Context of the research activity

Artificial Intelligence (AI) systems are widespread in many aspects of the society. Machine Learning, in particular, enabled the development of algorithms able to automatically learn from data without any human intervention. While this leads to many advantages in terms of more efficient decision processes and productivity, it also presents several drawbacks such as disregarding end-user perspectives and needs.

In this respect, Human-Centered AI (HCAI) emerged as a novel conceptual framework [1] for reconsidering the centrality of humans while keeping the benefit of AI systems. To do so, the framework builds on the idea that a system can contemporary exhibit high levels of automation and high levels of human control.

The Ph.D. proposal applies and extends the research on HCAI to smart environments, e.g., AI-powered environments equipped with Internet-of-Things devices. In such environments, AI systems typically tend to automate the activities that people perform; users, however, want to remain in control. This generates a conflict that could be tackled by adopting the HCAI framework.

This proposal aims at designing, developing, and evaluating concrete HCAI systems to support people operating in smart environments, with a particular focus on industry-related contexts. Also, it aims at extending the understanding of the HCAI framework’s principles and providing valuable lessons for different fields.


Objectives

The main research objective is to investigate solutions for designing and developing HCAI systems in smart environments. A particular focus will be on how the adoption of the HCAI framework can bring tangible benefits to users and to the smart environments research field, while extending the research on HCAI.
The research activities will mainly build on the following characteristics of the HCAI framework:
- High levels of human control and high levels of automation are possible: design decisions should give users a clear understanding of the AI system state and its choices, guided by human-centered concerns, e.g., the consequences and reversibility of errors. Well-designed automation preserves human control where appropriate, thus increasing performance and enabling creative improvements.
- AI systems should shift from emulating and replacing humans to empowering and “augmenting” people, as people are different from computers. Intelligent system designs that take advantage of unique computer features are more likely to increase performance. Similarly, designs that recognize the unique capabilities of humans will have advantages such as encouraging innovative use and supporting continuous improvement.

In particular, the Ph.D. research activity will focus on:
1) Study of AI algorithms and models, distributed architectures, and HCI techniques able to support the identification of suitable industry-related use cases for building effective and realistic HCAI systems.
2) Enhancement of the HCAI framework to include end-user personalization, e.g., as a way to recover from errors or to guide the system choices.
3) Development of strategies for dealing with de-skilling effects. Such effects may undermine the human skills that are needed when automation fails and the difficulty of remaining aware when some user actions become less frequent.

Such goals will require advancement both in interfaces and interaction modalities, and in AI algorithms and their integration into user-facing smart environments.

| Skills and competencies for the development of the activity | The ideal candidate should have a solid background in Computer Engineering or Data Science, with prior experience with machine learning and/or deep learning. |
| Knowledge of Internet-of-Things architectures and Human-Computer Interaction methods is a plus. |