

Vorlesungsverzeichnis

M.Sc. Computer Science for Digital Media (ab PV 20)

Winter 2025/26

Stand 20.10.2025

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M.Sc. Computer Science for Digital Media (ab PV 20)

Faculty Welcome for Master's Students Computer Science for Digital Media

Monday, 13th October 2025, 10 a.m., Bauhausstraße 11, seminar room A

Project fair

Monday, 13th October 2025, 5 p.m., Steubenstraße 6, Maurice-Halbwachs-Auditorium

Advanced Computer Science

Graphical and Interactive Systems

4256303 Photogrammetric Computer Vision

V. Rodehorst, M. Kaisheva

Veranst. SWS: 4

Vorlesung

Mo, wöch., 09:15 - 10:45, Bauhausstraße 11 - N 004, Lecture, ab 20.10.2025

Mo, unger. Wo, 11:00 - 12:30, Bauhausstraße 11 - N 004, Lab class, ab 20.10.2025

Beschreibung

Die Vorlesung gibt eine Einführung in die Grundlagen der Sensor-Orientierung und 3D-Rekonstruktion. Das Ziel ist ein Verständnis der Prinzipien, Methoden und Anwendungen der bildbasierten Vermessung. Behandelt werden unter anderem die algebraische projektive Geometrie, Abbildungsgeometrie, Kalibrierung, Orientierungsverfahren, Stereo-Bildzuordnung und weitere Verfahren zur Oberflächenrekonstruktion.

Voraussetzungen

Einführung in die Informatik, Grundlagen Programmiersprachen

Leistungsnachweis

Erfolgreiche Bearbeitung der Übungen und des Projektes mit abschließender Klausur

4345590 HCI Theory and Research Methods

E. Hornecker, M. Osipova

Veranst. SWS: 4

Vorlesung

Di, wöch., 13:30 - 15:00, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Lecture/ Lab class, ab 14.10.2025

Mo, wöch., 13:30 - 15:00, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Lecture, ab 20.10.2025

Beschreibung

The course introduces students to the different types of research methods commonly used within HCI research, from quantitative experimental studies to qualitative research methods and mixed method strategies, and present case studies as examples illustrating the use of these methods. As these methods all come from different directions, it provides an overview of the different (interdisciplinary) perspectives within HCI. The focus of this course is on qualitative methodologies and what is important for these both on a practical and theoretical-conceptual level.

Students will get to know a variety of methodological approaches (interviews, observation, questionnaires, ethnography, field studies, diary studies, experience sampling) and gain practical experience in utilizing a selection of these methods through practical assignments and mini-projects, and through work with the research literature. They will further learn about different data analysis strategies, gain an understanding of the different quality criteria

inherent to qualitative versus quantitative style research, and of how to productively combine qualitative and quantitative methods in a research strategy.

The course will furthermore show how the role of theory in HCI has expanded from the early days of human factors and mathematical modelling of behaviour to include explanatory and generative theories, which reflect influences from fields such as design, sociology, and ethnography.

Successful students should be able to

- appreciate the diversity of research methods and relate them to research paradigms and theory
- select research methods appropriate to the domain and research question, based on an understanding of the characteristics, strengths and weaknesses, and practical demands of methods
- reflect on ethical aspects of study design
- utilize a range of HCI research methods and approaches to investigate a research question
- design, plan, and organize user studies and interpret the data
- report and present user studies and findings properly
- relate the role of theory in HCI to the expanding range of methodical approaches utilized for HCI research

engl. Beschreibung/ Kurzkomentar

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Students need to organize themselves into small groups for assignments and should thus be able to communicate, at least remotely, with each other.

Leistungsnachweis

practical assignments in group work, individual short mini-essays, and final practical mini-project (individually) with report (at end of semester).

439100 Raumbezogene Informationssysteme/ Spatial information systems (GIS)

T. Gebhardt, V. Rodehorst

Veranst. SWS: 4

Integrierte Vorlesung

Fr, wöch., 13:30 - 15:00, Marienstraße 13 C - Hörsaal B, Übungen, ab 24.10.2025

Mi, wöch., 09:15 - 10:45, Marienstraße 13 C - Hörsaal B, Vorlesungen

Beschreibung

Die Vorlesung vermittelt vertiefte Grundlagen raumbezogener Informationssysteme, wie z.B. die Aufnahme, Organisation, Analyse und Präsentation raumbezogener Daten. Die Themen umfassen geographische Daten und frei verfügbare Ressourcen, Referenzsysteme und Kartennetzentwürfe, Geo-Datenbanken und effiziente Datenstrukturen, geometrische und topologische Datenanalyse, kartographische Generalisierung und Visualisierung sowie GIS im Planungskontext.

Bemerkung

Für die Selbsteinschreibung in den zugehörigen MOODLE-Lernraum (Hyperlink siehe oben!) lautet das Passwort: spatial2025

Leistungsnachweis

Erfolgreiche Bearbeitung der Übungen und des Projektes mit abschließender Klausur

4556228 Virtual Reality

B. Fröhlich, K. Brehm, E. Schott, T. Zöppig

Veranst. SWS: 4

Vorlesung

Do, wöch., 13:30 - 15:00, Bauhausstraße 11 - R 015, Lecture, ab 16.10.2025

Fr, wöch., 09:15 - 10:45, Lab class, Group AVR-Lab, R.N104, B11, ab 17.10.2025

Fr, wöch., 11:00 - 12:30, Lab Class, Group BVR-Lab, R.N204, B11, ab 17.10.2025

Beschreibung

Virtual Reality (VR) erfreut sich seit mehreren Jahren großer Beliebtheit in Forschung, Unterhaltung und Bildung. VR-Systeme ermöglichen die Interaktion einer oder mehrerer Benutzer*innen mit einer computersimulierten Umgebung, welche dreidimensional auf einem stereoskopischen Display dargestellt wird. In dieser Veranstaltung lernen Sie die theoretischen, technischen und angewandten Grundlagen moderner Virtual Reality-Systeme genauer kennen.

Die Vorlesung beginnt mit den Grundlagen der Computergrafik und des stereoskopischen Sehens, welche zur Realisierung von VR-Anwendungen erforderlich sind. Danach werden Sie verschiedene 3D-Eingabegeräte und 3D-Interaktionstechniken wie Selektion, Manipulation und Navigation in virtuellen Umgebungen kennenlernen. Der letzte Teil des Kurses baut auf dem bereits erworbenen Wissen auf und konzentriert sich auf kollaborative VR-Systeme für mehrere am gleichen oder an verschiedenen Orten befindliche Benutzer*innen.

Die Vorlesung wird von Laborveranstaltungen begleitet, welche neueste Virtual Reality-Technologien wie Multi-Viewer-3D-Projektionssysteme und hochauflösende Head-Mounted Displays einsetzen. Im Rahmen der Übungsaufgaben werden Sie verschiedene 3D-Interaktionstechniken für diese immersiven Displays sowie unter Nutzung von räumlichen Trackingsystemen und 3D-Eingabegeräten implementieren und auswerten. Je nach Situation können Sie auch von zu Hause aus an den Übungen arbeiten.

Wir planen, ausgewählte Vorlesungen und Übungen direkt in virtueller Realität durchzuführen, um das Konzept „Teaching VR in VR“ zu testen. Dazu werden wir nach Möglichkeit alle Teilnehmer*innen mit HMDs ausstatten.

Voraussetzungen

Basic knowledge of computer graphics is recommended. Fundamental programming skills are required.

Digital Engineering or MediaArchitecture students may also attend this lecture if they have already acquired the necessary programming skills through successful completion of appropriate courses and are able to demonstrate their programming skills at the beginning of the lab course. If you are interested in attending this course, please contact one of the teaching assistants named above.

Leistungsnachweis

Vorlesungsbegleitende, bewertete Übungen, zweiwöchentliche Testate und eine schriftliche Abschlussprüfung.

Security and Data Science

418260002 Security Engineering

S. Lucks, J. Leuther

Veranst. SWS: 3

Vorlesung

Mo, wöch., 15:15 - 16:45, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Lecture, ab 13.10.2025

Do, gerade Wo, 15:15 - 16:45, Karl-Haußknecht-Straße 7 - Seminarraum (IT-AP) 001, Lab class, ab 16.10.2025

Beschreibung

Die Entwicklung sicherer und vertraulicher Systeme ist eine Herausforderung für System-Architekten als auch für Software-Entwickler. Die IT-Sicherheit wird durch das immer größer werdende Bewusstsein in der Politik und den Massenmedien zu einem stetig wachsenden und wichtigen Aspekt in der IT-Industrie.

In dieser Vorlesung wird die Programmiersprache Ada'05 (bzw. Ada'12) eingeführt, welche heutzutage als geeignete Sprache für die Implementierung sicherer und vertraulicher Systeme betrachtet wird. Desweiteren werden Methoden aus dem Feld des Software-Engineering präsentiert, welche es ermöglichen, Software-Systeme sicher, vertraulich und benutzbar zu gestalten.

engl. Beschreibung/ Kurzkomentar

Security Engineering

The development of safe and reliable systems is a challenging task for both system architects and software developer.

Due to the raising awareness of the politics and mass media, IT-security is becoming an increasingly important aspect of the IT industry.

The course introduces the programming language Ada'05, which is considered particularly suitable for implementing secure and reliable systems. In addition, methods from the field of software engineering are presented, which serve the safety, reliability and maintainability of software systems.

Leistungsnachweis

Mündliche Prüfung

Beleg als Voraussetzung zur Prüfungszulassung.

422250037 Formal Methods for Software Engineering

J. Ringert, .. Soaibuzzaman

Veranst. SWS: 4

Vorlesung

Di, wöch., 09:15 - 10:45, Bauhausstraße 11 - R 015, Lecture, ab 14.10.2025

Fr, wöch., 11:00 - 12:30, Bauhausstraße 11 - R 015, Lecture/ Lab class, ab 17.10.2025

Beschreibung

Formal methods are rigorous techniques for the mathematical analysis of software and hardware systems. This course introduces aspects of formal methods with applications to software engineering problems.

The topics covered in the course include:

- Introduction to Formal Methods
- Formal methods tools, e.g.,
 - SMT solvers on the example of Z3
 - Relational models and the Alloy Analyzer
 - Model Checking using SMV
- Applications of formal methods in practice

After completion students will be able to

- Model problems in different formalisms
- Analyze software models using formal method tools
- Evaluate formal methods for software engineering problems

Leistungsnachweis

Participation in exercises

Marked homework project including a presentation

423150021 Deep Learning for Computer Vision**V. Rodehorst, J. Eick, A. Frolov, D. Tschirschwitz**

Veranst. SWS: 4

Integrierte Vorlesung

Fr, wöch., 15:15 - 16:45, Bauhausstraße 11 - N 004, Lecture/ Lab class, ab 17.10.2025

Mo, wöch., 17:00 - 18:30, Bauhausstraße 11 - N 004, Lecture/ Lab class, 20.10.2025 - 03.11.2025

Mo, wöch., 17:00 - 18:30, Bauhausstraße 9a - Linux-Pool, DBL, 1.OG, LINUX-Pool, DBL, Bh9a, 1. OG, ab 10.11.2025

Mo, wöch., 17:00 - 18:30, Bauhausstraße 11 - Pool G, ab 10.11.2025

Beschreibung

In diesem Kurs werden die Prinzipien, Techniken und Anwendungen des tiefgehenden Lernens in Computer Vision behandelt. Die Teilnehmer lernen, wie man neuronale Netze für die Bildklassifizierung, Objekterkennung, semantische Segmentierung und andere Computer-Vision-Aufgaben entwickelt, trainiert und validiert. Es werden auch Techniken zur Verbesserung der Leistung von Deep-Learning-Modellen und Veranschaulichungen behandelt, um Anhaltspunkte für die weitere Modellentwicklung zu erhalten. Am Ende des Kurses werden die Studierenden in der Lage sein, Deep-Learning-Techniken anzuwenden, um reale Probleme in verschiedenen Bereichen zu lösen.

Voraussetzungen

Image Analysis and Object Recognition

Leistungsnachweis

Erfolgreiche Teilnahme an den Laborübungen.

Gewichtung der Note: 100% schriftliche Klausur

424220000 Methods of Social Data Analysis

M. Jakesch, N. Navajas Fernández

Veranst. SWS: 4

Vorlesung

Mi, wöch., 11:00 - 12:30, Bauhausstraße 11 - R 015, Lecture, ab 22.10.2025

Di, wöch., 15:15 - 16:45, Bauhausstraße 11 - R 015, Lab class, ab 28.10.2025

Beschreibung

How can we use data to answer questions about people and society? This course introduces foundational concepts and methods in the quantitative analysis of social data. Through a blend of theoretical insights and hands-on practice, students will get to know the quantitative data analysis pipeline—from data collection and cleaning to statistical modeling and inference.

Topics include the design and execution of surveys and experiments, the concepts of sampling, bias and variance, statistical modeling and inferences, and the ethics of working with people's data. Students will develop an understanding of correlation, regression, statistical power, confidence intervals, and hypothesis tests—skills essential for conducting robust analyses in a data-rich but complex social world.

By the end of the course, students will be able to design basic studies, evaluate the reliability of quantitative evidence, and use statistical methods to test hypotheses on data. They will also have gained some familiarity with R, a statistics-focused programming language widely used data scientists and researchers.

Voraussetzungen

Familiarity with basic concepts of programming and probability is required.

Leistungsnachweis

In-class presentations, course mini-project, final exam.

4439110 Introduction to Machine Learning

B. Stein, J. Bevendorff, M. Kanadan

Veranst. SWS: 4

Vorlesung

Do, wöch., 09:15 - 10:45, Bauhausstraße 11 - N 004, Lecture , ab 23.10.2025

Do, wöch., 09:15 - 10:45, Bauhausstraße 11 - R 014, Lecture , ab 23.10.2025

Do, gerade Wo, 11:00 - 12:30, Bauhausstraße 11 - N 004, Lab class, ab 30.10.2025

Do, gerade Wo, 11:00 - 12:30, Bauhausstraße 11 - R 014, Lab class, ab 30.10.2025

Beschreibung

In this course students will learn to understand machine learning as a guided search in a space of possible hypotheses. The mathematical means to formulate a particular hypothesis class determines the learning paradigm, the discriminative power of a hypothesis, and the complexity of the learning process.

The lecture covers hypothesis spaces, model bias, regression for classification, logistic regression, effectiveness computation, loss function derivation, gradient descent, regularization, neural networks, decision trees, impurity functions, Bayesian learning. The lecture introduces concepts, algorithms, and theoretical backgrounds.

The accompanying lab treats both theoretical and applied tasks to deepen the understanding and hands-on experience of the field. Team work (2-3 students) is appreciated.

Leistungsnachweis

Klausur

4446631 Online Computation**A. Jakoby, R. Adejoh**

Veranst. SWS: 4

Vorlesung

Di, wöch., 11:00 - 12:30, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Lecture, ab 14.10.2025

Do, wöch., 17:00 - 18:30, Bauhausstraße 11 - R 015, lab class, ab 16.10.2025

Beschreibung

Online-Berechnung beschreibt ein Modell für Algorithmen und Probleme, die Entscheidung unter Unsicherheit erfordern. In einem Online-Problem hat der Algorithmus nicht den Zugriff auf die gesamte Eingangs von Anfang an: die Eingabe erfolgt in einer Folge von Schritten. Ein Online-Algorithmus kann seine Berechnungen nur auf die beobachtete Vergangenheit beziehen, ohne dass gesichertes Wissen über die bevorstehende Folge in der Zukunft vorhanden ist. Die Auswirkungen einer Entscheidung können nicht rückgängig gemacht werden.

Online Problemen und Algorithmen finden ihre Anwendung in vielen Bereichen, wie zum Beispiel:

- Datenstrukturen,
- Optimierungsprobleme,
- Geometrische Algorithmen,
- Parallele und verteilte Systeme,
- Planungsprobleme.

In der Vorlesung Online Berechnung, werden wir einige Online-Probleme und Algorithmen vorstellen und analysieren. Ferner werden einige grundlegende Methoden aus einigen aus den obigen Bereichen vorgestellt.

engl. Beschreibung/ Kurzkomentar

Online Computation

Online computation is a model for algorithms and problems which require decision under uncertainty. In an online problem the algorithm does not know the entire input from the beginning: the input is revealed in a sequence of steps. An online algorithm should make its computation based only on the observed past and without any secure knowledge about the forthcoming sequence in the future. The effects of a decision taken cannot be undone.

We find online problems and online algorithms within many areas, such as

- data structures,
- optimization problems,
- geometric algorithms,
- parallel and distributed systems,
- scheduling problems.

In the lecture Online Computation, we will present and analyze online problems and algorithms as well as some basic methods from some of these areas.

Leistungsnachweis

oral examination

Specialization**418260002 Security Engineering****S. Lucks, J. Leuther**

Veranst. SWS: 3

Vorlesung

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Leistungsnachweis

Mündliche Prüfung

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V. Rodehorst, M. Kaisheva

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4345590 HCI Theory and Research Methods**E. Hornecker, M. Osipova**

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engl. Beschreibung/ Kurzkomentar

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Students need to organize themselves into small groups for assignments and should thus be able to communicate, at least remotely, with each other.

Leistungsnachweis

practical assignments in group work, individual short mini-essays, and final practical mini-project (individually) with report (at end of semester).

439100 Raumbezogene Informationssysteme/ Spatial information systems (GIS)

T. Gebhardt, V. Rodehorst

Veranst. SWS: 4

Integrierte Vorlesung

Fr, wöch., 13:30 - 15:00, Marienstraße 13 C - Hörsaal B, Übungen, ab 24.10.2025

Mi, wöch., 09:15 - 10:45, Marienstraße 13 C - Hörsaal B, Vorlesungen

Beschreibung

Die Vorlesung vermittelt vertiefte Grundlagen raumbezogener Informationssysteme, wie z.B. die Aufnahme, Organisation, Analyse und Präsentation raumbezogener Daten. Die Themen umfassen geographische Daten und frei verfügbare Ressourcen, Referenzsysteme und Kartennetzentwürfe, Geo-Datenbanken und effiziente

Datenstrukturen, geometrische und topologische Datenanalyse, kartographische Generalisierung und Visualisierung sowie GIS im Planungskontext.

Bemerkung

Für die Selbsteinschreibung in den zugehörigen MOODLE-Lernraum (Hyperlink siehe oben!) lautet das Passwort: spatial2025

Leistungsnachweis

Erfolgreiche Bearbeitung der Übungen und des Projektes mit abschließender Klausur

4439110 Introduction to Machine Learning

B. Stein, J. Bevendorff, M. Kanadan

Veranst. SWS: 4

Vorlesung

Do, wöch., 09:15 - 10:45, Bauhausstraße 11 - N 004, Lecture , ab 23.10.2025

Do, wöch., 09:15 - 10:45, Bauhausstraße 11 - R 014, Lecture , ab 23.10.2025

Do, gerade Wo, 11:00 - 12:30, Bauhausstraße 11 - N 004, Lab class, ab 30.10.2025

Do, gerade Wo, 11:00 - 12:30, Bauhausstraße 11 - R 014, Lab class, ab 30.10.2025

Beschreibung

In this course students will learn to understand machine learning as a guided search in a space of possible hypotheses. The mathematical means to formulate a particular hypothesis class determines the learning paradigm, the discriminative power of a hypothesis, and the complexity of the learning process.

The lecture covers hypothesis spaces, model bias, regression for classification, logistic regression, effectiveness computation, loss function derivation, gradient descent, regularization, neural networks, decision trees, impurity functions, Bayesian learning. The lecture introduces concepts, algorithms, and theoretical backgrounds.

The accompanying lab treats both theoretical and applied tasks to deepen the understanding and hands-on experience of the field. Team work (2-3 students) is appreciated.

Leistungsnachweis

Klausur

4446631 Online Computation

A. Jakoby, R. Adejoh

Veranst. SWS: 4

Vorlesung

Di, wöch., 11:00 - 12:30, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Lecture, ab 14.10.2025

Do, wöch., 17:00 - 18:30, Bauhausstraße 11 - R 015, lab class, ab 16.10.2025

Beschreibung

Online-Berechnung beschreibt ein Modell für Algorithmen und Probleme, die Entscheidung unter Unsicherheit erfordern. In einem Online-Problem hat der Algorithmus nicht den Zugriff auf die gesamte Eingangs von Anfang an: die Eingabe erfolgt in einer Folge von Schritten. Ein Online-Algorithmus kann seine Berechnungen nur auf die beobachtete Vergangenheit beziehen, ohne dass gesichertes Wissen über die bevorstehende Folge in der Zukunft vorhanden ist. Die Auswirkungen einer Entscheidung können nicht rückgängig gemacht werden.

Online Problemen und Algorithmen finden ihre Anwendung in vielen Bereichen, wie zum Beispiel:

- Datenstrukturen,

- Optimierungsprobleme,
- Geometrische Algorithmen,
- Parallele und verteilte Systeme,
- Planungsprobleme.

In der Vorlesung Online Berechnung, werden wir einige Online-Probleme und Algorithmen vorstellen und analysieren. Ferner werden einige grundlegende Methoden aus einigen aus den obigen Bereichen vorgestellt.

engl. Beschreibung/ Kurzkomentar

Online Computation

Online computation is a model for algorithms and problems which require decision under uncertainty. In an online problem the algorithm does not know the entire input from the beginning: the input is revealed in a sequence of steps. An online algorithm should make its computation based only on the observed past and without any secure knowledge about the forthcoming sequence in the future. The effects of a decision taken cannot be undone.

We find online problems and online algorithms within many areas, such as

- data structures,
- optimization problems,
- geometric algorithms,
- parallel and distributed systems,
- scheduling problems.

In the lecture Online Computation, we will present and analyze online problems and algorithms as well as some basic methods from some of these areas.

Leistungsnachweis

oral examination

4556228 Virtual Reality

B. Fröhlich, K. Brehm, E. Schott, T. Zöppig

Veranst. SWS: 4

Vorlesung

Do, wöch., 13:30 - 15:00, Bauhausstraße 11 - R 015, Lecture, ab 16.10.2025

Fr, wöch., 09:15 - 10:45, Lab class, Group AVR-Lab, R.N104, B11, ab 17.10.2025

Fr, wöch., 11:00 - 12:30, Lab Class, Group BVR-Lab, R.N204, B11, ab 17.10.2025

Beschreibung

Virtual Reality (VR) erfreut sich seit mehreren Jahren großer Beliebtheit in Forschung, Unterhaltung und Bildung. VR-Systeme ermöglichen die Interaktion einer oder mehrerer Benutzer*innen mit einer computersimulierten Umgebung, welche dreidimensional auf einem stereoskopischen Display dargestellt wird. In dieser Veranstaltung lernen Sie die theoretischen, technischen und angewandten Grundlagen moderner Virtual Reality-Systeme genauer kennen.

Die Vorlesung beginnt mit den Grundlagen der Computergrafik und des stereoskopischen Sehens, welche zur Realisierung von VR-Anwendungen erforderlich sind. Danach werden Sie verschiedene 3D-Eingabegeräte und 3D-Interaktionstechniken wie Selektion, Manipulation und Navigation in virtuellen Umgebungen kennenlernen. Der letzte

Teil des Kurses baut auf dem bereits erworbenen Wissen auf und konzentriert sich auf kollaborative VR-Systeme für mehrere am gleichen oder an verschiedenen Orten befindliche Benutzer*innen.

Die Vorlesung wird von Laborveranstaltungen begleitet, welche neueste Virtual Reality-Technologien wie Multi-Viewer-3D-Projektionssysteme und hochauflösende Head-Mounted Displays einsetzen. Im Rahmen der Übungsaufgaben werden Sie verschiedene 3D-Interaktionstechniken für diese immersiven Displays sowie unter Nutzung von räumlichen Trackingsystemen und 3D-Eingabegeräten implementieren und auswerten. Je nach Situation können Sie auch von zu Hause aus an den Übungen arbeiten.

Wir planen, ausgewählte Vorlesungen und Übungen direkt in virtueller Realität durchzuführen, um das Konzept „Teaching VR in VR“ zu testen. Dazu werden wir nach Möglichkeit alle Teilnehmer*innen mit HMDs ausstatten.

Voraussetzungen

Basic knowledge of computer graphics is recommended. Fundamental programming skills are required.

Digital Engineering or MediaArchitecture students may also attend this lecture if they have already acquired the necessary programming skills through successful completion of appropriate courses and are able to demonstrate their programming skills at the beginning of the lab course. If you are interested in attending this course, please contact one of the teaching assistants named above.

Leistungsnachweis

Vorlesungsbegleitende, bewertete Übungen, zweiwöchentliche Testate und eine schriftliche Abschlussprüfung.

Electives

418260002 Security Engineering

S. Lucks, J. Leuther

Veranst. SWS: 3

Vorlesung

Mo, wöch., 15:15 - 16:45, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Lecture, ab 13.10.2025

Do, gerade Wo, 15:15 - 16:45, Karl-Haußknecht-Straße 7 - Seminarraum (IT-AP) 001, Lab class, ab 16.10.2025

Beschreibung

Die Entwicklung sicherer und vertraulicher Systeme ist eine Herausforderung für System-Architekten als auch für Software-Entwickler. Die IT-Sicherheit wird durch das immer größer werdende Bewusstsein in der Politik und den Massenmedien zu einem stetig wachsenden und wichtigen Aspekt in der IT-Industrie.

In dieser Vorlesung wird die Programmiersprache Ada'05 (bzw. Ada'12) eingeführt, welche heutzutage als geeignete Sprache für die Implementierung sicherer und vertraulicher Systeme betrachtet wird. Desweiteren werden Methoden aus dem Feld des Software-Engineering präsentiert, welche es ermöglichen, Software-Systeme sicher, vertraulich und benutzbar zu gestalten.

engl. Beschreibung/ Kurzkomentar

Security Engineering

The development of safe and reliable systems is a challenging task for both system architects and software developer.

Due to the raising awareness of the politics and mass media, IT-security is becoming an increasingly important aspect of the IT industry.

The course introduces the programming language Ada'05, which is considered particularly suitable for implementing secure and reliable systems. In addition, methods from the field of software engineering are presented, which serve the safety, reliability and maintainability of software systems.

Leistungsnachweis

Mündliche Prüfung

Beleg als Voraussetzung zur Prüfungszulassung.

420160001 Introduction to Mechanics**T. Rabczuk, L. Nguyen Tuan**

Veranst. SWS: 4

Vorlesung

Do, wöch., 13:30 - 15:00, Marienstraße 7 B - Seminarraum 103, Lecture

Fr, wöch., 09:15 - 10:45, Marienstraße 7 B - Seminarraum 206, Lab class

Beschreibung

Einführung in die Mechanik

1. Einführung in die Statik:

1.1 Kräfte und Momente

1.2 Auflagerkräfte statisch bestimmter Systeme

1.3 Schnittkräfte in Fachwerken und Balken

2. Einführung in die Elastostatik

2.1 Spannungszustand

2.2 Verzerrungszustand

2.3 Berechnung von Spannungen und Verschiebungen unter axialer und Biegebeanspruchung

2.4 Prinzip der virtuellen Arbeit

engl. Beschreibung/ Kurzkomentar

1. Introduction to statics:

1.1 Forces and moments

1.2 Reaction forces of statically determinate systems

1.3 Internal actions in pin-jointed frames and beams

2. Introduction to elastostatics

2.1 Stresses

2.2 Strains

2.3 Stresses and displacements under axial and bending loading.

2.4 Principle of Virtual Work

Leistungsnachweis

Schriftliche Klausur, 150 Minuten

422250037 Formal Methods for Software Engineering**J. Ringert, .. Soaibuzzaman**

Veranst. SWS: 4

Vorlesung

Di, wöch., 09:15 - 10:45, Bauhausstraße 11 - R 015, Lecture, ab 14.10.2025

Fr, wöch., 11:00 - 12:30, Bauhausstraße 11 - R 015, Lecture/ Lab class, ab 17.10.2025

Beschreibung

Formal methods are rigorous techniques for the mathematical analysis of software and hardware systems. This course introduces aspects of formal methods with applications to software engineering problems.

The topics covered in the course include:

- Introduction to Formal Methods
- Formal methods tools, e.g.,
 - SMT solvers on the example of Z3
 - Relational models and the Alloy Analyzer
 - Model Checking using SMV
- Applications of formal methods in practice

After completion students will be able to

- Model problems in different formalisms
- Analyze software models using formal method tools
- Evaluate formal methods for software engineering problems

Leistungsnachweis

Participation in exercises

Marked homework project including a presentation

423150021 Deep Learning for Computer Vision

V. Rodehorst, J. Eick, A. Frolov, D. Tschirschwitz

Veranst. SWS: 4

Integrierte Vorlesung

Fr, wöch., 15:15 - 16:45, Bauhausstraße 11 - N 004, Lecture/ Lab class, ab 17.10.2025

Mo, wöch., 17:00 - 18:30, Bauhausstraße 11 - N 004, Lecture/ Lab class, 20.10.2025 - 03.11.2025

Mo, wöch., 17:00 - 18:30, Bauhausstraße 9a - Linux-Pool, DBL, 1.OG, LINUX-Pool, DBL, Bh9a, 1. OG, ab 10.11.2025

Mo, wöch., 17:00 - 18:30, Bauhausstraße 11 - Pool G, ab 10.11.2025

Beschreibung

In diesem Kurs werden die Prinzipien, Techniken und Anwendungen des tiefgehenden Lernens in Computer Vision behandelt. Die Teilnehmer lernen, wie man neuronale Netze für die Bildklassifizierung, Objekterkennung, semantische Segmentierung und andere Computer-Vision-Aufgaben entwickelt, trainiert und validiert. Es werden auch Techniken zur Verbesserung der Leistung von Deep-Learning-Modellen und Veranschaulichungen behandelt, um Anhaltspunkte für die weitere Modellentwicklung zu erhalten. Am Ende des Kurses werden die Studierenden in der Lage sein, Deep-Learning-Techniken anzuwenden, um reale Probleme in verschiedenen Bereichen zu lösen.

Voraussetzungen

Image Analysis and Object Recognition

Leistungsnachweis

Erfolgreiche Teilnahme an den Laborübungen.

Gewichtung der Note: 100% schriftliche Klausur

424220000 Methods of Social Data Analysis

M. Jakesch, N. Navajas Fernández

Veranst. SWS: 4

Vorlesung

Mi, wöch., 11:00 - 12:30, Bauhausstraße 11 - R 015, Lecture, ab 22.10.2025

Di, wöch., 15:15 - 16:45, Bauhausstraße 11 - R 015, Lab class, ab 28.10.2025

Beschreibung

How can we use data to answer questions about people and society? This course introduces foundational concepts and methods in the quantitative analysis of social data. Through a blend of theoretical insights and hands-on practice, students will get to know the quantitative data analysis pipeline—from data collection and cleaning to statistical modeling and inference.

Topics include the design and execution of surveys and experiments, the concepts of sampling, bias and variance, statistical modeling and inferences, and the ethics of working with people's data. Students will develop an understanding of correlation, regression, statistical power, confidence intervals, and hypothesis tests—skills essential for conducting robust analyses in a data-rich but complex social world.

By the end of the course, students will be able to design basic studies, evaluate the reliability of quantitative evidence, and use statistical methods to test hypotheses on data. They will also have gained some familiarity with R, a statistics-focused programming language widely used data scientists and researchers.

Voraussetzungen

Familiarity with basic concepts of programming and probability is required.

Leistungsnachweis

In-class presentations, course mini-project, final exam.

425260000 Advanced Cryptography: Cryptanalysis of the AES and Reduced-Round AES

S. Lucks, J. Leuther

Seminar

Beschreibung

Since its standardization in October 2000, the Advanced Encryption Standard is worldwide the most commonly used block cipher. Many attempts have been made to analyze the AES -- and specifically, to attack reduced-round variants of the AES. Also, certain unusual attack methods have been presented, such as "known-key attacks" and "related-key attacks", which made it able to attack the AES with the full number of rounds. The purpose of the seminar is to study some of those attempts. Each student will be assigned an attack.

The seminar will be a block seminar with a joint meeting and student talks in March 2026. The deadline for students to register their participation will be early November 2025.

To enroll, please join the course on moodle.

Voraussetzungen

"Introduction to Modern Cryptography" or any equivalent course.

4256303 Photogrammetric Computer Vision

V. Rodehorst, M. Kaisheva

Veranst. SWS: 4

Vorlesung

Mo, wöch., 09:15 - 10:45, Bauhausstraße 11 - N 004, Lecture, ab 20.10.2025

Mo, unger. Wo, 11:00 - 12:30, Bauhausstraße 11 - N 004, Lab class, ab 20.10.2025

Beschreibung

Die Vorlesung gibt eine Einführung in die Grundlagen der Sensor-Orientierung und 3D-Rekonstruktion. Das Ziel ist ein Verständnis der Prinzipien, Methoden und Anwendungen der bildbasierten Vermessung. Behandelt werden unter anderem die algebraische projektive Geometrie, Abbildungsgeometrie, Kalibrierung, Orientierungsverfahren, Stereo-Bildzuordnung und weitere Verfahren zur Oberflächenrekonstruktion.

Voraussetzungen

Einführung in die Informatik, Grundlagen Programmiersprachen

Leistungsnachweis

Erfolgreiche Bearbeitung der Übungen und des Projektes mit abschließender Klausur

4345590 HCI Theory and Research Methods

E. Hornecker, M. Osipova

Veranst. SWS: 4

Vorlesung

Di, wöch., 13:30 - 15:00, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Lecture/ Lab class, ab 14.10.2025

Mo, wöch., 13:30 - 15:00, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Lecture, ab 20.10.2025

Beschreibung

The course introduces students to the different types of research methods commonly used within HCI research, from quantitative experimental studies to qualitative research methods and mixed method strategies, and present case studies as examples illustrating the use of these methods. As these methods all come from different directions, it provides an overview of the different (interdisciplinary) perspectives within HCI. The focus of this course is on qualitative methodologies and what is important for these both on a practical and theoretical-conceptual level.

Students will get to know a variety of methodological approaches (interviews, observation, questionnaires, ethnography, field studies, diary studies, experience sampling) and gain practical experience in utilizing a selection of these methods through practical assignments and mini-projects, and through work with the research literature. They will further learn about different data analysis strategies, gain an understanding of the different quality criteria inherent to qualitative versus quantitative style research, and of how to productively combine qualitative and quantitative methods in a research strategy.

The course will furthermore show how the role of theory in HCI has expanded from the early days of human factors and mathematical modelling of behaviour to include explanatory and generative theories, which reflect influences from fields such as design, sociology, and ethnography.

Successful students should be able to

- appreciate the diversity of research methods and relate them to research paradigms and theory
- select research methods appropriate to the domain and research question, based on an understanding of the characteristics, strengths and weaknesses, and practical demands of methods
- reflect on ethical aspects of study design
- utilize a range of HCI research methods and approaches to investigate a research question
- design, plan, and organize user studies and interpret the data
- report and present user studies and findings properly
- relate the role of theory in HCI to the expanding range of methodical approaches utilized for HCI research

engl. Beschreibung/ Kurzkomentar

The course will introduce students to the different types of research methods commonly used within HCI research in order to study and understand people, from quantitative experimental studies to qualitative research methods and mixed method strategies, and will present example case studies illustrating the use of these methods. The focus of this course lies on qualitative methods (e.g. interviews and observation) and qualitative data analysis (that is, approaches which do not rely on statistical analysis). You will gain practical experience in utilizing a selection of these methods through practical assignments and mini-projects, and will work with the research literature.

The course will furthermore provide an overview of how the role of theory in HCI has expanded from the early days of human factors and mathematical modelling of behaviour to include explanatory and generative theories, which reflect influences from fields such as design, sociology, and ethnography.

Successful students should be able to

- appreciate the diversity of research methods and relate them to research paradigms and theory
- select research methods appropriate to the domain and research question, based on an understanding of the characteristics, strengths and weaknesses, and practical demands of methods
- utilize a range of HCI research methods and approaches to investigate a research question
- report and present user studies and findings properly
- relate the role of theory in HCI to the expanding range of methodical approaches utilized for HCI research

Due to the current situation, the course will be taught online, with a Moodle page as main entry point where you find all further details and access to contents and sessions. Please prepare for a mix of synchronous teaching (where you need to be online at specific times) and asynchronous delivery.

We will start with recorded lectures, but might switch to live-lectures (if this proves to work out). We plan to run the practical sessions in real-time via University online platforms. We also plan a half-hour real-time check-in session per week for discussion and questions. Provided in-person teaching may be allowed again, we may do a few in-presence sessions later in the semester, if this does not leave out any of the participants.

Students need to organize themselves into small groups for assignments and should thus be able to communicate, at least remotely, with each other.

Leistungsnachweis

practical assignments in group work, individual short mini-essays, and final practical mini-project (individually) with report (at end of semester).

439100 Raumbezogene Informationssysteme/ Spatial information systems (GIS)

T. Gebhardt, V. Rodehorst

Veranst. SWS: 4

Integrierte Vorlesung

Fr, wöch., 13:30 - 15:00, Marienstraße 13 C - Hörsaal B, Übungen, ab 24.10.2025

Mi, wöch., 09:15 - 10:45, Marienstraße 13 C - Hörsaal B, Vorlesungen

Beschreibung

Die Vorlesung vermittelt vertiefte Grundlagen raumbezogener Informationssysteme, wie z.B. die Aufnahme, Organisation, Analyse und Präsentation raumbezogener Daten. Die Themen umfassen geographische Daten und frei verfügbare Ressourcen, Referenzsysteme und Kartennetzentwürfe, Geo-Datenbanken und effiziente Datenstrukturen, geometrische und topologische Datenanalyse, kartographische Generalisierung und Visualisierung sowie GIS im Planungskontext.

Bemerkung

Für die Selbsteinschreibung in den zugehörigen MOODLE-Lernraum (Hyperlink siehe oben!) lautet das Passwort: spatial2025

Leistungsnachweis

Erfolgreiche Bearbeitung der Übungen und des Projektes mit abschließender Klausur

4439110 Introduction to Machine Learning

B. Stein, J. Bevendorff, M. Kanadan

Veranst. SWS: 4

Vorlesung

Do, wöch., 09:15 - 10:45, Bauhausstraße 11 - N 004, Lecture , ab 23.10.2025

Do, wöch., 09:15 - 10:45, Bauhausstraße 11 - R 014, Lecture , ab 23.10.2025

Do, gerade Wo, 11:00 - 12:30, Bauhausstraße 11 - N 004, Lab class, ab 30.10.2025

Do, gerade Wo, 11:00 - 12:30, Bauhausstraße 11 - R 014, Lab class, ab 30.10.2025

Beschreibung

In this course students will learn to understand machine learning as a guided search in a space of possible hypotheses. The mathematical means to formulate a particular hypothesis class determines the learning paradigm, the discriminative power of a hypothesis, and the complexity of the learning process.

The lecture covers hypothesis spaces, model bias, regression for classification, logistic regression, effectiveness computation, loss function derivation, gradient descent, regularization, neural networks, decision trees, impurity functions, Bayesian learning. The lecture introduces concepts, algorithms, and theoretical backgrounds.

The accompanying lab treats both theoretical and applied tasks to deepen the understanding and hands-on experience of the field. Team work (2-3 students) is appreciated.

Leistungsnachweis

Klausur

4446631 Online Computation

A. Jakoby, R. Adejoh

Veranst. SWS: 4

Vorlesung

Di, wöch., 11:00 - 12:30, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Lecture, ab 14.10.2025

Do, wöch., 17:00 - 18:30, Bauhausstraße 11 - R 015, lab class, ab 16.10.2025

Beschreibung

Online-Berechnung beschreibt ein Modell für Algorithmen und Probleme, die Entscheidung unter Unsicherheit erfordern. In einem Online-Problem hat der Algorithmus nicht den Zugriff auf die gesamte Eingangs von Anfang an: die Eingabe erfolgt in einer Folge von Schritten. Ein Online-Algorithmus kann seine Berechnungen nur auf die beobachtete Vergangenheit beziehen, ohne dass gesichertes Wissen über die bevorstehende Folge in der Zukunft vorhanden ist. Die Auswirkungen einer Entscheidung können nicht rückgängig gemacht werden.

Online Problemen und Algorithmen finden ihre Anwendung in vielen Bereichen, wie zum Beispiel:

- Datenstrukturen,
- Optimierungsprobleme,
- Geometrische Algorithmen,
- Parallele und verteilte Systeme,
- Planungsprobleme.

In der Vorlesung Online Berechnung, werden wir einige Online-Probleme und Algorithmen vorstellen und analysieren. Ferner werden einige grundlegende Methoden aus einigen aus den obigen Bereichen vorgestellt.

engl. Beschreibung/ Kurzkomentar

Online Computation

Online computation is a model for algorithms and problems which require decision under uncertainty. In an online problem the algorithm does not know the entire input from the beginning: the input is revealed in a sequence of steps. An online algorithm should make its computation based only on the observed past and without any secure knowledge about the forthcoming sequence in the future. The effects of a decision taken cannot be undone.

We find online problems and online algorithms within many areas, such as

- data structures,
- optimization problems,
- geometric algorithms,
- parallel and distributed systems,
- scheduling problems.

In the lecture Online Computation, we will present and analyze online problems and algorithms as well as some basic methods from some of these areas.

Leistungsnachweis

oral examination

4526501 Academic English Part One

G. Atkinson

Veranst. SWS: 2

Kurs

Mi, wöch., 15:15 - 16:45, Consultations, R.N212, B11 (indiv.appointments)

Mi, wöch., 17:00 - 18:30, Bauhausstraße 11 - R 015, Academic English Part I+II (alternating)

Beschreibung

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 in reverse order or concurrently (i.e. in the same semester). You may only do the latter on the authority of the course leader (Atkinson).

Voraussetzungen

Registration (compulsory)

All students must register. First time participants are required to present a B2 English Level certificate along with their email registration. All students, **including those who have already taken Academic English Part**

Two and those who need to repeat Academic English Part One, must register by contacting Howard Atkinson at: howard.atkinson@uni-weimar.de.

You will be informed by email when registration opens and when the deadline is. Please do not attempt to register until you have received this Email. Registration Emails should be given the subject heading: AE I Registration.

Leistungsnachweis

continuous assessment

4526502 Academic English Part Two

G. Atkinson

Veranst. SWS: 2

Kurs

Mi, wöch., 15:15 - 16:45, Consultations, R.N212, B11 (indiv.appointments)

Mi, wöch., 17:00 - 18:30, Bauhausstraße 11 - R 015, Academic English Part I+II alternating

Beschreibung

Part Two of the Academic English course concentrates on improving and refining aspects of academic writing style. It includes sections on clause and sentence structure, punctuation rules and how to incorporate quotations, statistics and footnotes into academic texts.

Bemerkung

You are advised to take Part One first, although it is possible to take both parts in reverse order or concurrently (i.e. in the same semester). You may only do the latter on the authority of the course leader (Atkinson).

Voraussetzungen

Registration (compulsory)

All students must register. First time participants are required to present a B2 English Level certificate along with their email registration. All students, **including those who have already taken Academic English Part One and those who need to repeat Academic English Part Two**, must register by contacting Howard Atkinson at: howard.atkinson@uni-weimar.de.

You will be informed by email when registration opens and when the deadline is. Please do not attempt to register until you have received this Email. Registration Emails should be given the subject heading: AE II Registration.

Leistungsnachweis

continuous assessment

4556228 Virtual Reality

B. Fröhlich, K. Brehm, E. Schott, T. Zöppig

Veranst. SWS: 4

Vorlesung

Do, wöch., 13:30 - 15:00, Bauhausstraße 11 - R 015, Lecture, ab 16.10.2025

Fr, wöch., 09:15 - 10:45, Lab class, Group AVR-Lab, R.N104, B11, ab 17.10.2025

Fr, wöch., 11:00 - 12:30, Lab Class, Group BVR-Lab, R.N204, B11, ab 17.10.2025

Beschreibung

Virtual Reality (VR) erfreut sich seit mehreren Jahren großer Beliebtheit in Forschung, Unterhaltung und Bildung. VR-Systeme ermöglichen die Interaktion einer oder mehrerer Benutzer*innen mit einer computersimulierten

Umgebung, welche dreidimensional auf einem stereoskopischen Display dargestellt wird. In dieser Veranstaltung lernen Sie die theoretischen, technischen und angewandten Grundlagen moderner Virtual Reality-Systeme genauer kennen.

Die Vorlesung beginnt mit den Grundlagen der Computergrafik und des stereoskopischen Sehens, welche zur Realisierung von VR-Anwendungen erforderlich sind. Danach werden Sie verschiedene 3D-Eingabegeräte und 3D-Interaktionstechniken wie Selektion, Manipulation und Navigation in virtuellen Umgebungen kennenlernen. Der letzte Teil des Kurses baut auf dem bereits erworbenen Wissen auf und konzentriert sich auf kollaborative VR-Systeme für mehrere am gleichen oder an verschiedenen Orten befindliche Benutzer*innen.

Die Vorlesung wird von Laborveranstaltungen begleitet, welche neueste Virtual Reality-Technologien wie Multi-Viewer-3D-Projektionssysteme und hochauflösende Head-Mounted Displays einsetzen. Im Rahmen der Übungsaufgaben werden Sie verschiedene 3D-Interaktionstechniken für diese immersiven Displays sowie unter Nutzung von räumlichen Trackingsystemen und 3D-Eingabegeräten implementieren und auswerten. Je nach Situation können Sie auch von zu Hause aus an den Übungen arbeiten.

Wir planen, ausgewählte Vorlesungen und Übungen direkt in virtueller Realität durchzuführen, um das Konzept „Teaching VR in VR“ zu testen. Dazu werden wir nach Möglichkeit alle Teilnehmer*innen mit HMDs ausstatten.

Voraussetzungen

Basic knowledge of computer graphics is recommended. Fundamental programming skills are required.

Digital Engineering or MediaArchitecture students may also attend this lecture if they have already acquired the necessary programming skills through successful completion of appropriate courses and are able to demonstrate their programming skills at the beginning of the lab course. If you are interested in attending this course, please contact one of the teaching assistants named above.

Leistungsnachweis

Vorlesungsbegleitende, bewertete Übungen, zweiwöchentliche Testate und eine schriftliche Abschlussprüfung.

Projects

425210000 Building Language Models

B. Stein, M. Gohsen, M. Wiegmann
Projekt

Veranst. SWS: 10

Beschreibung

Implement several language models from different generations from scratch using the same training texts. Build a website to provide a prefix, select the model and its parameters, and see the differences in the generation.

Bemerkung

Time and place will be announced at the project fair.

Leistungsnachweis

Abschlusspräsentation und Ausarbeitung

425210001 Experimentelle Videospiel-Entwicklung

A. Jakoby, G. Pandolfo

Veranst. SWS: 10

Projekt

Beschreibung

Das Projektmodul widmet sich der experimentellen Entwicklung von Videospielen und interaktiven Prototypen, die auf kritischen, gestalterischen und forschenden Ansätzen basieren. Die Inhalte des Moduls orientieren sich an den Prinzipien der Research Creation – einer Verbindung von künstlerisch-praktischer und wissenschaftlich-theoretischer Arbeit – und fördern die Auseinandersetzung mit innovativen Spielkonzepten jen-seits konventioneller Formen und Mechaniken.

Im Laufe des Semesters werden eigene Spielideen entworfen, iterativ entwickelt und kritisch reflektiert. Dabei stehen sowohl schnelle Prototyping-Prozesse als auch die konzeptionelle Schärfung individueller Projekte im Fokus. Die Ergebnisse sollen im Rahmen Winterwerkschau 25/26 und der Summaery 2026 sowie über die Online-Plattform des Critical Game Labs veröffentlicht werden. Das Projektmodul wird jedes Semester angeboten und kann sowohl einmalig als auch mehrfach belegt werden, da sich die inhaltlichen Schwerpunkte und Arbeitsformen kontinuierlich weiter-entwickeln.

Das Modul ist Teil der Bauhaus Gamesfabrik und wird durch das Drittmittelprojekt Freiraum gefördert. Eine inhaltliche Anbindung besteht an das Projektmodul Experimentelle Videospielkritik sowie das Seminarmodul Game Studies, Design and Development von Milan Pingel – eine Kombination dieser Veranstaltungen wird empfohlen.

Teilnahmebedingungen:

Die Teilnehmer*innenzahl ist begrenzt. Für die Teilnahme wird ein kurzes Motivationsschreiben sowie ein Portfolio mit relevanten Arbeiten (z.#B. Game-Design, digitale Medien, interaktive Projekte, künstlerische Arbeiten etc.) erbeten. Bitte sende beides bis zum Semesterstart per E-Mail an: gianluca.pandolfo@uni-weimar.de

Bemerkung

erste Veranstaltung: 16.10.2025

Mittwoch 13:30 Uhr - 15:30 Uhr

Voraussetzungen

Studierende der Medieninformatik sollten Programmierkenntnisse mitbringen

425210003 Digital Twin Framework for Buildings and Structures

M. Artus, C. Koch, J. Ringert, B. Burse
Projekt

Veranst. SWS: 10

Beschreibung

Buildings and civil engineering structures are unique. Creating a digital twin for them takes much time because of the requirements specific to each building. Reducing the time for creating Digital Twins for these assets, it would be helpful to have a framework that takes care about generating software for embedded systems, data storage, communication and visualization. This project can make use of several software developed in prior projects.

Bemerkung

Time and place will be announced at the project fair.

Voraussetzungen

Basic Knowledge in Programming, Software Engineering

425210004 From Text to Image

B. Stein, T. Gollub, S. Ruth
Projekt

Veranst. SWS: 10

Beschreibung

The project deals with the problem of automatically assessing the characteristics of images that refer to a particular text. For example, we want to assess which of the main objects mentioned in the text are present in the images. Or how aspects, that are left open in the text, are visualized in the images.

Bemerkung

Time and place will be announced at the project fair.

Leistungsnachweis

Abschlusspräsentation und Ausarbeitung

425210005 Gaussian Splatting for Mobile Mixed Reality Devices

B. Fröhlich, A. Kreskowski, G. Rendle
Projekt

Veranst. SWS: 10

Beschreibung

Novel-view synthesis techniques based on Neural Radiance Fields [[Mildenhall et al. 2020](#)], Plenoxels [[Fridovich-Keil et al. 2022](#)], or, most recently and best known, 3D Gaussian Splatting [[Kerbl et al. 2023](#), [Liu et al. 2024](#)] enable the visually high-fidelity representation of surfaces that are hard or even almost impossible to reconstruct using classic photogrammetric approaches. Examples of such surfaces include fur, vegetation, transparent or translucent objects and thin structures in general. The novel-view synthesis approaches perform faithful interpolation of existing color information contained in a set of high-quality input images. Novel views can be rendered in real-time, provided one has access to reasonable powerful graphics hardware.

In a previous project, we explored the Gaussian Splatting literature and optimized an existing Unity-based rendering plugin for efficient rendering of Gaussian-based scenes on desktop graphics hardware. We also identified several challenges in rendering these models on mobile devices.

In this project, we aim to build on these insights and optimize Gaussian Splatting algorithms for mobile mixed reality (MR) devices such as the Meta Quest 3 or other mobile devices such as tablets. We will research, implement, and evaluate promising techniques in areas like visibility culling, output-sensitive rendering, data compression, and hybrid representations. Our goal is to fully leverage mobile hardware for real-time rendering at appropriate quality levels.

In addition to the challenge of efficiently rendering on low-power MR hardware, we want to address related research questions with part of the project team, such as how to interact with scene elements consisting of hundreds of thousands of unstructured Gaussian-based primitives or how to convincingly blend Gaussian-Splatting-based scenes with camera streams obtained by mixed-reality devices.

If you are experienced or interested in real-time computer graphics and/or topics in the field of mixed reality, we would be excited to welcome you to our project!

We will provide you with a Quest 3 for the duration of the project and will address the challenges of rendering photorealistic real-world datasets on low-power MR hardware.

Bemerkung

Time and place will be announced at the project fair.

Voraussetzungen

Solid software programming skills in C++ and a successfully completed computer graphics course or equivalent qualifications. Experience with GPGPU programming or algorithm design is helpful, but not required.

Leistungsnachweis

Active participation during the project meetings; design, implementation and evaluation of algorithms designed throughout the project; intermediate and final project presentations; final project report.

425210006 Hot Topics in Computer Vision WiSe25/26

V. Rodehorst, J. Eick, A. Frolov, M. Kaisheva
Projekt

Veranst. SWS: 10

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.

Bemerkung

Time and place will be announced at the project fair.

Voraussetzungen

Vorlesungen „Photogrammetric Computer Vision“ oder „Image Analysis and Object Recognition“ wünschenswert. Gute Programmierkenntnisse (z.B. C/C++, MATLAB/Octave, Python, OpenCL/CUDA)

Leistungsnachweis

Aktive Mitarbeit, Einführungsvortrag, Abschlusspräsentation, Dokumentation

425210007 Immersive Decision Theater

B. Fröhlich, T. Zöppig, E. Schott
Projekt

Veranst. SWS: 10

Beschreibung

In today's fast-paced and interconnected world, making effective decisions in domains such as politics, sustainable development, large-scale infrastructure planning, or crisis response requires a deep understanding of complex systems and their dynamic interdependencies. To make the right decisions, stakeholders must

quickly grasp intricate relationships, integrate expert knowledge from remote locations, visualize cascading effects, and simulate potential outcomes. Immersive environments offer a powerful medium for supporting such high-stakes decision-making processes, enabling distributed decision-makers to collaboratively experience, explore, and evaluate complex scenarios through interactive simulations and immersive visual analytics. In our project "Immersive Decision Theater," we aim to develop a mixed-reality application where multiple users can explore complex scenarios and gain deeper insights into decision parameters and their potential consequences. We envision this as a space where decision-makers, domain experts, and affected communities can collaboratively plan, communicate, and discuss future strategies and scenarios. The platform will feature interactive representations of underlying system models, immersive visual analytics of available data sources and effective visualizations of simulated outcomes to support informed, data-driven decision-making. A central challenge lies in enabling natural communication and collaboration between colocated and distributed VR users, ensuring mutual understanding and supporting decision processes through immersive simulation.

Finding solutions to complex problems in distributed immersive environments raises several research questions. These include how to spatially organize diverse information sources and corresponding data visualizations within the virtual decision theater, how to ensure coherent and meaningful experiences for both colocated and remote participants and how to enable fluid transitions between different content layers, presentation forms, and user perspectives, e.g. by transitioning between the real and virtual worlds.

To address these challenges, you will learn to design and implement social mixed reality applications using Unity3D and C#. Furthermore, you will explore advanced multi-user interaction concepts by experimenting with world-in-miniatures, mixed-reality transitions, visualizing data in a spatial context and many others. Programming and interaction design will be central components of the project; therefore, we recommend a strong background in VR development with Unity and C#, and/or solid experience in designing user

interactions for social immersive environments.

Objectives

- Design and conceptualize a decision theater that supports multiple perspectives on complex scenarios.
- Implement strategies and techniques to interact with and explore the scenario and its underlying data.
- Address potential conflicts between colocated and spatially or temporally distributed users.
- (Optional) Integrate simulation frameworks that react on changes in the virtual model.

Bemerkung

Time and place will be announced at the project fair.

Voraussetzungen

Solid software programming / scripting experience (e.g. C#, C++, Python). Experience in Unity is very helpful. Successful completion of the Virtual Reality course is recommended.

425210008 Next-Generation Development of the Args.me Argument Search Engine

B. Stein, K. Heinrich, M. Kanadan
Projekt

Veranst. SWS: 10

Beschreibung

In this project, we enhance args.me, an argument search engine, by expanding its features and improving performance. We develop a unified user interface that incorporates advanced retrieval algorithms, considers user preferences, leverages argumentative snippets, and integrates dialogical argumentation capabilities.

Bemerkung

Time and place will be announced at the project fair.

Leistungsnachweis

Abschlusspräsentation und Ausarbeitung

425210009 Optimierung von Stundenplänen

A. Jakoby
Projekt

Veranst. SWS: 10

Bemerkung

Time and place will be announced at the project fair.

425210010 Robustheit von Digitalen Wasserzeichen

A. Jakoby
Projekt

Veranst. SWS: 10

Bemerkung

Time and place will be announced at the project fair.

425210011 Software Engineering for Autonomous Vehicles 3

J. Ringert, .. Soaibuzzaman
Projekt

Veranst. SWS: 10

Beschreibung

We will develop software to control autonomous vehicles. The physical vehicle will be equipped with a range of sensors, e.g., LiDAR, cameras, gyroscopes, and distance sensors. We will use industry strength software platforms like the Robot Operating System (ROS2).

Bemerkung

Time and place will be announced at the project fair.

Voraussetzungen

Digital Engineering students must have completed their foundations.

Leistungsnachweis

Projektbericht und Ergebnisse in Form von Software.

425210012 SPHINCS and Friends: Modern Hash-Based Signatures

S. Lucks, J. Leuther
Projekt

Veranst. SWS: 10

Beschreibung

Hash-based signature algorithms are promising candidates for securing communication in the age of quantum computers. SPHINCS+ is an example of such a stateless signature algorithm that gained popularity from the recent „Post-Quantum Cryptography Standardisation Competition“. A major downside of hash-based signature algorithms like SPHINCS+ is the size of the signature itself, which is magnitudes larger than what other algorithms provide. However, there are recent alternatives to SPHINCS+ that are being developed to reduce the downsides while still maintaining the benefits of the hash-based approach. For example, two such variants are Giza and Manticore. In this project, you will work with experts on this subject to get familiar with these alternatives. Your task is to analyse them cryptographically and to implement prototypes of these algorithms.

Bemerkung

Time and place will be announced at the project fair.

Voraussetzungen

- Course: Introduction to Modern Cryptography (or equivalent)
- Interest in Scientific Work
- Ability to self-organize

Leistungsnachweis

Zwischenpräsentationen, Abschlusspräsentation, Abschlussbericht

425210013 UX4HA: Making Home Assistant Easy to Use for Energy Management

E. Hornecker, M. Osipova
Projekt

Veranst. SWS: 10

Beschreibung

Home Assistant (<https://www.home-assistant.io>) is the world's largest open-source project on GitHub, developed and maintained by a global community of contributors. With over 2 million installations, the smart home platform represents a significant open-source success story, built around the values of choice, sustainability, and privacy. Home Assistant runs locally unlike many commercial alternatives, allowing users full data ownership.

The platform is increasingly adopted by individuals motivated by goals such as sustainability, cost-efficiency, and energy independence. Many people are driven to smart home technologies that track their consumption and allow them to engage in active energy management, such as reducing peak load, responding to time-varying electricity prices, and integrating personal power production. Importantly, energy in this context comes from different sources: gas, water, electricity from the grid, self-generated solar power, electricity storage in home batteries, etc. This energy can be used for lighting, cooling, heating, ventilating, and many other purposes. Monitoring and managing these diverse energy flows is essential for achieving broader sustainability and efficient resource consumption. In addition to energy, the Home Assistant energy dashboard provides features to monitor water usage within the smart home.

This research project is run in collaboration with "Open Home Foundation", the parent organization behind the Home Assistant platform. The project will investigate how effectively Home Assistant products support people who use the platform with these energy-related motivations. It explores the user journey from initial awareness, to setup, to meaningful usage of the Energy Dashboard and energy-related features. The focus lies on analyzing how the platform's current features equip people to consume, monitor, interpret, and act on their energy data in ways that align with their sustainability and energy management goals.

The project tasks include evaluating Home Assistant's energy features and the associated setup and onboarding processes, assessing usability, clarity, and alignment with the expectations of both novel and experienced users that newly started with energy management. The aim is to identify how the platform, particularly its energy features, can better support users' energy-related needs and wishes regarding smart home practices.

The project's active phase runs till the end of March. Presence in Weimar is mandatory with a possibility of remote work during the last three weeks of March. Vacations can be organized with a prior notice (thus the workload can be managed by the team). Christmas break is already scheduled according to official break duration.

Through User-Centered Design process we will go from research to prototypes. The deliverables of the project include: platform evaluation, UX research and actionable research report, and new features/feature improvement prototypes. The research results could be used as a case for your portfolios.

Project is offered as 12 ECTS or 18 ECTS project with respective amount of workload. The workload is scheduled in two-week sprints and distributed through the whole semester with accommodation for a Christmas break. Presence at the project meeting and ability to allocate required time for working on the project is mandatory requirement (therefore, we do **not** recommend doing more than 30 ECTS altogether and to carefully consider which other intensive courses to take alongside).

All students need to email Margarita with CV to check whether you qualify for the project. Feel free to reach out for more details or with questions or clarifications to be sure that this project is a good fit for you. margarita.osipova@uni-weimar.de

Bemerkung

Time and place will be announced at the project fair.

Voraussetzungen

Students from HCI Masters and CS4DM: have successfully completed at least one of the following courses from the HCI chair: "HCI Theory & Research Methods", "Ubiquitous Computing", or "HCI Introduction".

We further expect general interest in smart home technology and UX research and design, willingness to work in a team and solve complex design problems. Prototyping skills (lo-fi and hi-fi) as well as Figma knowledge would be beneficial.

We additionally require for the applicants to have a respective amount of time to work on the project from October till the end of March.

To avoid issues after the project selection algorithm, we **require** interested students to write an email to Margarita to confirm eligibility for participation in the project. If you have not emailed us and do not qualify after the algorithm distribution, you would be automatically unenrolled from this project.

Please apply by E-Mail to margarita.osipova@uni-weimar.de (please include a motivation statement, mention which courses you took, and provide a description of your prior experience in relevant areas, with examples of prior work if applicable)!

425210014 Visuelle Analyse von Fragebögen

B. Fröhlich, D. Kiesel, I. López García
Projekt

Veranst. SWS: 10

Beschreibung

Fragebögen sind eines der am häufigsten genutzten Mittel um Daten zu erheben, sei es für eine Wahrnehmungsstudie, eine Meinungsumfrage oder die sozialwissenschaftliche Feldforschung. Die Auswertung dieser Fragebögen nutzt meist statistische Standardverfahren, die jede Frage gesondert betrachten. Zusammenhänge zwischen Antworten oder Verbindungen zu orthogonalen Informationen wie beispielsweise der Demographie der Teilnehmenden werden dabei oft vernachlässigt.

Im Rahmen dieses studentischen Projektes werden wir verschiedene Visualisierungen und Interaktionen entwickeln, die verschiedene Fragetypen – etwa Einfachauswahl, Mehrfachauswahl, Bewertungsskala oder Freitext – darstellen, Zusammenhänge zwischen Antworten und Demographie aufdecken und damit die Analyse von Fragebogendaten deutlich erleichtern können.

Bemerkung

Time and place will be announced at the project fair.

Voraussetzungen

Programming skills in Javascript and D3.js. A completed Visualization course.

Leistungsnachweis

active participation during the project meetings; presentation of literature; design, implementation and evaluation of different visualization and interaction designs; intermediate and final project presentation; final report.

425210031 Beyond Maps - Immersive Exploration of Heat, Air, Sound and Motion

K. Brehm, L. Thiebes, T. Zöppig, B. Fröhlich, U. Plank-Wiedenbeck, J. Uhlmann
Projekt

Beschreibung

The quality of life in urban areas is largely determined by urban planning and the urban transport network. Road traffic has a significant impact on urban mobility, air quality, noise pollution, and the microclimate in an urban context. Currently, results from simulations of traffic, air pollutants, noise, and microclimate are often presented in engineering practice in the form of lengthy texts, tables, and complex diagrams or maps. The presentation of environmental simulations in virtual reality (VR) offers innovative ways to visualise this information. Moreover, social virtual environments (SVE) allow multiple users to join a shared immersive workspace to collaborate on urban planning problems and evaluate how different designs would affect the environmental qualities of a "liveable city". One highly relevant use case is citizen participation, to empower laypeople to understand the complexities of urban development projects in their community and meaningfully engage in the decision-making process.

In this interdisciplinary project, students from engineering and computer science will work together to develop a concept for such an SVE based on the real-world planning scenario of the Weimar "Bahnhofsquartier". You will design an application prototype that supports users in their exploration and understanding this complex planning scenario by visualising validated simulation data of relevant environmental effects. Users will be able to compare and evaluate alternative planning variants, interactively discover the effects of design parameters on environmental qualities, and work together to discuss and form opinions about the planning problem.

Each student will contribute skills from their field of study to the development of the prototype:

- The team will collaborate across disciplines to develop the concept for the prototype and to create the necessary interface between Unity3D and the simulation program to visualise the analysis data in Unity3D.
- Students who focus on the simulation implementation will gain experience in new domains like Urban Micro-Climate and expand their experience in already known domains like Geospatial Modelling with QGIS, Computational Fluid Dynamics with ANSYS or Microscopic Traffic Simulation with PTV.

Students who focus on the VR development will apply and deepen their knowledge about multi-user VR development in Unity3D and C#. You will explore advanced multi-user interaction concepts, such as experimenting with ego-/exocentric and multiple views on the spatial data and interaction with simulation parameters.

Voraussetzungen

Alle Teilnehmenden sollten Freude an der Arbeit in einer interdisziplinären Gruppe haben und sich auf Englisch unterhalten können.

Darüber hinaus sollten Sie neugierig auf die Projektthemen sein:

- Interaktionsdesign für Virtual Reality sowie Mixed Reality
- Umweltsimulation, Verkehr und Stadtplanung

Bevor Sie sich für dieses Projekt anmelden, stellen Sie bitte sicher, dass Sie die folgenden Kursvoraussetzungen erfüllen:

Für Studierende, die an der VR-Implementierung interessiert sind: Erfolgreicher Abschluss von *Introduction to Virtual Reality* oder vergleichbare Vorerfahrung ist erforderlich.

Für Studierende, die an der Implementierung der Umweltsimulation interessiert sind: Erfolgreicher Abschluss von entweder *Microscopic Traffic Simulation* oder *Geo-Spatial Information Systems* ist erforderlich.

425210038 Responsible AI

M. Jakesch

Veranst. SWS: 10

Projekt

Beschreibung

Responsible AI refers to principles, practices, and frameworks that can guide the ethical and accountable development of artificial intelligence systems and ensure that deployed systems are safe, fair, and beneficial to society. In this project, students will engage with perspectives from across the field through weekly readings, reflections, and discussions of central texts.

In parallel, each student will design and carry out a Responsible AI research project. Possible approaches include system audits, experiments, user studies, conceptual work, or dataset collection. The course emphasizes both conceptual engagement and hands-on practice, with the goal of preparing students to participate in the evolving debates around responsible AI.

The main project outcome will be an individual project report, giving students the opportunity to practice scientific writing and potentially develop a publishable contribution. Assessment will be based on the final project, as well as active participation, presentations, and demonstrated progress throughout the semester.

Bemerkung

Time and place will be announced at the project fair.

Voraussetzungen

Successful prior completion of "Methods of Social Data Analysis" or "Machine Learning" or "Natural Language Processing". If you do not fulfill the requirement but believe you would be a good fit for the project, please reach out to the instructor.

Leistungsnachweis

Scientific project report