Introduction

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Lab Course Media Informatics

Contents

1 Welcome

Me

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- My Background
  - Media Informatics = Human-Centred Computing + Human-Computer Interaction + Artificial Intelligence + Digital Media + Transdisciplinarity + ...
- Deutsch oder English
  - German: Du oder Sie
- Office Hours
  - Wednesday, 17:00-18:00

What is a lab course?

1. Single task every (n) week(s)
   - I give an assignment, you solve it
2. Big project being done by yourself
   - You get one task, I evaluate
3. Training practical skills through mid-sized project
   - More structured than the second option
   - Mixture of "lectures", group meetings and independent group work phases

This lab course is of the third kind, with somewhat more supervision in the beginning and more and more independent work (but with reporting) at the end.

Process

Problem-Based Learning
Solving an open-ended problem found in trigger material. We do not focus on problem solving with a predefined solution, but we strive for the development of skills through solving a real world problem.

Student-focused active learning
I provide guidance and scaffolding, you solve the problem. This type of process is not suited for learning basic knowledge, which is better served by lectures (cognitive load, retention of knowledge).

Feedback

Agility
The number of course vs. group meetings depends on the topics chosen, individual and group competencies and the need for support.
Constant feedback is explicitly welcomed.

Just quitting the course does help neither you nor me, therefore, I would like to ask you to tell me about any problems with the course immediately (if needed anonymously).

2 Rules & Regulations

2.1 Workload

Workload

- 3 SWS
  - About 2 SWS during term time
    - Course meetings
    - Group meetings
  - The rest group meetings & presentations during the autumn break
- 5 ECTS

- 125 hours
  - 45 hours course/group meeting
  - 80 hours self-study
- Self-study includes
  - 60 hours group work
  - 16 hours written documentation
  - 4 hours presentation (incl. preparation)
- If you want to finish the course during term time this translates to a workload of about 8 hours per week.

2.2 Credits

Credits

- **Data Analytics:**
  - Elective – Application – Media Systems
- **IMIT (PO $\leq$ 2011):** Veranstaltungen Master
  - Gebiete der Informatik – Gebiet Medieninformatik
  - Gebiete der Informatik – Gebiet Algorithmen
- **IMIT, AI (PO $\geq$ 2014):** Veranstaltungen Master
  - Wahlmodule – Informatik – Gebiet Medieninformatik
- **LA Informatik:**
  - Fachwissenschaftliche Vertiefung
- **WINF (PO $\leq$ 2011):** Veranstaltungen Master, entweder
  - Gebiete der Informatik, Gebiet Algorithmen
  - Wahlbereich, Gebiet Medieninformatik
- **WINF (PO $\geq$ 2014):** Wahlbereich
- **Other**: Maßgabe des zuständigen Prüfungsausschusses

2.3 Learning Outcomes

Lernziele

Aus dem **Modulhandbuch**:

[...] Erfolgreiche Studierende *konzipieren und realisieren* kleinere und mittlere *Projekte* im Bereich der Medieninformatik. Sie wenden dazu die in der Veranstaltung benutzten *Prinzipien, Methoden und Werkzeuge* an und kennen deren Möglichkeiten und Grenzen. Die Studierenden erlernen die *Lösung komplexer Probleme in kleinen Teams*. Hierfür sollen sie lernen, verschiedene Aufgaben zu identifizieren sowie komplexe Aufgaben in handhabbare Bestandteile zu zerlegen, und ihr Projekt so zu planen, dass sie das gesetzte Ziel erreichen. Das im bisherigen Studium *angeeignete Wissen* soll von ihnen *genutzt* werden, um sich die für die Aufgabe nötigen technischen und methodischen Fertigkeiten *anzueignen* [...]

Learning Outcomes

From the **course catalog**:

[...] Successful students *design and implement* small or medium sized *projects* in the area of media informatics. They make use of *principles, methods and tools* presented and know their limits and benefits. Students learn to *solve complex problems in teams*. To do this, they have to identify different tasks and divide complex tasks into solvable sub problems. They learn how to plan and manage their projects so that they can achieve the set goal. The *knowledge accumulated* in previous courses has to be *put to use* in order to *acquire* the technical and methodological competencies necessary to solve the task at hand [...]

Course Content

From the **course catalog**:

- Requirements elicitation for multimedia systems
  - User-Centered Processes (Contextual Design, Scenario-Based Design)
- Design of multimedia systems
  - Prototypes, design methods
- Use of modern authoring tools
  - Android SDK, Arduino SDK, Livecode, gitlab, ...
- Implementation of multimedia applications
  - Java, Python, JavaScript, (angular, meteor, node), ...
- Project documentation and presentation
  - Writing a documentation and giving presentations

2.4 Course Format

Project

- Problem-based learning
- Student-focused active learning
- One project from requirements analysis up to a finished (prototypical) product
  - One larger task to be finished until the end of term or, if the group chooses so, until the end of autumn break
  - Group work in groups of 3-6 students (group size depends on size and complexity of task)
  - Topic suggestions will be made later in this slide deck
- Voluntary task if suited for the course
  - Product demos
  - Presentation of tools, methods and processes

Team Building

- Between 3 and 6 students
  - You cannot work individually, in groups of two or in groups larger than six
- Formation via topic
  - Groups of student can collectively decide on topics
  - Individual students can join groups for the topics
- If groups should get too big it is usually possible to divide them into sub-groups with independent topics
- The convener has the last word on who is in which group
  - Groups can be split or merged so they work smoothly
  - In case of problems, the convener will act as a mediator

2.5 Regulations

Admission

- The number of slots in the seminar is limited
  - Max 20 participants
  - Max 6 groups
- Admission to the course is prioritized as follows

1. Attending the kick-off meeting
2. LA Informatik because of limited choice in the run-up of the programme
3. Number of courses in the area of "Media Informatics" that have successfully been completed
4. Special circumstance (work in the university self governance institutions, parenting, ...)
5. Year of study

Exam

1. Implementation of an **artefact** in media informatics
   - Generally a software artefact
   - Other types of artefact if accepted by convener
2. **Two presentations**
   - Mid-project presentation
     - 30 minutes of presentation plus 15 minutes of discussion
     - Requirements analysis and concept done
   - End-project presentation
     - 30 minutes of presentation plus 15 minutes of discussion
     - Description of artefact and process
     - Demonstration of the artefact
3. Written **documentation**
   - Between $(15 + n * 5)$ and $(25 + n * 5)$ pages, where n is the number of group members
   - The media informatics template has to be used
     - mi.kriwi.de/templates
4. **Self-evaluation** of participants and groups

2.6 Evaluation Criteria

Evaluation Criteria

- The exam grade takes both presentations, the development process, the documentation and the implemented artefact into account
- Active participation in course discussions is required & can be part of grade
- Presentations are exams, you are required to attend
  - Exemptions must be arranged with the convener at least seven days before your presentation
  - If no exemptions have been arranged with the convener by that date, you will need proof for urgent circumstances (e.g. a certificate of incapacity for work)
- You are committed when you accept a topic and do not withdraw seven days before your mid-project presentation

English below. Die folgende Auflistung zeigt beispielhaft Bewertungskriterien für das Praktikum (Stand: April 2018). Dabei ist diese Liste als lebendige Leitlinie für die Bewertung zu verstehen: von ihr kann je nach Charakter des Praktikums auch abgewichen werden.

Vorträge	**Zwischenpräsentation**
	Lag der Umfang der Präsentation im vorgegebenen Rahmen?
	War der Vortrag inhaltlich gut gestaltet?
	Waren Foliendesign und Vortragsstil angemessen?
	Wurden rhetorische Grundregeln eingehalten?
	Abschlußpräsentation
	Lag der Umfang der Präsentation im vorgegebenen Rahmen?
	War der Vortrag inhaltlich gut gestaltet?
	Waren Foliendesign und Vortragsstil angemessen?
	Wurden rhetorische Grundregeln eingehalten?
Ausarbeitung	**Inhaltliche Kriterien**
	Hat die Ausarbeitung eine angemessene inhaltliche Breite?
	Werden wichtige Aspekte in angemessener Tiefe behandelt?
	Wird die Realisierung gut dokumentiert?
	Werden Abbildungen und Tabellen sinnvoll eingesetzt?
	Formale Kriterien
	Sind Umfang und Gliederung der Arbeit angemessen?
	Sind Mikro- und Makrotypographie angemessen?
	Sind Rechtschreibung und Grammatik einwandfrei?
	Ist der sprachliche Ausdruck angemessen?
Demo/Artefakt	**Inhaltliche Kriterien**
	Wurde das Problem vor der Realisierung gut analysiert?
	Ist der praktische Teil der Arbeit gut konzipiert?
	Wurde die Konzeption gut umgesetzt?
	Wurde der praktische Anteil ausreichend demonstriert?
	Wurde die Realisierung hinreichend evaluiert?
	Formale Kriterien
	Ist der Umfang der Realisierung angemessen?
	Ist die Qualität der Realisierung angemessen?
	Wurde ein angemessenes Vorgehensmodell gewählt?
	Wurden Methoden und Werkzeuge sinnvoll eingesetzt?
Bonus	***Teamarbeit und besondere Leistungen (Bonus)***
	Ist eine außerordentlich gute Teamarbeit erkennbar?
	Ist überdurchschnittlich gutes Zeitmanagement erkennbar?
	Wurden außergewöhnliche Hindernisse überwunden?
	Wurde auf externe Kompetenzen sinnvoll zugegriffen?

The following list shows examples for evaluation criteria for the lab course (as of April 2018). Note that this is a living guideline that can be changed if the character of the project supports that.

Presentations	**Mid-project**
	Was the length of the presentation within limits?
	Was the content of the talk adequate?
	Were slide design and style of the talk adequate?
	Was the rhetoric of the presentation adequate?
	End-project
	Was the length of the presentation within limits?
	Was the content of the talk adequate?
	Were slide design and style of the talk adequate?
	Was the rhetoric of the presentation adequate?
Documentation	**Content**
	Was the content covered in adequate breadth?
	Was the content covered in adequate depth?
	Is the artefact realisation covered in sufficient detail?
	Are figures and tables adequately made use of?
	Form
	Are length and structure of the document adequate?
	Are micro- and macro-typography adequate?
	Are spelling and grammar sufficient?
	Is the use of language adequate?
Demo/Artefact	**Content**
	Was the problem sufficiently analysed before implementation?
	Is the concept for the practical parts sufficient?
	Has the concept been implemented well?
	Was the practical part demoed sufficiently?
	Was the practical part evaluated sufficiently?
	Form
	Is the quantity of the practical parts sufficient?
	Is the quality of the practical parts sufficient?
	Was a suitable process model chosen?
	Have methods and tools been used suitably?
Bonus	***Team work and special achievements (Bonus)***
	Has the team work been extraordinary?
	Has time management been extraordinary?
	Were extraordinary obstacles cleared?
	Was external competence included adequately?

3 Dates & Times

Options

- There are two options for completing the course
  1. Complete the whole task during term time, giving the mid-project presentation in the middle of summer term and the end-project presentation in the first exam period (beginning of break)
  2. Make use of the autumn break for the completion of the project, giving a mid-project presentation at the end of term and the end-project presentation in the second exam period (end of break)
- Each group decides for themselves which option to chose
- A group that decides to complete the course during the summer term has to state this intention one week before the scheduled mid-term presentations

Meetings

- Two different types of meetings
  - Course meetings
    - Topics of interest to everyone

        - Mid-project presentations
        - End-project presentations
    - Group meetings
        - What have we done recently?
        - What are we going to do next?
        - What are the problems, where is support needed?
- Course meetings during term
    - Wednesday, 14-16 o'clock (kick-off, topic meetings) *or*
    - Wednesday, 14-18 o'clock (presentations)
    - Samelsonplatz B 148
- Course meetings during autumn break
    - See schedule for details
- Group meetings on individual arrangements
    - Group meetings can be cancelled by the group if a meeting is not needed
- *Any Conflicts?*

Dates: During Term

10.4. ▷ Kick-off, topics announced (14-16)

17.4. ▷ Topics assigned, tools lecture (14-16)

23./24.4. ◁ Group meetings

30.4./1.5. □ No meetings (labour day, group formation)

7./8.5. ◁ Group meetings

14./15.5. ◁ Group meetings (*Vollversammlung*)

21./22.5. □ No meetings (conference)

28./29.5. ◁ Group meetings

5.6. ▷ Mid-project-presentations (14-18) *Campusfest*

11./12.6. □ No meetings (project week)

18./19.6. ◁ Group meetings

25./26.6. ◁ Group meetings

2./3.7. □ No meetings (conference)

9./10.7. ◁ Group meetings

Dates: Autumn Break

Groups deciding to finish during term:

5.6. ▷ Mid-project-presentations (14-18)

17.7. ▷ End-project-presentations (12-18)

Groups deciding to work during autumn break:

5.6. ▷ Mid-project-presentations (14-18) *or*

17.7. ▷ Mid-project-presentations (12-18)

5.8. ⊠ Status report (email)

26.8. ⊠ Status report (email)

9.9. ⊠ Status report (email)

Meetings/hangouts if needed

23.9. ▷ End-project presentations (12-18)

Dates: Deliverables
Deliverables for all groups:

15.4. ⊠ Outline of own project idea (email)

9.8. ⊠ Slides mid-project presentation (PDF, learnweb)

28.10. ⊠ Project documentation (PDF, learnweb)

28.10. ⊠ Artefact (how depends on artefact type)

28.10. ⊠ Slides end-project presentation (PDF, learnweb)

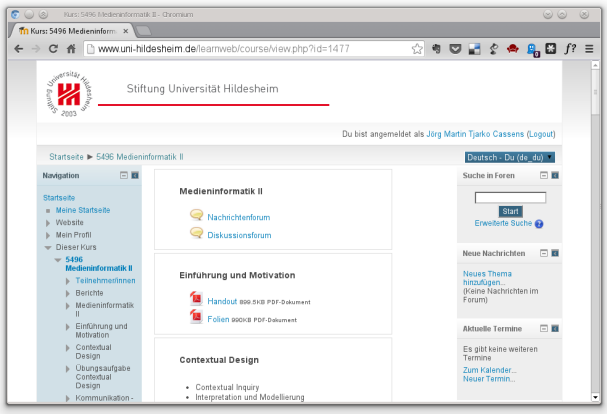
11.11. ⊠ Self-evaluation (learnweb)

11.11. ⊠ Project documentation (paper)

▷ in-person general course meetings ◁ in-person project group meetings ⊠ deadlines for online or offline delivery □ no meetings
Dates subject to change

4 Resources

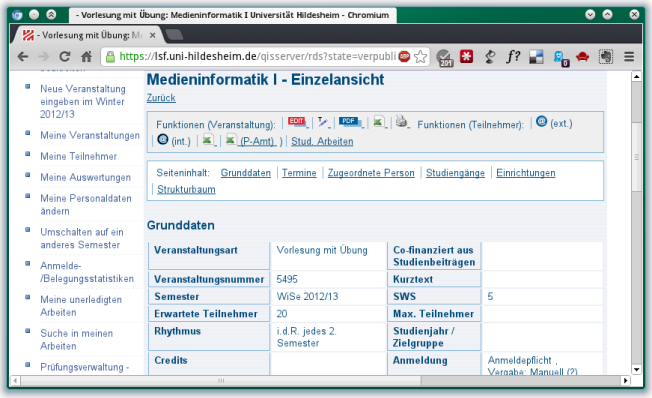
Learnweb



☞ learnweb.uni-hildesheim.de

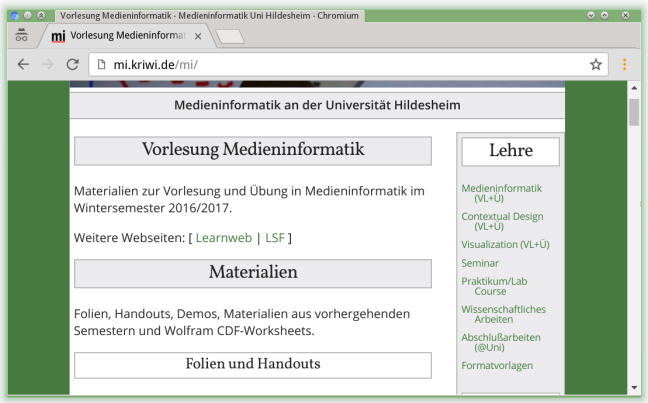
course: So19_5497_PraktMI, password: Course Number

LSF



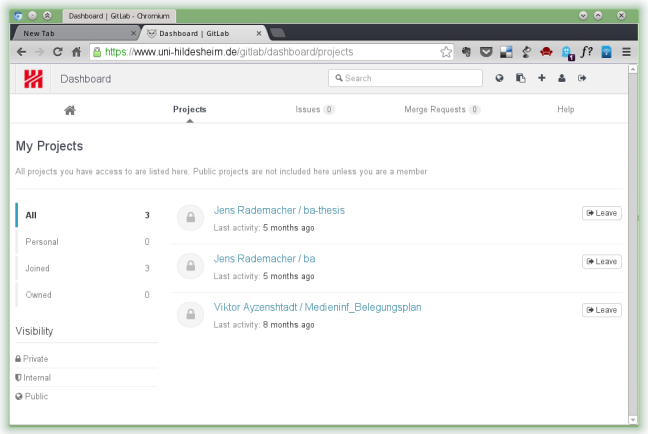
☞ lsf.uni-hildesheim.de

mi.kriwi.de



☞ mi.kriwi.de/pmi

Development Server



☞ uni-hildesheim.de/gitlab

Loan of Hardware

- You can get different types of devices from different sources
- Media Informatics
  - Embedded systems
    - Raspberry Pi, Arduino, Intel Galileo
    - Different sensors and actuators
  - Natural User Interfaces
    - 3D depth-imaging (kinect)
    - Hand gesture sensors (leap motion controller)
    - Webcams
    - Wii Remote and IR-pens
  - Mobile devices
    - Android-Tablets, Mobile phones
    - Windows Mobile, Blackberry OS
- Media technology by the University
  - Camera
  - Tripods
  - Microphones
- To a limited amount, we can purchase new devices

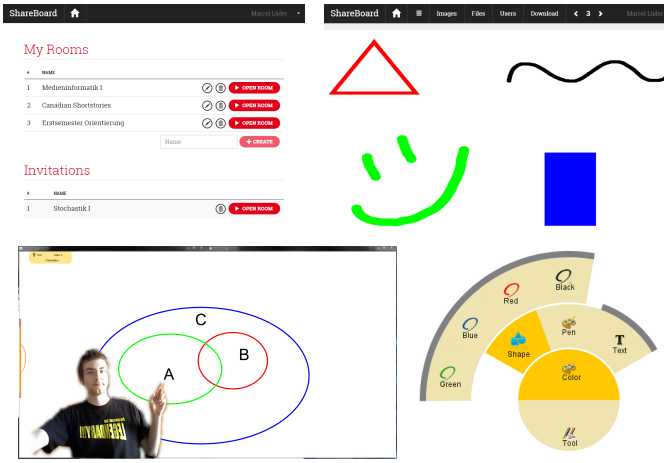
5 Projects

Project Outlines
In the following, I am going to introduce a number of possible project topics.

Caveat
All ideas for projects are "underspecified" – what could or should be implemented depends on on how many of you commit to the different projects. It also depends on the competencies you bring into the project. Every project idea can be expanded as well as reduced. Not every project is suited for all group sizes, though. It does not make sense to let 6 people build an Arduino-based RFID scanner.

5.1 ShareBoard

ShareBoard: Examples



ShareBoard: Status

- **What has been done before?**
  - First implementation (lab course)
  - 3D-Gestures (large lab course)
  - Diverse enhancements (Concept Maps, handwriting recognition, video chat; projects and bachelor theses)
  - User-Avatars with depth keying (bachelor thesis)
  - HTML5-Version (bachelor and master theses)
  - Analysis of group behaviour when using ShareBoard for planning tasks (bachelor thesis)

Technologies used
Java, C#, sensors (kinect), web technologies

ShareBoard: Topics

- **Further development of web-version (ShareBoardJS)**
  - Starting from existing master thesis
  - HTML-based, works out-of-the-box in the browser
  - Uses angular.js and meteor.js
- **Communication**
  - Video and Voice
  - Support meetings, brainstorming, etc.
- **Natural Interaction**
  - Supporting multi-modal interaction

  - How do people interact with whiteboards?
  - e.g. recognizing different situations and adaptation of the ShareBoard (context)

Suggested technologies
Sensors (kinect, leap), web technologies

ShareBoard is an electronic whiteboard to support collaborative processes, especially when creating sketches and other drawings. It can be used both locally and connecting remote locations. It can be operated with touch displays, pens on digitizers, video projectors with infrared pens and Wii remotes or with mouse and keyboard. The use of 3D gestures (kinect) is also possible in the Java-version.

- **ShareBoardJS development:** Based on the experience gained with the previous Java implementation, ShareBoard was re-implemented using HTML5 technologies (including, but not limited to, node.js, meteor, angular). Through the development of the Java variant, valuable experience has been gained, above all, various features have been tested and accepted or rejected by users. ShareBoardJS currently does not have feature parity with the Java ShareBoard (and not all features will be ported). So this project offers the chance to build on an existing wealth of experience while creating a new codebase. Many of the required components are in the form of JavaScript libraries that need to be linked in an innovative way.

- **Enhanced communication:** The existing web version can be updated to include new or improved functionality, e.g. be extended in the area of video or audio chat or in support of meeting situations.

  One possible focus of this project is to support the audio-visual communication of various participants in a meeting. For the Java version, a solution has already been developed that uses its own streaming server to distribute video streams to the participants.

  This work is not necessarily just about displaying an image in a window. For the Java ShareBoard there has e.g. been a version working with a depth-camera, which removes the background of participants standing in front of the whiteboard. At the remote site, this section can then be displayed in front of the actual drawing area, which allows a more natural interaction of the conversation partners. It would be necessary to investigate in which form a similar solution can also be introduced in the JavaScript ShareBoard. So this topic leads directly to the following topic.

- **Natural interaction:** One goal with ShareBoard is to transfer the natural interaction with physical whiteboards to electronic whiteboards. First of all, you have to examine how people in different situations work with (electronic) whiteboards, and then design solutions for the ShareBoard and implement them prototypically.

  There are very different situations that can be covered (for example, a person uses the whiteboard to explain something to a group of listeners vs. a group uses the whiteboard to sketch something collaboratively). Differences between local and remote interaction may also be discussed (e.g., what modalities should be transmitted (voice, facial expression, gesture), and how can this be done).

- **Cross-Device Interaction:** Integration of ShareBoard with other devices should be improved. For example, one could transfer pictures on a mobile phone to ShareBoard with simple gestures, without having to go through complicated configuration steps. There could e.g. be a location-dependent integration. Preliminary work can be used for this project, both internal (LADI location-aware device integration) and external (Hoccer data sharing).

5.2 Academic Writing

Academic Writing: Status

- **What has been done before?**
- Supporting academic text production (master thesis)
  - That could be you writing your next assignment, documentation, thesis
- Web-based system
  - Text-repository
  - Upload your own text in different formats
  - Preliminary analysis
    - Categorization, keywords

        * Statistics (Wordcount)

Technologies used
Web technologies, web2py, NLP-tools

Academic Writing: Topics

- **Supporting academic text production and reception**
- Building on top of the existing pipeline
  - Text-repository
  - Upload own texts
    * Further analysis
  - Upload and analyse text you work with (references etc.)
  - Comparison with other texts
  - Visualization of key aspects
  - (Online-) support for the writing process
    * Finding other relevant texts
    * Support for citations
    * Citation management

Suggested technologies
Web technologies, web2py, NLP-tools, machine learning

The idea behind this system is to help students (and educators) to write texts or create and edit tasks. It should be possible to upload your own text to a web service and have it analysed. Another option would be to use a web-based text editor from the outset. In the ideal case, this would also support simultaneous use by several authors of the same document.

Such analysis of written texts starts with an analysis of word frequencies (without stopwords), can support spelling, expression or grammar, and can lead to content analysis using natural language processing (NLP) techniques.

The results of such an analysis should be presented to the user in an appealing form. The upload of the text should be possible in various formats that are internally translated into a suitable format. For this purpose, appropriate libraries can be used.

A goal is to create a repository of texts (or a corpus), and to allow comparisons between your own text and other texts. This can help to assess one's own work in relation to other work (use of foreign or loan words, grammatical or content structure).

Furthermore, the uploaded text (or text created online) can be analysed to give the writer hints to make use of further literature, and to make this literature directly accessible if necessary. The research process can be supported in a variety of ways.

The product to be created has a variety of possible applications in the context of individualized, personalized learning and teaching, (self-organized) group work at universities and the like.

A first prototype based on web2py has already been created during a master thesis. This tool implements an NLP pipeline that performs initial analysis on user-uploaded text. These include e.g. simple statistics (word and sentence count), an assessment of legibility (using established formulas), the tagging and categorization (using thesauri and web services) as well as the recognition of citations (but only in APA style). You can start from this prototype and save yourself from the time-consuming creation of basic functions, meaning you can start with the "interesting things".

On the one hand, the prototype can be extended by completely new functions (support for citations, integration of (contextualized) search options, content and stylistic analytics, reference management of literature read and automatic suggestion of suitable citations). On the other hand, in the very modular pipeline, individual elements can also be exchanged and replaced by better methods. Semantic web technologies can also significantly improve the tagging and categorization.

5.3 Lecture Project

Lecture Project

- **The Lecture Project**
  - Suppose you have a system helping you understand lectures...
  - Automatic recognition of important aspects of lectures from video
  - Contextualised query-based summarization
- **Early stages of project, big opportunities**
  - You might like to look at live behaviour tracking
    - or the corpus of videos
  - or you might like to look at acoustic cues for importance
    - Emotion detection, affective computing
  - or you might like to look at language modelling
    - linguistic models, NLP
  - *Cooperation with ongoing master thesis possible*

Suggested technologies
Web technologies, multi-modal analysis, NLP-tools, machine learning

This is a comparably new field of research in Media Informatics in Hildesheim, in cooperation with partners from other universities. There is a lot of creative freedom to incorporate your own ideas.

The ultimate goal is to give students and teachers the opportunity to interact in smarter ways with video and sound recordings as well as scripts and slides from a lecture (or other talk). Thus, a system is to be created in which the materials for the event are not only available in a linear fashion or with predefined entry points. Instead, it should be possible to access the content of the event via contextualized searches and automatically generated summaries of key content.

Human communication is always multimodal and multicodal. Lots of information is not (only) exchanged through speech, but through gestures and behaviour. This also applies to the behaviour of lecturers. Changes in intonation or volume, gestures and also the use of keywords indicate new sections or central statements.

In a first step, these "multimodal cues" are to be recorded and evaluated in order to automatically segment the lecture and to find a central statement. In a second step, methods of automatic text generation are used to create summaries or similar.

There are a lot of different sub-projects that can help with this project. One could for example make use of established image and video processing or audio processing techniques to detect these cues. There is a whole range of methods, for example from emotion recognition, that can be used.

Anyone interested in natural language processing (NLP) may e.g. look for transcriptions of lectures for cues. Anyone interested in gesture recognition can search the video footage for gestures.

Even those who are interested in hardware can find projects. How about an automatic camera that tracks speakers in space, or uses a 3D depth camera like the kinect to detect gestures?

5.4 Adaptive Learning Platform

Adaptive Learning Platform

- **Research & develop a new adaptive learning platform**
  - Not just talking heads
  - Adjust to needs and preferences of users
  - Use sophisticated learning analytics to support the users
    - students
    - teachers
- **Application Area**
  - Computer science curriculum for teachers
  - Language learning
- *Cooperation with an external partner possible*

Suggested technologies
Web technologies, nlp-tools

Every teacher wants to provide their students with an individual and personalised learning experience, but this can be difficult with class sizes growing. I am sure you have been in a class where you were bored and other people were struggling to keep up.

Adaptive learning platforms provide an environment for teachers to create content that meets the needs of all students no matter where they are in their learning development. The core components of an adaptive learning platform are:

- The ability to identify students as individuals rather than homogeneous groups,
- The ability to employ "branching" statements to provide each student with the right level of material for their individual level, and
- the ability to blend content with challenges.

Adaptive learning platforms are nothing new and have been known under many different names, from intelligent tutoring systems to e-learning platforms.

The goal of this project is to explore the state of the art and classify different adaptive learning platforms available and to develop a prototype platform that can be extended for use in many different content areas, like computer science or language learning.

One challenge is to integrate modern theories of learning with an adaptive, smart (intelligent) system to guide the user, and all that in "nice packaging", for example a modern web-based application. Another challenge is the technical side, where such a system would ideally integrate in existing infrastructure. The third challenge is to make such a system modular and adaptable to different courses.

We want to avoid boring online-courses which only exists of talking heads and slides, but engage the student and give him or her the feedback needed to improve the learning process.

5.5 Privacy-respecting Learning Analytics

Privacy-respecting Learning Analytics

- **Research & develop a anonymous learning analytics**
  - Use sophisticated learning analytics to support the users
    - students
    - teachers
  - Make it possible to do so by preserving privacy
    - Virtual IDs for students and institutions
    - Privacy-preserving attendance tracking
- **Application Area**
  - University or school courses
- *Cooperation with ongoing bachelor thesis possible*

Suggested technologies
Sensors, actuators, web technologies, nlp-tools

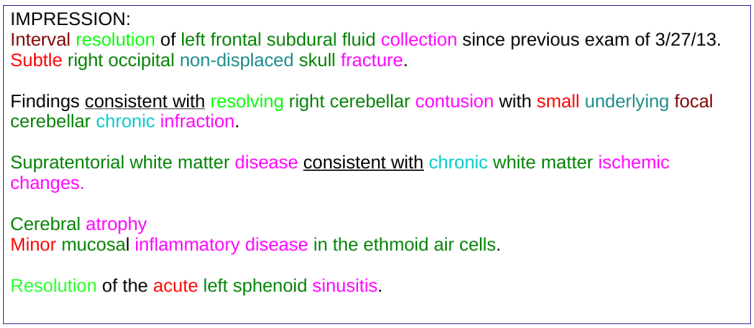
Learning analytics can be extremely helpful for learners in developing new skills and increasing their knowledge, but they are also very invasive in terms of privacy and security. From the institutional perspective, institutions that provide training need access to information about learning to ensure that they are providing top quality services and actually improving learning outcomes. As an individual, you don't want institutions to know everything about you and your individual learning progress.

The goal of this project is to provide the necessary analytics to individuals and institutions without compromising the privacy and security of individual learners or allowing the potential for linking information such as grades and learner behaviour that individuals may want to keep private. The challenge in this project is to take two very different perspectives on the same data and to respect and realise the needs of both perspectives.

There are many different sub-projects that can contribute to this project including: the creation of secure virtual identities, the linking of virtual identities with physical behaviour, the creation of group and institutional identities, transient identities e.g. group work in classes or team behaviours etc., learning analytics and visualizations, data aggregation and visualisation, and data management and security. Anyone interested in data management, data security, data analytics or data visualisation will find interesting projects within this area.

5.6 Visual Annotator

Visual Annotator: Example



- An annotator allows to mark, classify and annotate segments of texts (sentences, words, groups of words)
- Annotators are a basic tool for linguistic research

Visual Annotator: Topics

- **Build *the* collaborative online annotator**
- Existing systems are restricted in the models that can be used and in usability
- In particular, there is a need for a web-based tool that allows for group collaboration
- The envisioned tool should also make it easy to annotate large corpora of texts
- Combination with machine learning tools is possible
- *Cooperation with an external partner possible*

Suggested technologies
Web technologies, front-end development, machine learning, nlp-tools

An annotator for written text allows parts of a text to be marked and tagged, e.g. to show the text structure ("this is an object") or to clarify different speech acts ("this is a question") or communicative goals ("this acts as an explanation"). Such annotated texts are on the one hand of interest in linguistic research, but on the other hand have a high application potential. In particular, they provide the gold standard and training set for machine learning tools that automatically classify (parts of) texts later.

Such a tool should make it possible to annotate a large number of texts (possibly simultaneously and mechanically supported), to ensure the congruence of the annotations, and to ensure access to annotated texts. A proprietary system with similar, but limited functionality has e.g. been successfully used to develop an automatic classification of medical diagnoses. Here, reports from radiologists were examined to see whether the description of medical images were describing cancer, and if so, of what kind. Radiologists do not themselves write a diagnosis, which is reserved for the treating physician, but describe the images in a way hinting towards certain diagnoses. The text needs to contain enough information for the physician to decide whether it is cancer, but the classification information is somewhat hidden. A relatively small number of texts were manually annotated, and these annotations then served to train machine classifiers.

Work on such a annotator is ongoing, and some preliminary results exist. However, what would really be a big leap forward is to integrate the annotator and the machine learning. Right now, both are separated, but it would be very helpful to be able to annotate a certain portion of a text corpus, then do some machine learning on the annotated data plus automated annotation of the rest of the corpus. A human user could then examine the quality of the classifier learned to see whether (and where) to extend the manually annotated corpus.

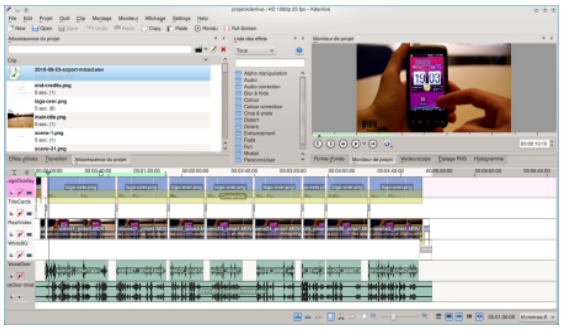
A field of application of such a tool would be e.g. system to support learning and writing processes. Furthermore, such a tool can greatly simplify the work on the "Lecture Project".

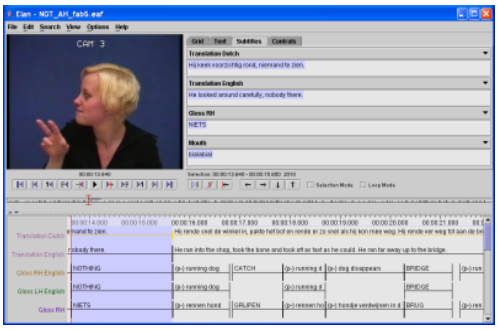
5.7 Video Concordancer

Video Concordancer

- Video Concordancer
  - Several videos from field or lab studies

- Finding & comparing videos
- (Synchronous) annotation of videos
- Multi-modality
- *Cooperation with an external partner possible*





Suggested technologies
Web technologies, front-end development

Particularly in linguistics, psychology, educational disciplines and the social sciences, but also in human-computer interaction research, observations or empirical field studies are often carried out with the help of video recordings.

For further work with this type of data, it is necessary to annotate the existing videos, e.g. with information about the plot, linguistic means used, the topic of the situation or similar.

Existing video annotation tools often have one or more disadvantages, such as:

- The tools can often work with only one video stream, but not multiple synchronized videos.
- Support of multimodality, that is the annotation of other forms of interaction than speech (facial expressions, gestures), is often inadequate.
- Collaboration and collaboration of various annotators is poorly supported technically.
- And perhaps the crucial problem: The linking of video sequences that are related (for example, the linking of different sequences in which the same communication means or targets appear) is insufficiently resolved (concordance).

The tool to be developed has the potential to be widely used in applied research for the development of so-called corpora.

5.8 Behavioural Interfaces

Star Trek Doors

Our Doors

Built as part of the Masters thesis of John Sverre Solem

Behavioural Interfaces: Status

- **What is it?**
- Behavioural Interfaces are interfaces that recognize and model user behaviour
- Can be used for e.g. intention recognition
  - Example star trek doors: automatic doors that do not open based on proximity (alone), but because they recognize the users' intentions to walk through the door
- **What has been done before?**
  - Sliding Doors (2 Master Theses)
  - Recognition of "Wandering behaviour" with Alzheimer's patient (Bachelor Thesis)

Technologies used
Java, reasoners, sensors (kinect)

Behavioural Interfaces: Topics

- **Doors, whiteboards, lectures, Smart Rooms...**
- Possible applications
  - Star-Trek-Doors 2.0
  - Other
    - ShareBoard intention recognition
    - Connections to other topics mentioned (lecture project)
- *Cooperation with an external partner possible*

Suggested technologies
Embedded systems, sensors (kinect), reasoning, machine learning

Human communication is always multimodal and multicodal. Lots of information is not (only) exchanged through speech, but through gestures and behaviour. For example, the distance between two persons (in a given context and in a given cultural environment) often tells a lot about the social position of the persons to each other. Friends tend to be closer together than supervisors and employees.

Especially in the field of ambient systems, but also e.g. in robotics or traffic engineering, it makes sense to recognize and model the behaviour of human actors. One of our examples are the above-mentioned "Star Trek Doors": these are not opened simply by the proximity of a person, but because the pattern of movement of the person communicates the intention to go through the door. In this case, surprisingly few parameters are necessary to make a first 'educated guess' about the communicated intention – in the case of the door, this was hip position, shoulder position and speed vector or its change over time.

In such a project, on the one hand, the result of the "Star Trek Doors" can be reproduced, on the other hand, other situations can be examined to see how human activities can be identified and modelled. Is it e.g.

possible to deduce the activity taking place in a meeting room – meeting or lecture – from the arrangement of persons and, if necessary, to control the light accordingly? In Ambient Assisted Living environments, are yoga exercises distinguishable from falls? Is it possible to draw conclusions from the movement pattern of Alzheimer's patients, e.g. whether the person in question is just wandering around aimlessly (a typical disease pattern) or whether the movements are purposeful?

Ideally, the results should again be used as input to other (ambient) systems, e.g. CAKE to enable better context modelling, or to expand the functions of ShareBoard in terms of situational awareness.

5.9 Ambient Systems

Ambient Systems: Example

Context Awareness and Knowledge Environment
Mate for Awareness in Teams

Ambient Systems: Status

- **What has been done before**
  - Server and protocols (case study)
  - Different actuators and sensors (lab course)
  - Simulator CASi (lab course)
  - Basic version in Python (Bachelor Thesis)

Technologies used
Java, reasoning

Ambient Systems: Topics

- **Architecture**
  - Integration of Machine Learning and Reasoning
  - PyCAKE and CAKE could act as starting point
    - or fresh start
  - new sensors and actuators
- **Applications**
  - Adaptive museum guide
  - Ambient assisted living (AAL)
  - Privacy respecting (Py-) CAKE in a Box
  - Modelling, learning and reasoning

Suggested technologies
Java, Python, embedded systems, sensors (kinect, Leap), reasoning, machine learning

- **Intelligent (Py-) CAKE:** The existing CAKE and PyCAKE environments both provide the foundation for integrating various methods of knowledge-based reasoning and machine learning. A major task in this area would be to analyse the capabilities and limits of the existing architecture in order to further build on top of them. Both systems currently have a kind of rule-based reasoning systems, and inclusion of case-based reasoning could be an option for those who are interested in CBR. Integration of other machine learning methods for online updates could also be helpful.

  An exciting topic would be end user programming, so how can the end users of ambient systems be enabled to implement their own rules or knowledge. The bandwidth ranges from simple rule editors as they are e.g. "if this then that" (ifttt.com) to "Programming by Example" (something is shown to the system, and the knowledge base and reasoning is adapted to fit those examples).

  Depending on the size of the group, the integration of sensors and actuators as well as their design and implementation can be part of the project. Embedded systems platforms (Arduino Uno, Arduino Nano, Raspberry Pi) are available in sufficient numbers to test various ideas for interacting with ambient, disappearing systems. Other devices, sensors, "shields" and the like can be purchased on demand. Therefore, this project is also interesting for those who want to make hardware components themselves.

- **New application area:** Concept for and implementation of a CAKE-based system for new application areas, such as an adaptive guide for museums, home automation or ambient assisted living. Depending on the size and interest of the group, work in the area of sensors and actuators as well as the AI components could be part of the project.

- **CAKE in a Box:** Personal CAKE environments on the Raspberry PI, plus a suitable application scenario. Individual users of the system can set up their own CAKE environments in the existing CAKE system. This eliminates the need to pass on potentially sensitive sensor data (location, meetings with other people) to a central service. Individual CAKE environments can be linked together, e.g. to inform family members or friends about own activities. The middleware for this functionality exists, although it might need updating, but it would be nice to be able to offer CAKE-like environments on a Raspberry Pi with simple install and configuration options.

  Ultimately, it should be possible to set up an ambient system in simple steps: inserting an SD card into the Raspberry, mounting sensors and actuators, and installing the necessary software from an 'app store'. The application logic, or AI component, should be adaptable by the end users. The project "CAKE in a Box" is supposed to help reach this vision.

  PyCAKE is explicitly designed with the Raspberry Pi as the target platform. If this CAKE variant is chosen, usability and user experience would be central (the existing system can only be used from the command line).

5.10 ExRAI

Explainable and Responsible AI: Topics

- Not so much an topic on its own as a perspective on the other projects
- A lot of the topic areas include machine learning and artificial intelligence components
  - e.g. learning analytics, writing support, ambient systems
- This is about accountable, responsible, transparent, explainable systems
- Possible focus areas could include
  - (Multimodal) explanations of system behaviour
  - Dialogical aspects of explanation
- *Cooperation with ongoing master thesis possible*

Suggested technologies
Artificial intelligence, machine learning, nlp-tools, web technologies

Explanations are important vehicles to convey information between communicating agents in everyday interaction. They enhance the knowledge of the participants so that they accept certain statements and gain a better understanding of the actions and motivations of the other agents involved. Explaining behaviour and reasoning increases perception of competence and integrity, building trust and confidence, the currency of social group formation.

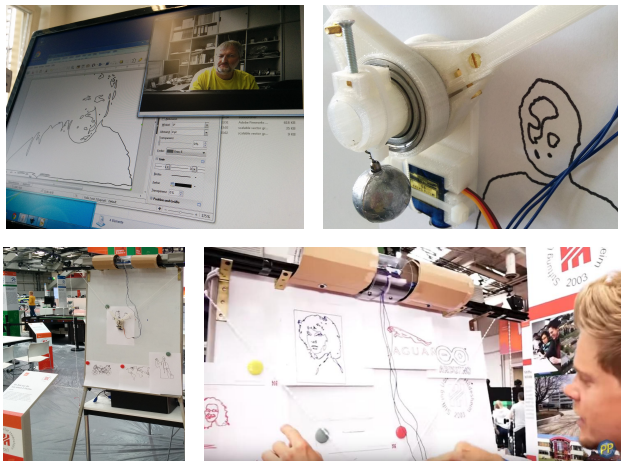
In Artificial Intelligence, the term explanation can be interpreted in two different ways. The **internal view** deals with explanation as *part of the reasoning process itself*. For example, a recommender system can use domain knowledge to explain the absence or variation of feature values, e.g. the relation between Scandinavian countries. The **external view** is about *giving explanations of the found solution, its application, or the reasoning process to the other actors*. For example, said recommender system tells the user why an apartment in Norway was suggested despite the user asking for one in Sweden.

Most of AI currently sees explanations as a relatively uniform and definable concept, largely on the system side of development. This means that they see explanations as monologic. But if we want explanations, they need to be the right one. With people, we can draw on social group membership, shared social history, behaviour, shared values etc. With AI, we do not always have those options available so we need other options to understand and generate explanations. Our question here is: can we make use of established models to do so?

This is not so much a topic on its own, but a perspective on other topic suggestion. Can we for example use an explainable system in the lecture project that does not only tell a student what important parts of the lecture are, but why they are important? Can we have an intelligent tutoring system or learning analytics that tells the student why it assesses the student's performance in a specific way?

5.11 Interactive Exhibit

Interactive Exhibit: Examples



Interactive Exhibit: Status

- **What has been done before?**
  - Photo booth
    - An application uses depth-keying to identify a person
    - A raster image is saved
    - This image is converted to svg
  - V-Plotter
    - Plotter made of Arduino, Raspberry, motors & servos
    - Can draw svg on paper
  - Bandit Grendel
    - Mobile Game "Cops and Robbers"
    - Cops on the street, robber at home

Technologies used
Java, C, sensors (kinect), embedded systems, web technologies, mobile devices

Interactive Exhibit: Topics

- **Further development of existing exhibit**
  - Automation or better support of existing workflow
  - Better plotter
  - Integration of 3D-modelling
  - Balancing and enhancing the gameplay
- **Something else that is exciting**

Suggested technologies
Sensors (kinect, leap), actuators, web technologies, mobile devices

The PhotoBooth is essentially a depth image camera, similar to the Kinect for the Xbox game console. Such a camera takes two pictures: a normal colour image, and a so-called depth image. The depth image stores how far the individual parts of the colour image are from the camera. One can then do some nice things, e.g. the outlines of people can be recognized and the background hidden. With the PhotoBooth, you can see a deep picture without a background of yourself.

This resulting raster graphics image is then manually converted into a vector image, using a technique called tracing. Tracing tries to identify vectors in the image, for example lines of similar luminance or chrominance. The resulting vector image is then converted into a svg suitable for the second component. We use inkscape and libreoffice for these conversions.

The V-plotter is a line graphics plotter. A plotter differs from a printer in that it draws the individual lines one after the other instead of putting them together as one line at a time. In a V plotter, the "printer" is made of a servo-controlled pen that is connected in a triangle (inverted V) to two step motors. Our V-plotter consists of a few off-the-shelf electronic components. It is a Raspberry Pi microcomputer and an Arduino microcontroller plus driver ("shield") for motors and servos. The other mechanical components are printed on a 3D printer.

Bandit Grendel is a mobile phone version of "Cops and Robbers", where one player plays the (virtual) robber and moves him around on a map and the cops have to go out onto the streets and try to come close to the robber, using hints like barking dogs.

A project in this area could either improve on the existing system, e.g. by better workflows, or you could come with totally new and cool solutions for interactive exhibits. This project has strong ties to arts and design and to walk up and use systems.

5.12 BYOI

Bring Your Own Idea

- New applications based on your interests and competencies
- From requirements analysis to finished prototype
- Challenges:
  - Find and express ideas
  - Match my own competencies to ensure sufficient supervision
  - Choosing appropriate tools
- How to do it
  - You think about your project idea in a group
  - *You write a one-page outline with a scenario on what the application will look like and send it to me next Monday evening at the latest*
  - I will evaluate your proposal
    - Does it fit this course?
    - Am I able to supervise it?
    - Does it have an appropriate size (not too big, not too small)

Topic Overview

1. ShareBoard
2. Academic Writing
3. Lecture Project
4. Adaptive Learning Platform
5. Privacy-respecting Learning Analytics
6. Visual Annotator
7. Video Concordancer
8. Behavioural Interfaces
9. Ambient Systems
10. Explainable and Responsible AI
11. Interactive Exhibit
12. BYOI (please elaborate)

6 Discussion & Attendance

Attendance List I

Please fill in the forms that are being handed out

- If more than 20 people want to take the course the priorities defined earlier will be used
- Two types of lists
  - Several lists for groups
    - Please specify the time slots we can use for group meetings
    - You can specify up to 3 preferred time slots
  - One list for attendants without group preference yet
    - Use to mark your intent to take the course
- Groups have to be formed at the next meeting at the latest
- You can join any group where space is available
- If groups get larger than 6 they will be split

Attendance List II

MI	Medieninformatik course taken
Seminar	Seminar Medieninformatik taken
CDIS	Contextual Design of Interactive Systems passed (previously Medieninformatik II)
Vis	Data & Process Visualization passed
AmI	Attending Contextualised Computing & Ambient Intelligent Systems
AI	Angewandte Informatik
DA	Data Analytics
IMIT	IMIT ☺
LA Inf	Lehramt Informatik
WIN	Wirtschaftsinformatik
Other	Other program (please specify)

Group Allocation

Phase 1: Own ideas

1. You give an outline of an idea, it gets added to topics

Phase 2: Elimination

1. You vote for any topic you would be willing to do
   - You have as many votes as you like
2. Eliminate topics with less than 3 votes

Phase 3: Formation

1. You vote for the topic you like the most
   - You have one vote, signified through a Post-It
2. If you are in a group with less than 3 members
   a) Try to convince others to join
   b) If still less than 3, join another group
   c) Repeat till no group has less than 3 members
3. If there a more than 6 groups with 3-6 primary members each
   a) Eliminate topic with least interest (draw = coin toss)
   b) Repeat till max 6 groups, all with 3-6 members