

Module: Human-Computer Interfaces

Level	Master	Short Name	HCI
Responsible Lecturers	Matthies, Denys, Prof. Dr.-Ing.		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Elective	ECTS Credit Points	5
Semester of Studies	(Unspecified)	Semester Hours per Week	4
Length (semesters)	1	Workload (hours)	150
Frequency	WiSe	Presence Hours	60
Teaching Language	English	Self-Study Hours	90

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Project Work	Exam Language	English
Exam Length (minutes)		Exam Grading System	One-third Grades
Learning Outcomes	<p>The students get an overview of the interdisciplinary science of Human-Computer Interaction (HCI) and its central concepts, definitions, and research areas. They acquire knowledge regarding the History and Future Trends of HCI, Foundations of HCI (especially Psychology, Cognitive Sciences, Ergonomics), HCI Models and Interaction Concepts, Prototyping (Input & Feedback Interfaces), Human-Centered Machine Learning, Human Activity Recognition (HAR), Sensing Technologies for HAR, and typical Evaluation Methods in HCI. Participants learn that a User Interface (UI) goes beyond being a software interface, including physical interfaces, as they learn how to apply their acquired theoretical knowledge throughout the lectures to develop, analyze, and evaluate UIs. Furthermore, students practice their fabrication skills by independently building a hardware-based UI on the scope of their self-chosen HCI project.</p> <p>The examination includes the implementation, a written report, and an oral presentation of the project.</p>		
Participation Prerequisites			

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	<ul style="list-style-type: none"> ✓ Use of gender-neutral language (THL standard) ✓ Target group specific adjustment of didactic methods ✓ Making subject diversity visible (female researchers, cultures etc.)
Applicability	
Remarks	

Module Course: Human-Computer Interfaces (Lecture)

(of Module: Human-Computer Interfaces)

Course Type	Lecture	Form of Learning	Presence
Mandatory Attendance	yes	ECTS Credit Points	2
Participation Limit		Semester Hours per Week	2
Group Size		Workload (hours)	60
Teaching Language	English	Presence Hours	30
Study Achievements ("Studienleistung", SL)		Self-Study Hours	30
SL Length (minutes)		SL Grading System	

The following section is filled only if there is a course-specific exam.

Exam Type		Exam Language	
Exam Length (minutes)		Exam Grading System	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	<p>Introduction into HCI</p> <ul style="list-style-type: none"> • Basic Terms • Interaction Paradigms • Ubiquitous Computing <p>History & Future</p> <ul style="list-style-type: none"> • Computer & Networks <ul style="list-style-type: none"> • Automation and complex information systems • Network development • Development of graphical user interfaces • Future Computing <ul style="list-style-type: none"> • HCI Visionaries • Assistive Augmentation <p>Foundations of HCI</p> <ul style="list-style-type: none"> • Human cognition and information processing • Human behavior and errors • Security-related behavior • Stress and strain in sociotechnical systems <p>HCI Models & Interaction Concepts</p> <ul style="list-style-type: none"> • HCI Models • Interaction Concepts <ul style="list-style-type: none"> • Focused Interaction • Peripheral Interaction • Implicit Interaction
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- Reflexive Interaction

Prototyping Input & Feedback Interfaces

- Rapid Prototyping
- Prototyping Platforms
- Input Interfaces
- Feedback Interfaces

Human-Centered Machine Learning

- Overview
- Machine Learning
- Human-in-the-Loop

Human Activity Recognition

- Overview
- HAR Chain
- Examples

Sensing Technologies

- Inertial
 - Accelerometer
 - Gyroscope
 - Magnetometer
- Electric
 - Passive Capacitive / Electric Field Sensing
 - Active Capacitive Sensing
- Acoustic
 - Doppler Effect
 - Technological Developments
- Optical
 - Optical (Light) Sensors
 - Image (Camera) Sensors

Evaluation

- Study Design
- Standardized Test
 - Usability: SUS
 - User Experience: UEQ, meQUE
 - Load: NASA TLX, Burden Scale
- Data Acquisition
- Methods for Data Analysis

Literature

Carroll, J. M. (2003). HCI Models, Theories and Frameworks: Toward a Multidisciplinary Science. San Francisco u.a.: Morgan Kaufman.

Norman, D. (1988). The Psychology of Everyday Things. New York: Basic Books. (deutsch: Dinge des Alltags, Frankfurt: Campus)

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Engelbart, D. C. (1962). *Augmenting Human Intellect: A Conceptual Framework*. Summary Report AFOSR-3223 under Contract AF 49 (638)-1024, SRI Project 3578 for Air Force Office of Scientific Research. Stanford Research Institute.

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Bakker, S., Hausen, D., Selker, T. (2016). *Peripheral Interaction: Challenges and Opportunities for HCI in the Periphery of Attention*. Springer.

Matthies, D.J.C., Urban, B., Wolf, K., & Schmidt, A., (2019). *Reflexive Interaction - Extending the concept of Peripheral Interaction*. In *Proceedings of the 31st Australian Conference On Human-Computer-Interaction (OzCHI 2019)*, Fremantle, Australia.

Gillies, M., Fiebrink, R., Tanaka, A., Garcia, J., Bevilacqua, F., Heloir, A., ... & Caramiaux, B. (2016). *Human-centred machine learning*. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems* (pp. 3558-3565).

Ford, K. M., Hayes, P. J., Glymour, C., & Allen, J. (2015). Cognitive orthoses: toward human- centered AI. *AI Magazine*, 36(4), 5-8.

Riedl, M. O. (2019). Human-centered artificial intelligence and machine learning. *Human Behavior and Emerging Technologies*, 1(1), 33-36.

Dudley, J. J., & Kristensson, P. O. (2018). A review of user interface design for interactive machine learning. *ACM Transactions on Interactive Intelligent Systems (TiiS)*, 8(2), 1-37.

Sowe, S. K., Simmon, E., Zettsu, K., de Vaulx, F., & Bojanova, I. (2016). *Cyber-physical-human systems: Putting people in the loop*. *IT professional*, 18(1), 10-13.

Remarks	
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Module Course: Human-Computer Interfaces (Practical Training)

(of Module: Human-Computer Interfaces)

Course Type	Practical Training	Form of Learning	Presence
Mandatory Attendance	yes	ECTS Credit Points	3
Participation Limit		Semester Hours per Week	2
Group Size	12	Workload (hours)	90
Teaching Language	German/English	Presence Hours	30
Study Achievements ("Studienleistung", SL)		Self-Study Hours	60
SL Length (minutes)		SL Grading System	

The following section is filled only if there is a course-specific exam.

Exam Type		Exam Language	
Exam Length (minutes)		Exam Grading System	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	<ul style="list-style-type: none"> Analyzing user requirements and technological requirements of information systems Design and prototypical implementation of a User Interface Practical evaluation using standardized or custom evaluation techniques
Literature	
Remarks	