Advanced Human-Machine Interaction

Proposal for an elective MAP-I Curricular Unit
6 ECTS, 30h TP

CONTEXT

Human-Machine Interaction (HMI) is a critical field of study in today's technology-driven world, as it focuses on improving the interactions between people and machines. The increasing integration of digital systems across all aspects of society, from personal devices to industrial automation, highlights the need for systems that are intuitive, efficient, and responsive to human behaviour. HMI seeks to bridge this gap by developing interfaces that enhance user experience while minimizing cognitive and physical effort, making technology more accessible and effective for a wider range of users. One of the main reasons HMI is essential is its role in the design of human-centred systems. These systems prioritize user needs, ensuring that technology aligns with human abilities and limitations. As the complexity of technologies like artificial intelligence, augmented reality, and automation increases, effective interaction design becomes crucial to ensure that users can understand and utilize these tools to their full potential.

The study of HMI fosters the skills to integrate multidisciplinary approaches, incorporating knowledge from computer science, human factors, and engineering towards the creation of innovative solutions to complex interaction challenges, particularly in fields such as healthcare, education, and entertainment, where usability and accessibility are paramount. In addition, the on designing and developing HMI work as a catalyst in shaping emerging technologies. By ensuring that interfaces for virtual environments, autonomous systems, and conversational agents are designed with a deep understanding of human needs and behaviours, HMI contributes to making technology more inclusive and adaptable. This has broad implications for improving the quality of life and fostering more meaningful and productive human-technology relationships in the future.

OBJECTIVES AND LEARNING OUTCOMES

The Advanced Human-Machine Interaction course aims to introduce students to apply an iterative human-centred approach to the design and development of interactive multimodal systems. Its main objectives are to provide an overview of the primary issues and application areas, offer a historical perspective of the field, and introduce the most important concepts, methods, and tools required to design, implement, and evaluate multimodal systems and applications. Additionally, the course seeks to develop students' abilities to read and evaluate scientific literature, present research findings to an audience, and enhance teamwork skills.

SYLLABUS

A) Introduction to Human-Machine Interaction

B) Human-Centred Design and Development
  a. Understanding Users
  b. Scenarios, Goals, Task Analysis
  c. Requirements
  d. Evaluation of Interactive Systems
C) Design and Development of Multimodal Interactive Systems
  a. Input Modalities
  b. Output modalities
  c. Modality fusion and fission
  d. Conversational Interfaces
D) Interaction Beyond Reality and for Collaboration
  a. 3D user Interfaces
  b. Introduction to XR (VR, AR and MR)
  c. Interaction in XR
  d. Collaborative XR Scenarios

TEACHING METHODS AND EVALUATION

Classes will mix lectures about the theoretical principles and technologies associated with the different topics along with active discussions and tasks applying them to practical examples. These examples will typically be in the form of hands-on guides that allow understanding and gaining experience with the basics of applying the methods and using the technologies.

Evaluation will entail the design and development of a functional proof-of-concept for a multimodal interactive system chosen by the student. The idea should be pitched in the last class and the developed proof-of-concept presented and discussed at the end of the semester.

BIBLIOGRAPHY

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