Description of the ID master course Embodying Intelligent Behavior in Social Context

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The course will take place on Tuesdays from 13:30 to 15:15 and
Thursdays from 8:45 to 10:30. Please, note, that this year's meeting
do not always occur in the same meeting room.

This course will give an introduction to how and when to apply learning algorithms for the design of social applications that will benefit from intelligent and interactive embodied objects, robots, or online solutions. For this purpose, the students will first learn how to use readily programmed learning algorithms and simultaneously will design learning systems with a degree of autonomy or products that are mostly embodied and interact with people. Operation in close proximity of people requires a higher degree of autonomy than the industrial autonomous systems, because of safety reasons, and because of the complexity of human behavior and the natural environment. In addition to autonomy and embodiment, the systems and products that are subject to this course strive for interactivity. The interactive aspects of the designed autonomous systems often require learning and are inspired by intelligent or brain-inspired models.

The other important aspect of the course is to explore how technology can change the way people behave in a social setting. Social skills and interaction are basic to human development, progress, and happiness. There are numerous examples where technology has been used for enhancing and teaching social skills, in areas as social innovation, health, education, and connecting in everyday life settings. In this course, we provide some mechanisms, technological solutions, and visions of how the design of technological systems can promote social interaction.

Designing social intelligent interactions, i.e. interactions with humans can be interpreted in many ways. In the past few years, topics as explainability (Explainable AI or XAI) is becoming increasingly important, so we introduce this aspect of explainability as a main point of departure for designing contemporary interactive systems. To help you make an XAI system, we will request the student groups to read and present a paper on XAI and give a presentation on its workings.

The students need to learn to embody learning algorithms in meaningful everyday-life applications. For this purpose, the students have to understand the main paradigms of learning and adaptation in artificial and natural systems. Second, in parallel, the students need to develop concepts for meaningful social interaction mediated by technology. An important aspect of this concept will be explainability. Programming of the learning algorithm is not necessary (ready available code can be used), but understanding its functionality will develop the ability of the students to actually use AI in everyday life settings where uncertainty and changing conditions make the use of these algorithms a necessity.

		✏ Schedule	
Week 1	Tuesday	Lecture: Introduction to the course, examples of (X)AI in education and healthcare, project evaluation • Lecture 1a: Course Introduction • Lecture 1b: Explainable AI in Education and Healthcare. Project evaluation	EB KT
	Thursday	Lecture: Short overview of most used learning paradigms and one learning algorithm per paradigm. and Mapping real-life problems to learning paradigms.	EB
Week 2	Tuesday	Practicum: Learning Algorithms and Python Tutorial (supervised, unsupervised, RL) and examples	KT
	Thursday	Student presentations: XAI paper Discussion Explainable AI.	EB, KT, JH
Week 3	Tuesday	Lecture: Supervised and unsupervised learning algorithms.	EB
	Thursday	Lecture: • Lecture 3a: Reinforcement learning lecture • Lecture 3b: Interactive Machine Learning: Bridging the gap between HCI and Machine Learning;	KT
Week 4	Tuesday	Consultation group projects(upon appointments made between the groups and one of the teachers)	
	Thursday	• Self-learning: preparation of preparation midterm presentations • Consultation group projects (upon appointments made between the groups and one of the teachers)	
Week 5	Tuesday	Students' midterm presentations: projects Groups 9-15. (Use Template 1)	All
	Thursday	Students' midterm presentations: projects Groups 1-8. (Use Template 1)	
Week 6	Tuesday	Lecture: Expression and understanding emotions. Creating emotional interactions.	EB
	Thursday	Consultation group projects(upon appointments made between the groups and one of the teachers)	
Week 7	Tue	Testing and validation of interactive learning systems (1hour). Consultation group projects(upon appointments made between the groups and one of the teachers)	EB
Week 8	Tuesday	Students' midterm presentations: projects Groups 1-8. (Use Template 2)	ALL
	Thursday	Students' midterm presentations: projects Groups 9-15. (Use Template 2)	ALL

Learn to develop technological concepts and solutions (algorithms and hardware) that can promote behavioral changes and social interaction

Learn to use learning algorithms as an interaction design tool to enhance the quality of interaction with and between humans

Learn the basic concepts of Explainable AI as a method for enhancing the interactions with technology

Learn to integrate all the above in a embodied objects, robots, or online solutions that interact in a certain context. For 2021-2022, the context is Education and Health and we hope that you will be able to create an application/demo where embodied intelligent object is beneficial in an Educational or Health context.

Deliverables:

1. Report (see Report template in Files directory; Assignment 4)
2. Presentations (See Presentation templates in Lecture one; Template Assignment 1,2)
3. Final Presentation/Demo/Video/ (Assignment 3)

Grading:

1.**Presentation (Assignment 1; Template Assignment 1) 10%**

2. **Presentation (Assignment 2; Template Assignment 2)**

This is a Midterm presentation, it is meant to help you prepare the final presentation and to identify and correct wrong focus or understanding, too ambitious or too easy tasks are chosen that do not need ML, or some conceptual mistakes are present. It is not graded; qualitative feedback will be given during the presentation.

3. **Final Presentation/Demo/Video/ (Template Assignment 3)**
4. **Report (see Report template in Files directory; Assignment 4)**

Assignments 3 and 4 represent the final outcome of your work. They are difficult to separate. Their integrated evaluation gives the 90% of your grade.

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Software:
Lectures/practicums on these tools will be given. Look at the recorded

Week 2	Tuesday	<mark>Practicum: Learning Algorithms and Python Tutorial (supervised, unsupervised, RL) and examples</mark>

Templates and explanation :

<mark>Assignment 1</mark>

One experimental paper on explainable AI will be assigned to each group. In addition, (at least one) review paper on the same topic is provided to everyone. The experimental paper gives a case study, while the review paper provides general knowledge on the subject.

For the second meeting of Week 2, you need to upload a presentation to summarize the experimental paper assigned to your group, focusing on:

- the problem motivation,
- the role of AI and the learning algorithm,
- the role and application of XAI -- if not applicable: can XAI improve the interaction and how?
- identify limitations of the study and proposed improvements focusing on the role of (X)AI.

One person per group should be ready to present these slides to all students and teachers. All students should be prepared to discuss the quality of this solution (using the conclusions from the review paper(s) you read).

<mark>Assignment 2</mark>

Template Assignment 2

Intermediate presentation:
- Design rationale/vision/motivation for an interaction scenario
- Make explicit the interactive behaviours of all involved agents
- Specify which learning algorithm is most appropriate for your case
- Elaborate on how/where to use the intelligent algorithm, and how these choices enhance the social interaction or achieving the goal of the interaction
- Explain what the role of the ML algorithm and the added value of XAI is

<mark>Assignment 3</mark>

Please, deliver the final presentation slides and video for the project.

Final Presentation –slides and video:

- The final concept
- Demonstration of the working/learning/interactive part of the concept –Short video
- Results, and evaluation
- The positioning of your work in the context of the course material: learning algorithms in design in general, in education/health applications and XAI

<mark>Assignment 4</mark>

Please, deliver the final report of your project prepared according to the template which can be found in the Files directory, the file name is ReportTemplate2022.doc.

Study material

- **See Syllabus**

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