute Programmierkenntnisse (z.B. C/C++, MATLAB, OpenCL)

**Leistungsnachweis**

Aktive Mitarbeit, Einführungsvortrag, Abschlusspräsentation, Dokumentation

**Linguistic Geolocalization**

**B. Stein, M. Wiegmann, M. Wolska**  
Projekt

Veranst. SWS: 10

**engl. Beschreibung/ Kurzkomentar**

The location of an information source is of major interest in forensics, disaster relief and social, economic and political sciences. However, unstructured sources like text or social media posts rarely provide precise positions. In this project we want to collect, review and reproduce strategies for geolocalization of people from text. We will apply these strategies to (i) reconstruct path of fictional characters, i.e. Game of Thrones character's movements throughout the first book and (ii) locate where tweets have been sent from.

**Bemerkung**

Ort und Zeit werden zur Projektbörse bekannt gegeben.

**Leistungsnachweis**

Abschlusspräsentation und Ausarbeitung

**Optimization Problems with Constraints**

**A. Jakoby**  
Projekt

Veranst. SWS: 10

**Bemerkung**

Ort und Zeit werden zur Projektbörse bekannt gegeben.

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Time and place will be announced at the project fair.

**Play in my Dome IV**

**C. Wüthrich, G. Pandolfo, W. Kissel**  
Projekt

Veranst. SWS: 10

**Beschreibung**

Im GFXLab der Fakultät Medien möchten wir den Raum nutzen, um interactive Spiele in Form einer Domeprojektion zu erschaffen.

Nachdem wir vor zwei Semestern einen Dome (inkl. 3D sound) gebaut haben, werden wir an einer Gaming/ Projektionsumgebung arbeiten. Wir werden Gaming Devices für den Dome integrieren, Ambisonics Sound in Spiele einbetten und werden Spielkonzepte passend zum Dome entwickeln.

Für die Bewerbung wären Erfahrungen entweder in Sound/3D/Video/Game Engines vom Vorteil. Ein grundlegendes Interesse für die Materie wäre wünschenswert.

Das Projekt ist ein interdisziplinäres Projekt zwischen Studierende der Medieninformatik und der Medien-Kunst und Gestaltung.

#### **engl. Beschreibung/ Kurzkomentar**

Play in my Dome IV

At the GFXLab of the Faculty of Media we want to use the space above us for dome projections in interactive games. After having built the dome (including 3D sound) in two semester ago, we will start to work at implementing a gaming/projection environment for the dome. Integrating gaming devices in a dome, integrating Ambisonics sound into games, working at concepts for dome games are some – but not all – tasks of this project.

Project applicants should ideally but not necessarily have experience in sound/3D graphics/Video/3D games software, as well as the willingness to adapt things until they work and make things happen. Project beginners are very welcome.

This is an Interdisciplinary Project, open to Medieninformatik/Computer Science and Media students, as well as to students in the Media Arts and Design Bachelor/Master Study Course.

#### **Bemerkung**

Ort und Zeit werden zur Projektbörse (Medieninformatik) bekannt gegeben /Time and place will be announced at the project fair (CS4M).

Studierende der Fakultät K&G werden per Email benachrichtigt / Students of the faculty A&D will receive an email.

Anrechnung für MK/MG: 16 SWS, 18ECTS

#### **Voraussetzungen**

Für Studierende der Fak. K&G: Motivationsschreiben an [gianluca.pandolfo@uni-weimar.de](mailto:gianluca.pandolfo@uni-weimar.de)

### **Populating Virtual Environments**

**B. Fröhlich, S. Beck, A. Kreskowski, A. Kulik, A. Kunert, C. Matthes, P. Riehmann, T. Weißker**    Verant. SWS:    10  
Projekt

#### **Beschreibung**

Virtuelle Realität (VR) birgt ein bisher ungenutztes Potenzial als Bildungsmedium. Große, komplexe und interaktive 3D-Strukturen können aus jeder Perspektive betrachtet und erlebt werden. VR bietet eine Plattform für fundierte Diskussionen über die visualisierten Daten und für kollaboratives Lernen.

Unsere Mehrbenutzer-VR-Systeme ermöglichen es mehreren lokalen Benutzern, gemeinsam große 3D gescannte Umgebungen zu erkunden und sie unterstützen auch Telepresence -Meetings mit 3D-Video-Avataren. Die Aktivitäten der Benutzer in diesen Umgebungen können auch kontinuierlich erfasst und jederzeit wiedergegeben werden.

In diesem Projekt wollen wir diese Funktionalitäten nutzen, um große 3D-Scans historischer Orte mit 3D-Avatar-Aufnahmen von Personen in Interaktion mit der virtuellen Umgebung anzureichern. Dadurch können beispielsweise Experten ihre Erkenntnisse über die dargestellten Daten neuen Nutzern präsentieren oder die Verwendung der gescannten Artefakte vorführen.

Zu den wesentlichen technischen Herausforderungen des Projektes gehören die ausgabesensitive Darstellung mehrerer zeitvariabler 3D-Datensätze, das Design und die Implementierung effektiver Autorenwerkzeuge und komfortabler Gruppennavigationstechniken für das gemeinsame flanieren durch diese dynamischen virtuellen Umgebungen.

**Lerninhalte:**

- Kollaborative virtuelle Realität und Telepresence-Technologie
- Aufbau und Kalibrierung von 3D-Sensor-Systemen mit quelloffenen Softwarewerkzeugen
- Entwurf und Implementierung einer Schnittstelle für Audioaufnahmen mit quelloffenen Softwarewerkzeugen
- Entwurf und Implementierung eines Autorenwerkzeugs zur Aufnahme und Einbettung von 3D Video-Avataren in virtuelle Umgebungen
- Ausgabesensitive 3D-Renderingtechniken
- Softwareentwicklung für virtuelle Realität (mit Avango-Guacamole, Python)

**Anforderungen:**

- Erfahrung in der Softwareentwicklung mit C++ und Python
- Grundlagen der Computergrafik

**engl. Beschreibung/ Kurzkomentar**

Virtual reality (VR) holds a hitherto untapped potential as an educational medium. Large, complex and interactive 3D structures can be viewed and experienced from any perspective. VR offers a platform for well-founded discussions about the visualized data and for collaborative learning.

Our multi-user VR systems allow multiple local users to jointly explore large 3D scanned environments and they also support telepresence meetings with 3D video avatars. The activities of users in these environments can also be captured and replayed at any time.

In this project we want to use these functionalities to enrich large 3D scans of historical places with 3D avatar recordings of people interacting with the virtual environment. This allows experts, for example, to present their findings about the displayed data to new users or demonstrate the use of the scanned artifacts.

The challenges include output sensitive rendering of multiple time-varying 3D datasets, the design and implementation of effective authoring tools and comfortable group navigation techniques for joint promenading through these dynamic virtual environments.

**You will learn about and work on the following topics:**

- Collaborative virtual reality and telepresence technology
- Setup and calibration of 3D capturing systems using open source frameworks
- Design and implementation of an audio-recording module using open source frameworks
- Design and implementation of authoring tools for populating 3D scenes with 3D video avatars
- Output-sensitive 3D rendering techniques
- Software development for Virtual Reality (Avango-Guacamole, Python)

**Requirements:**

- Proficient programming skills in C++ and Python (e.g. successful completion of the course on programming languages)
- Solid understanding of computer graphics (e.g. successful completion of the course on computer graphics)

**Assessment:** active participation in the project, active participation in software development, development of a functional prototype, two presentations, final presentation, written documentation

**Bemerkung**

Ort und Zeit werden zur Projektbörse bekannt gegeben.

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Time and place will be announced at the project fair.

#### Voraussetzungen

Nachweisbare Erfahrung in der Softwareentwicklung mit C++ und Python, nachweisbare Kenntnisse von Grundlagen der Computergrafik

#### Leistungsnachweis

aktive Mitarbeit im Projekt, aktive Beteiligung an der Softwareentwicklung, Entwicklung eines funktionsfähigen Prototypen, zwei Vorträge, Abschlusspräsentation, schriftliche Dokumentation

### Realtime Stereo Matching

**V. Rodehorst, M. Kaisheva**

Veranst. SWS: 10

Projekt

#### Beschreibung

Die Teilnehmer werden an ein aktuelles forschungs- oder industrierelevantes Thema herangeführt. Es ist nicht beabsichtigt einen festgelegten Bereich in voller Breite zu explorieren. Stattdessen werden die Teilnehmer mit der vollen Komplexität eines begrenzten Themas konfrontiert und die Eigeninitiative gefördert. Es ermöglicht einen Einblick in die Forschungs- und Entwicklungsprojekte des Fachgebiets.

#### engl. Beschreibung/ Kurzkomentar

Realtime pixel matching using GPGPU programming in Computer Vision

#### Bemerkung

Ort und Zeit werden zur Projektbörse bekannt gegeben.

Time and place will be announced at the project fair.

#### Voraussetzungen

Gute Programmierkenntnisse (z.B. C/C++, MATLAB, OpenCL)

#### Leistungsnachweis

Aktive Mitarbeit, Einführungsvortrag, Abschlusspräsentation, Dokumentation

### Tangible Data. Designing and Evaluating data physicalization

**E. Hornecker, H. Waldschütz**

Veranst. SWS: 10

Projekt

#### engl. Beschreibung/ Kurzkomentar

If we think of data representations, we normally only think of visualisations. But what if data moved off the screen, with 3D physical shape and materiality, into the world, so we could touch it, hold it in our hands, feel it – or navigate the data by moving around it? And what if it could move and change shape to reflect updates and in response to user interactions? And how does this affect our perception and interpretation of the data?

Physical representations of data have existed for thousands of years. Initially emerging from the arts, 'data physicalization' is increasingly investigated in Information Visualisation and HCI, pushed by recent advances in digital fabrication and mechanical actuation.

In designing data physicalization, the challenge lies in establishing a meaningful relation between the (digital) data, and the properties of the used material, where the choice of material influences meaning and experience. So far, most work in this area has created static representations – but for dynamic data series and interactive feedback, we need flexible, shape-changing or moving representations.

This project collaborates with the 'Data matters' project (Computer Science students and Product Design or Media Architecture students), and will focus on designing the interaction with the physicalization, and on devising and running a user study of the resultant system. Students in this project will contribute to the design ideation and prototyping/development process. They will also research the literature on how people interact with and experience physicalizations.

We will work in small groups (mixing students from different disciplines) to develop dynamic data physicalizations, e.g. using motor-based actuation for shape-change or such. The project begins with literature research and a look at existing projects, investigation of options for creating dynamic physicalizations. A main part during the semester is to develop ideas/concepts, to prototype some, and to design and implement one of the ideas, based on data sources we will provide. The final outcome will be presented at the Summaery. HCI students will then organize and run the user study in own responsibility and timing during the first part of summer break.

HCI Master students will engage both with technology and design aspects. They will take part in creative conceptualization, focusing on user interaction and experience, and will devise and run a user study of the final design.

#### **Bemerkung**

Ort und Zeit werden zur Projektbörse bekannt gegeben.

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Time and place will be announced at the project fair.

#### **Voraussetzungen**

Interest in designing interactive systems, creative thinking and willing to work in interdisciplinary teams. Initial experience in doing user research is needed. Basic knowledge in Interaction Design and with Arduino/ Physical Computing are a nice-to-haves, likewise are basics in iterative design processes.

#### **Leistungsnachweis**

Active participation and interim presentations, autonomous and self-initiated working mode, project documentation

### **UAS Flightpath Planning**

**V. Rodehorst, P. Debus**

Veranst. SWS: 10

Projekt

#### **Beschreibung**

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#### **engl. Beschreibung/ Kurzkomentar**

Computing efficient full coverage flight paths for UAS in building survey

#### **Bemerkung**

Ort und Zeit werden zur Projektbörse bekannt gegeben.

Time and place will be announced at the project fair.

#### Voraussetzungen

Gute Programmierkenntnisse (z.B. C/C++, MATLAB, OpenCL)

#### Leistungsnachweis

Aktive Mitarbeit, Einführungsvortrag, Abschlusspräsentation, Dokumentation

### Visit the Dome!

**B. Stein, Y. Ajjour, W. Chen**

Veranst. SWS: 10

Projekt

#### Beschreibung

The project aims at the simplification and extraction of arguments in parliamentary debates for the public. Politicians discuss societal issues in parliamentary debates to enact new laws. E-government is an ongoing effort to engage users in taking such decisions. For this goal, countries like UK, Canada, and Germany make parliamentary debates available to the public on the internet. Despite their importance to people, such debates and their issues are largely not studied and analyzed. In this project, we will take the first step to extract issues and arguments in these debates and to present them to the public in a simplified way. After extraction, we will index them in an argument search engine that allows users to find arguments and interact with them

#### Bemerkung

Ort und Zeit werden zur Projektbörse bekannt gegeben.

#### Voraussetzungen

Programming: Python or Java

#### Leistungsnachweis

Abschlusspräsentation und Ausarbeitung

### Visual Cluster Monitoring

**B. Fröhlich, N.N., P. Riehmman, M. Völske**

Veranst. SWS: 10

Projekt

#### Beschreibung

Moderne Datenverarbeitungs- und Speichercluster bestehen aus hunderten Einzelknoten und somit aus tausenden Hardwarekomponenten, die ausfallen und den Betrieb des gesamten Clusters beeinträchtigen können. Die Überwachung aller Komponenten ist von entscheidender Bedeutung und es ist zu vermeiden, dass kritische Fehler im Rauschen regelmäßiger Status-Updates verloren gehen.

Unser Ziel ist es, neue und interaktive Visualisierungstechniken zur Überwachung und Analyse von tausenden Hardware-Sensoren und Millionen von Log-Einträgen zu entwickeln, implementieren und evaluieren. Eine geeignete Darstellung solcher multivariaten Zeitreihen liefert auch Einblicke in die internen Abläufe einer komplexen Cluster-Architektur und hilft, Ausreißer und Problemfälle sofort zu erkennen.

Wir werden das Open Source Monitoring-

Framework Grafana (grafana.org) nutzen, um den Computing und Storage Cluster der Webis Gruppe unserer Universität mit mehr als 5500 Kernen, 35 TeraByte Arbeitsspeicher und 17 PetaByte Festplattenspeicher zu überwachen. Unser interaktives Visualisierungssystem wird es ermöglichen, die Daten zu aggregieren, zu filtern und zu explorieren.

#### engl. Beschreibung/ Kurzkomentar

Modern data processing and storage clusters consist of hundreds of individual nodes or computing devices. Meaning, there are thousands of hardware components that may fail and impact the operation of the whole cluster. Monitoring all components is crucial, but it is even more important that critical failures do not get lost in the noise of regular status updates.

We aim at developing novel interactive visualization techniques for visually monitoring such large clusters capable of presenting the specifics of thousands of hardware sensors and millions of log entries over time; both retrospectively and in real time. An appropriate depiction of such multivariate time series data provides general insights in the various dynamic aspects during the operation of large clusters and aid in detection of outliers and failures.

Based on the open source monitoring framework Grafana (grafana.org) we are going to build our views and visualizations, which will allow us to aggregate and depict as well as to interactively filter and explore the monitoring information received from the computing and storage cluster of the Webis Group at our University consisting of more than 5500 cores, 35 terabyte memory and 17 petabyte of hard disk storage.

#### Bemerkung

Ort und Zeit werden zur Projektbörse bekannt gegeben.

Time and place will be announced at the project fair.

#### Leistungsnachweis

Zwischen- und Abschlusspräsentationen

## VR/AR

### 4336010 Image analysis and object recognition

V. Rodehorst, M. Kaisheva

Veranst. SWS: 3

Vorlesung

Di, wöch., 09:15 - 10:45, Marienstraße 13 C - Hörsaal C, Lecture, ab 02.04.2019

Do, unger. Wo, 11:00 - 12:30, Marienstraße 13 C - Hörsaal A, Lab, ab 11.04.2019

#### Beschreibung

Bildanalyse und Objekterkennung

Die Vorlesung gibt eine Einführung in die Grundlagen der Mustererkennung und Bildanalyse. Behandelt werden unter anderem die Bildverbesserung, lokale und morphologische Operatoren, Kantenerkennung, Bilddarstellung im Frequenzraum, Fourier-Transformation, Hough-Transformation, Segmentierung, Skelettierung, Objektklassifizierung und maschinelles Lernen zur visuellen Objekterkennung.

#### engl. Beschreibung/ Kurzkomentar

## Image analysis and object recognition

The lecture gives an introduction to the basic concepts of pattern recognition and image analysis. It covers topics as image enhancement, local and morphological operators, edge detection, image representation in frequency domain, Fourier transform, Hough transform, segmentation, thinning, object categorization and machine learning for visual object recognition.

### **Bemerkung**

Digital Engineering: 4 SWS

### **Leistungsnachweis**

Erfolgreiche Bearbeitung der Übungen (sowie des Projekts) und Klausur