

Affective User Research & Human-AI Interaction

Seminar Summer 2024, Karlsruhe Institute
of Technology

Dr. Ivo Benke, BioNTech

Dr. Lennard Schmidt, Google



This image was created with the assistance of DALL-E 2

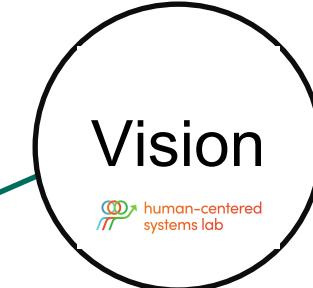
The human-centered systems lab (h-lab)



Designing human-centered systems for better work & life

The human-centered systems lab (h-lab)

Mission & Vision



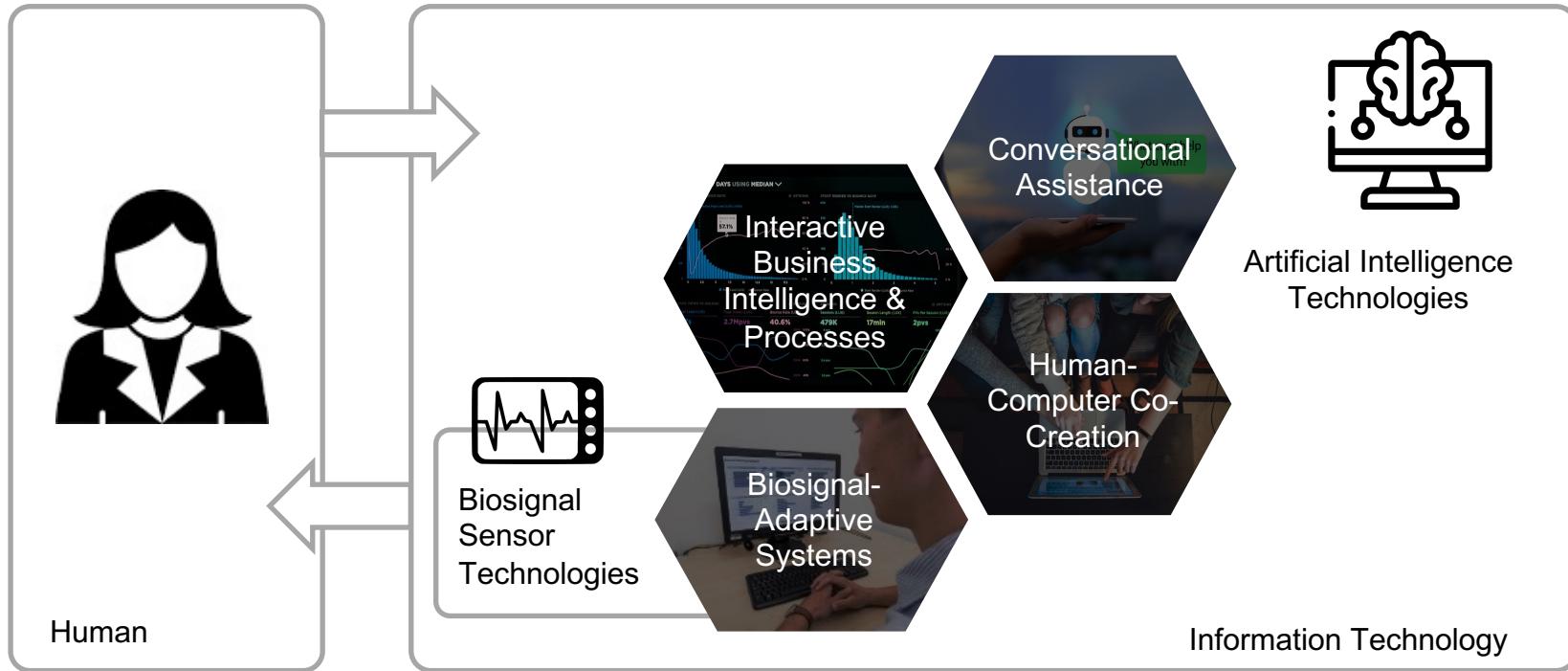
We enable better work & life through
human-centered systems

- We create impactful knowledge for **designing human-centered systems** enabling productivity and well-being through relevant and rigor scientific research.
- We leverage state-of-the-art **AI and biosignal sensor** technologies and follow a **socio-technical** research paradigm to contribute to the fields of **human-computer interaction** and **information systems**.



The human-centered systems lab (h-lab)

Research Fields



The human-centered systems lab (h-lab)

Research Teams



Our Research Project Partner Network



Co-Innovation with Students: Working on real-world & relevant problems

- Application of **methods, techniques & tools** for designing human-centered systems
- Lectures are accompanied with a problem-solving-oriented **capstone design & engineering team projects**
- Student work on real-world problems as part of **design-oriented seminars** and **team projects** to deliver solutions



Our Teaching Offerings

	Winter Semester	Semester-independent	Summer Semester
PhD		Biosignal-based Adaptive Systems Design Science Research	
M.Sc./ B.Sc.	HCS - Human-Centered Systems Seminar: Engineering / Research	Thesis Project & Colloquium FORES: Foundations of IS & HCI Research	DCS - Digital Citizen Science Seminar UAS - User-Adaptive Systems Seminar HCS - Human-Centered Systems Seminar: Engineering / Research
M.Sc.	EIS - Engineering Interactive Systems: AI & Wearables BIS - Business Intelligence Systems	Practical Seminar	DIS - Designing Interactive Systems: Human-AI Interaction
B.Sc.	EFA - Enterprise Systems for Financial Accounting and Controlling BWL Wirtschaftsinformatik (B.Sc. Industrial Engineering) WI I - Wirtschaftsinformatik I (B.Sc. Information Systems)	Practical Seminar	FOIS - Foundations of Interactive Systems WI II - Wirtschaftsinformatik II (B.Sc. Information Systems)

■ 3 ECTS (Seminar Module)

■ 2,5 / 4 / 4,5 ECTS (Lectures)

■ Engineering Capstone Project

■ Design Capstone Project

Cooperation with Transfer Institutions



NUTZERZENTRIERT
ENTWICKELT 

Das Siegel ✓ Wissen ✓ Fallbeispiele Team UIG e.V. Kontakt 

Nutzerzentriert Entwickelt

Das Siegel für Nutzerzentrierte digitale Produkte

Ihr entwickelt und verkauft ein digitales Produkt? Entspricht das Produkten den Anforderungen und Wünschen eurer Nutzenden? Begeistert und bindet es eure Nutzenden an euch? Egal, wo ihr gerade steht, wir begleiten euch auf dem Weg zu einem nutzerzentriert entwickelten Produkt – entlang aller Schritte des Prozesses!

[Benchmark Nutzerzentrierung](#) 

[Beratungsgespräch vereinbaren](#) 



<https://nutzerzentriert-entwickelt.de/>
<http://usability-in-germany.de/>



Scholar-ships  DIE
WIRTSCHAFTSINFORMATIK



Ausschreibung: Wirtschaftsinformatik-Stipendium 2023/24

Die Wirtschaftsinformatik e.V. bietet ein Stipendium für Bachelor- und Masterstudierende des KIT-Studiengangs Wirtschaftsinformatik an, das von der Schwarz IT KG finanziell unterstützt wird. Das Stipendium läuft 12 Monate und beinhaltet eine monatliche Unterstützung von 300 Euro. Drei Stipendien werden für den Zeitraum 2023/24 vergeben. Interessierte Studierende können ihre Bewerbungsunterlagen bis zum 30. Juli 2023 (17 Uhr) an wistipendium@wirtschaftsinformatik.de senden. Prof. Dr. Alexander Mädche steht für Rückfragen zur Verfügung.

Zukunft digital
gestalten

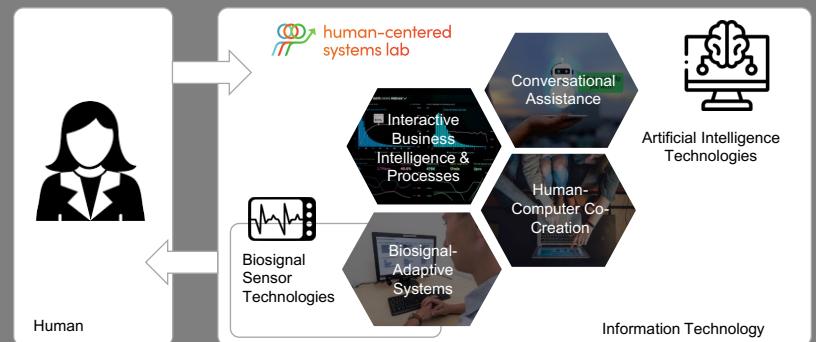


<https://www.wirtschaftsinformatik.de/>



Prof. Dr. Alexander Maedche

Karlsruhe Institute of Technology (KIT)
Human-Centered Systems Lab (h-lab)
Research Group Information Systems I
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alexander.maedche@kit.edu
<http://h-lab.iism.kit.edu>



Affective User Research & Human-AI Interaction

Seminar #0 Part: Organization

Dr. Ivo Benke, Dr. Lennard Schmidt



Introduction – Dr. Ivo Benke

Roles:

- **Since 2023:** Associate Director Analytics & AI Projects at BioNTech SE
- **Since 2021:** Lecturer at Karlsruhe Institute of Technology and University of Applied Sciences Pforzheim for Data Sciences
- **2022 - 2023:** Postdoctoral Researcher & Research Team Lead for 'Emotion-adaptive Systems for Work & Learning' at Human-centered Systems Lab



Education

- **2022:** Visiting Research Technion Israel Institute of Technology, Israel
- **2018 - 2021:** Ph.D. Information Systems, Karlsruhe Institute of Technology (KIT)
- B.Sc. & M.Sc. Industrial Engineering ("Wirtschaftsingenieurwesen"), KIT
- Research interests: Human-AI Interaction and Biosignals and Wearables
- Why do I teach a seminar on Affective User Research and Human-AI Interaction?
 - Interest in human interaction with generative AI tools and assistants
 - Understanding and development of underlying concepts and theories
 - Quantitative exploration of user experience and behavior

Introduction – Dr. Lennard Schmidt

Roles

- **Since 2022:** Senior Quantitative UX Researcher at Google
- **Since 2019:** Teaching assignments at ESCP Europe, Berlin, Management Development Institute, India and HHL, Leipzig
- **2020-2022:** Postdoctoral Research Associate at the chair for Marketing and Innovation Management at Brandenburg University of Technology



Education

- **2019-2020:** Visiting Researcher at Alliance Manchester Business School
- **2016-2020:** PhD in Quantitative Marketing at HHL Leipzig Graduate School of Management

Research interests:

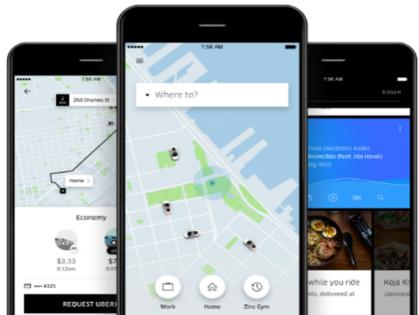
- Complex systems, Design systems, Causality

Agenda

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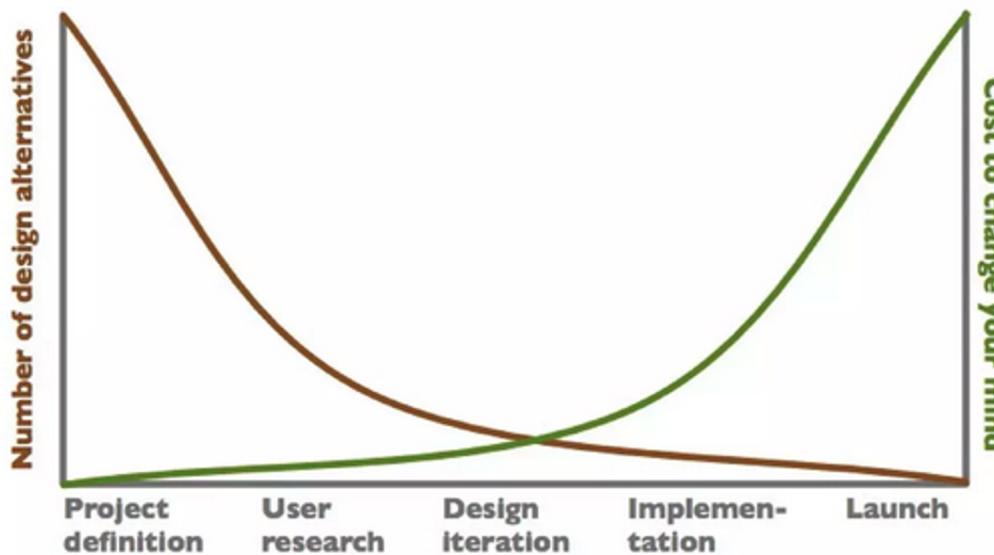
Interactive Systems strongly impact all areas of life ...



Why understanding the user matters...: Transforming digital Interactions

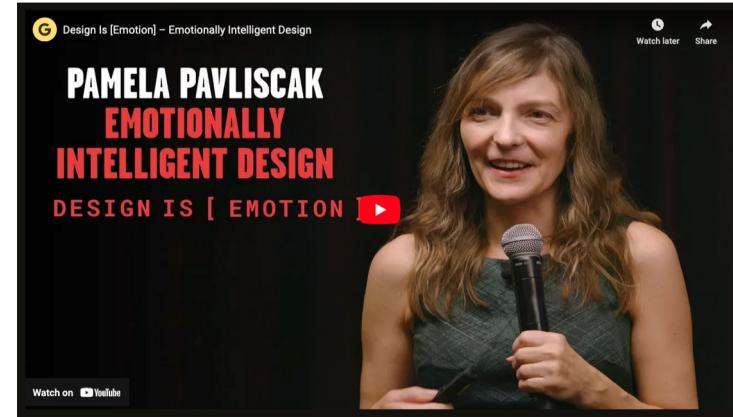
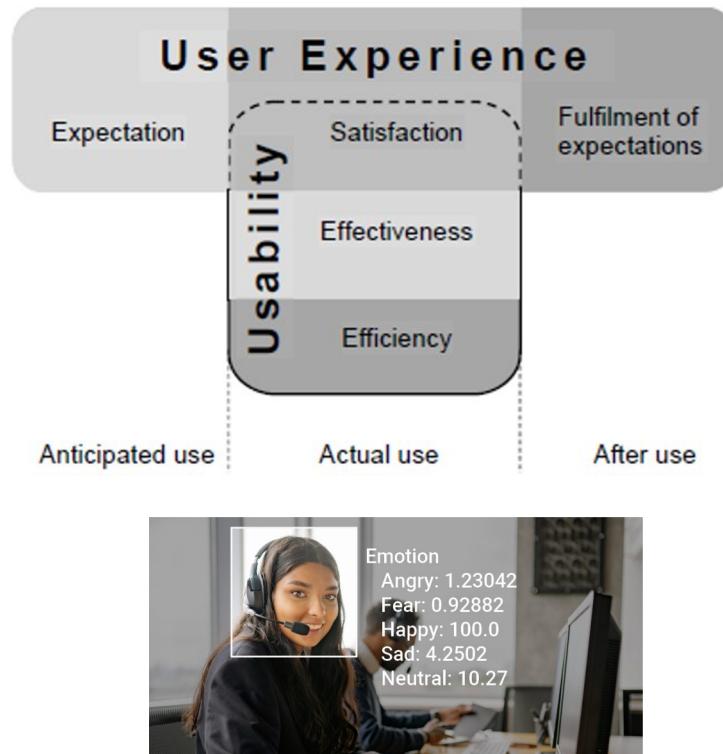
“Design is not just what it looks like and feels like. Design is how it works.”

Steve Jobs



- 91% of unsatisfied customers don't complain but leave a website without giving feedback after a bad experience. userinterviews.com
- Every dollar invested in UX brings \$100 in return. Forbes.com

Emotions play a central role in user experience of digital apps, assistants and systems



- **Emotions**
Emotions create a lasting bond between the user and the product.
- **User Satisfaction**
Positive emotions lead to higher user satisfaction and retention.
- Potential outcome **Brand Loyalty**
Happy users are more likely to become loyal customers.

Source: <https://design.google/library/evoking-emotions-pamela-pavliscak>

Human-AI interaction comes into focus

Human-AI interaction studies and designs how humans and artificial intelligence (AI) systems communicate and collaborate.

Customer Service Chatbots



<https://i.ebayimg.com/images/g/nfUAAOSw4mxDMHRJ/s-l600.jpg>

Personal assistants for daily life

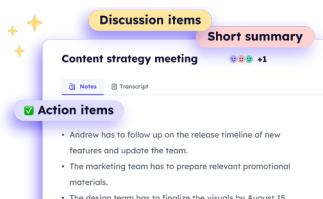


<https://www.mobilegeeks.de/wp-content/uploads/2019/09/DeepL-Logo-1200x627.jpg>

Personalised recommendations in ecommerce / Social Media:



Team Assistants



- Andrew has to follow up on the release timeline of new features and update the team.
- The marketing team has to prepare relevant promotional materials.
- The design team has to finalize the visuals by August 15.

Medical Decision Making



Mobility Assistants



<https://geekflare.com/de/daily-life-ai-example/>

Generative AI assistants & Prompt Engineering as central representatives of Human-AI interaction

Generative AI

Systems capable of creating new content, from text to images and beyond.

By 2025, generative AI is expected to contribute to 10% of all data produced.

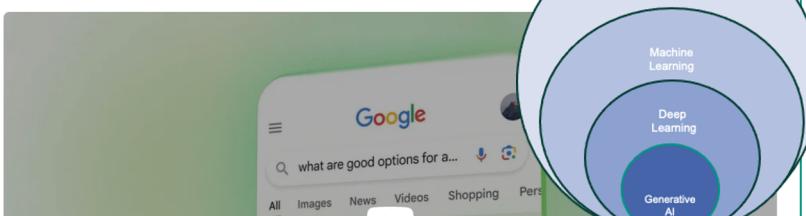
SEARCH

Generative AI in Search: Let Google do the searching for you

May 14, 2024 | 5 min read

With expanded AI Overviews, more planning and research capabilities, and AI-organized search results, our custom Gemini model can take the legwork out of searching.

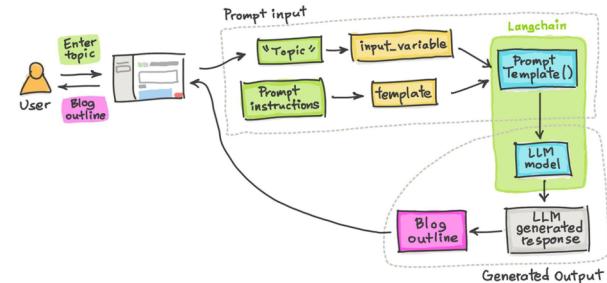
Liz Reid
VP, Head of Google Search



A diagram illustrating the layers of AI technology. It shows concentric circles representing different levels of AI: Generative AI (innermost), Deep Learning, Machine Learning, and finally AI at the outermost layer.

Prompt engineering

Designing inputs to guide AI systems in generating desired outputs.



Role of Emotions in Prompting

Recent study by the Institute of Software, Chinese Academy of Sciences, Microsoft, and other institutions, suggests that LLMs can be enhanced through “emotional prompts”

Computer Science > Computation and Language
Submitted on 14 Jul 2023 (v1), last revised 12 Nov 2023 (this version, v7)

Large Language Models Understand and Can be Enhanced by Emotional Stimuli

Dong Wang, Yixuan Zhang, Kaijie Zhu, Wenxin Hou, Jianxun Lian, Fang Luo, Qiang Yang, Xing Xie

The Answer To Why Emotionally Worded Prompts Can Goose Generative AI Into Better Answers And How To Spur A Decidedly Positive Rise Out Of AI

Inelligence significantly impacts our daily behaviors and interactions. Although Large Language Models (LLMs) are viewed as a stride toward artificial general intelligence, exhibiting impressive performance in numerous tasks, it is still LLMs can generally grasp psychological emotional stimuli. Understanding and responding to emotional cues gives humans vantage in problem-solving. In this paper, we take the first step towards exploring the ability of LLMs to understand stimuli. To this end, we first conduct automatic experiments on 45 tasks using various LLMs, including Flan-T5-Large, BLOOM, ChatGPT, and GPT-4. Our tasks span deterministic and generative applications that represent comprehensive scenarios. Our automatic experiments show that LLMs have a grasp of emotional intelligence, and their performance can be enhanced by emotional prompts (which we call “EmotionPrompt”) that combines the original prompt with emotional stimuli), e.g.,

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Seminar Objective & Deliverables

Develop a machine learning model for a research question based on a human-AI interaction dataset to analyze the interplay of human emotions and perceptions with the prompting and answering of a generative AI assistant.

Seminar Tasks

1. Explore dataset on “Affective Experiences in LLM Interaction” and get detailed understanding of form, size, and content of the data in the dataset.
Deliverable: Data story (as part pitch presentation)
2. Develop research question based on features available and potential prediction model concept.
 - User behavior (e.g., prompt form, timing)
 - Perceptual data: Affective user states during prompting and answering and perceptions
 - Feature engineering: Deriving new features from existing information
 - Leverage the capability of LLMs to either (1) develop new feature as input (e.g., prompt quality assessment by LLM) or (2) use LLM to leverage prediction output
3. Build, evaluate and explain machine learning model based on concept.

Deliverables

D1: Data story
Summary statistics, visualizations, features

D2: Research question
Research question and concept based on human-AI interaction theory

D3: ML model & Evaluation
Developed ML model to analyse research question

Seminar Organization

Affective User Research & Human-AI Interaction

Knowledge Sessions

Specific Topics in Human-AI Interaction

Human-AI Interaction: LLMs & Prompt Engineering

Emotional Theories

Affective User Research

Working Session

Working Session 1:
Dataset exploration

Working Session 2:
Prediction model concept development

Working session 3:
Prediction model concept implementation

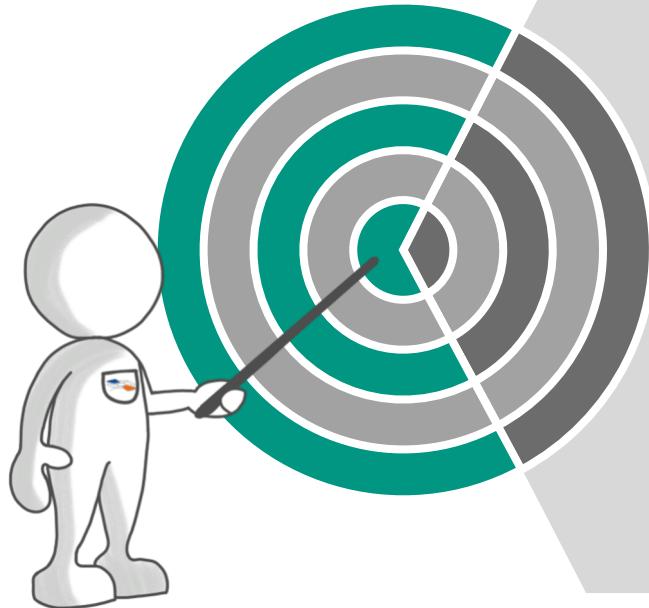
Presentation

Presentation Part 1:
Dataset exploration

Presentation Part 2:
Prediction model concept

Learning Objectives

Seminar

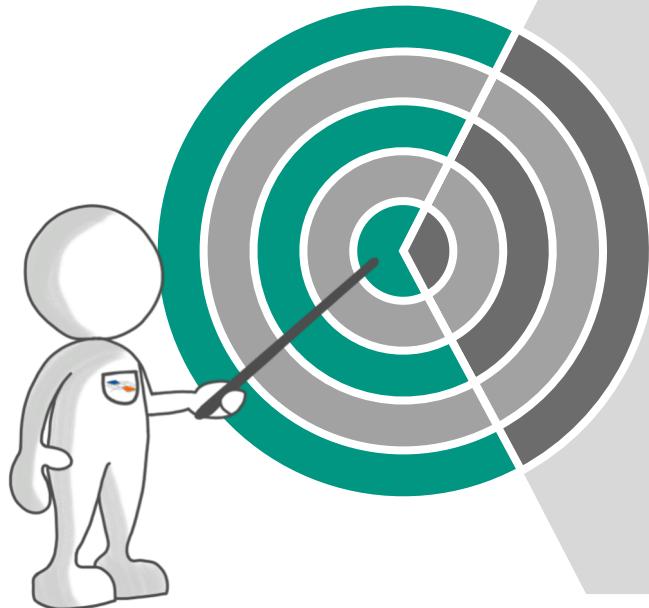


Students will be able to:

- Describe concept of affective user research
- Explain key emotional theories (the basic model of affect, influence on cognitive processes, and rational vs. emotional decisions) and selected theories for human-AI interaction
- Describe the concept behind and history of large language models and prompt engineering (types of prompts, basic prompting techniques, and prompting best practices)
- Apply data science methods for exploration, and prediction of affective user states, user perceptions, and user behavior

Learning Objectives

Knowledge Session 1: Affective User Research & Emotions



Students will be able to:

- Understand the motivation of affective user research. Describe key steps and methods of user research.
- Explain key emotional theories (the basic model of affect)
- Understand the importance of emotions in user experience and how to measure them.

Leading Questions

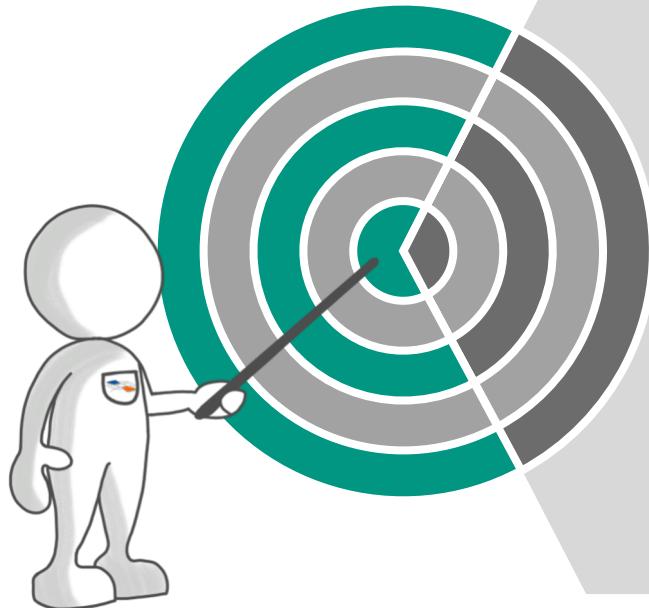
(Affective) User Research

- What is the purpose of user research?
- How to do user research and what are the key elements of user research investigation? How to decide if an interactive systems is „good“?
- Why do emotions play a role when interacting with applications and AI?
- What are emotions are and how do they differ from affect or mood?
- How can emotions be classified and measured?
- How do emotions evolve and what is their impact on cognitive processes?

Emotional Theories

Learning Objectives

Knowledge Session 3 & 4: Human-AI Interaction: LLM & Prompt Engineering

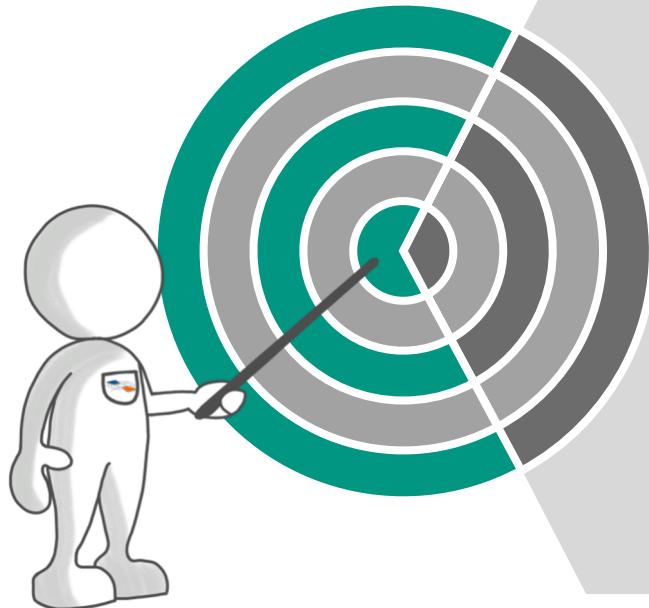


Students will be able to:

- Understand the evolution of human-AI interaction from human-computer interaction and describe the concept of human-centered AI
- Describe the concept behind large language models and explain types of LLM prompts
- Understand state-of-the-art prompting techniques and apply best practices for LLM prompting
- Understand selected concepts in human-AI interaction

Learning Objectives

Application: Data Science Methods



Students will be able to:

- Apply data science methods for exploration and data story telling
- Explore datasets and explain content of the data in the dataset based on a detailed understanding of form, size, and quality of the dataset
- Understand and develop machine learning models for prediction of affective user states and user behavior

Leading Questions

LLM & Prompt
Engineering

- What are “large language models” and what is prompt engineering?
- What are different types of prompts?
- How do I optimize outputs of LLMs and get the best result for my personal inquiry of an LLM?

Human-AI
Interaction
concepts

- What is human-AI interaction and how did it evolve?
- What are interesting aspects of human-AI interaction, in particular with a focus on LLMs and the interaction with generative AI?

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Thursday, July 11

Time	Content
9:00 – 9:30	Introduction
9:30 – 11:00	Affective user research & Emotions
11:00 – 12:30	Dataset & Open Assistant introduction
Lunch	
13:30 – 14:00	Methods for data exploration
14:00 – 15:45	Dataset exploration
16:00 – 17:30	Data story development and intermediate presentation

Friday, July 12

Time	Content
9:00 - 10:30	Human-AI interaction: LLM & Prompt engineering
10:45 - 11:45	Specific topics of Human-AI interaction
Lunch	
12:45 - 13:45	Data science methods
13:45 - 17:30	Development of prediction model concept and preparation of presentation

Saturday, July 13

Time	Content
08:45 – 11:00	Research question and model presentation

Deliverables & Assessment/Grading

Element	Description	Points
Dataset Exploration (team effort and accountability)	Participants will explore the dataset individually and develop a data story based on this data exploration in the team. The data story will be delivered via the ppt slides as pitch presentation.	30 points
Research Question and Prediction Model Concept (team effort and accountability)	Each team will develop a research question and prediction model concept to provide answers for this research question. The prediction model concept is the foundation for the model implementation. It is delivered via powerpoint presentation.	35 points
Prediction Model Implementation & Result (team effort and accountability)	After the presence phase of the seminar, the team members will implement the prediction model concept in form of a jupyter notebook and provide a interpretation of the results.	35 points

- Participation in the overall examination is binding with participation in the block event from July 11 - 13. Failure to pass the seminar (less than 30 points) is communicated the latest at the end of the second day of the seminar, July 12. The decision is always taken before the end of the seminar and will result in an overall grade of 5.0. The overall performance is communicated transparently to the participants.

(*) 2 SWS / 3 ECTS | approx. 75 hours work overall

Expected Effort

- Seminar has 3 ECTS = 75h workload overall

■ Block seminar	18h
■ Lectures	6h
■ Material introduction	4h
■ Work phase	8h
■ Model development	57h

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Materials Provided

Preparation for the seminar: Online courses for machine learning and python

- Machine Learning Crash Course: <https://developers.google.com/machine-learning/crash-course>
- Data Preparation and Feature Engineering: <https://developers.google.com/machine-learning/data-prep>

Course slides

- You will be provided with the slides of this course to allow to develop a research question and build you research model on it.

Dataset “Affective Experiences in LLM Interaction”

- You will receive the dataset about human interaction with an generative AI assistant for two tasks (information extraction, text creation) and human emotions (in csv format) and a description.

Materials To Deliver

Participants have to submit three deliverables in two formats.

Deliverables

D1: Data story

Summary statistics,
visualizations, features

D2: Research Question and Prediction Model Concept

Research question based
on human-AI interaction
concepts

D3: ML model & Evaluation

Developed ML model to
analyse research question

Deliverable Format

Intermediate Pitch and Full Presentation at block seminar and powerpoint slides

- Participants will provide a pitch during and final presentation at the end of the block event of the seminar.
- Participants will submit the powerpoint presentation with the data story, the research question, and the prediction model concept.



Prediction model implementation

- Participants will implement their prediction model based on the previously developed concept and submit it in form of a jupyter notebook and an interpretation as recording.



Materials To Deliver (2)

Deliverables



D1: Data story

Summary statistics,
visualizations, features

D2: Research Question and Prediction Model Concept

Research question based
on human-AI interaction
concepts

1) Intermediate presentation: Pitch presentation of Data Story

Content: Data story on dataset

Length: 5 min presentation, 5 min discussion

2) Final presentation: Research question & Prediction model concept

Content: Outline research question, relevant constructs, and the prediction model concept (ie. prediction target, method(s), feature engineering, etc.)

Length: 10 min presentation, 10 min discussion

Deliverables:

- Presentation during course
- Powerpoint slides of presentation at July 13, 2024 sent to:
ivolucasbenke@gmail.com

Presentation icons created by alkhalihi design - Flaticon

Materials To Deliver (3)

Deliverables



D3: ML model & Evaluation

Developed ML model to analyse research question

1) Prediction model concept implementation

Content: Implementation of prediction model in form of jupyter notebook. The notebook has to contain the following sections:

- Introduction and explanation of prediction model concept (Form: text)
- Development environment: Python and package versions, further details like APIs used (Form: list/text)
- Code implementation (Form: code)
- Summary and result interpretation (Form: text)

1) Presentation recording: Prediction model and result presentation

Content: Summary and interpretation of results in audio recording for 3-5 min. No video just audio required (hint: use ppt recording function).

Deliverables:

- Jupyter notebook until August 25, 2024 sent to: ivolucasbenke@gmail.com
- Recording of summary and interpretation until August 25, 2024 sent to: ivolucasbenke@gmail.com

Presentation icons created by kliwir art - Flaticon

Assessment Criteria

Deliverables

D1: Data story

Summary statistics,
visualizations, features

**D2: Research Question
and Prediction Model
Concept**

Research question based
on human-AI interaction
concepts

**D3: ML model &
Evaluation**

Developed ML model to
analyse research question

Criteria

Data story:

Originality of data story, conceptual connection to course content, execution quality, visualization quality and elaboration, presentation

Presentation and concept:

Feedback openness, conceptual connection to course content, creativity and originality of the concept and research question, application of feature engineering and additional tools, presentation

Implementation:

Feedback implementation, level of detail of implementation, readability, application of feature engineering and additional tools

Recording:

Presentation, summary quality, interpretation quality

Materials To Deliver (4)

Deliverables

Date	Deliverable
July 11, 2024 EOB	Intermediate presentation: Data Story
July 13, 2024, 10:00	<ol style="list-style-type: none">1. Presentation: Research question and prediction model concept2. PPT slidedeck of presentation
August 25, 2024, EOB	<ol style="list-style-type: none">1. Implementation (Jupyter notebook)2. Recording of results summary and interpretation

Thank You



Dr. Ivo Benke

ivolucasbenke@gmail.com



Dr. Lennard Schmidt

lennard.schmidt@hhl.de