

ARTIFICIAL INTELLIGENCE

CINECA - Human-centered AI for Educational Systems

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Supervisor	DE RUSSIS LUIGI - luigi.derussis@polito.it
Contact	Antonio Russo (CINECA) DE RUSSIS LUIGI - luigi.derussis@polito.it
Context of the research activity	The Ph.D. proposal aims at designing, prototyping, and evaluating innovative Human-Centered AI (HCAI) systems to support teachers and students in their educational activities. In the educational context, AI systems often tend to automate the activities that people perform. Teachers and students, however, want to personalize their activities according to various factors, e.g., their understanding of the various topics. This generates a conflict that could be tackled by adopting the HCAI framework.
	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 main research objective of this Ph.D. proposal is to investigate solutions for designing and developing HCAI systems in educational contexts, for teachers and students. A particular focus will be on how the adoption of the HCAI framework can bring tangible benefits to users and to the educational research field. The research activities will mainly build on the following two 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. 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

Objectives

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 educational use cases for building effective and realistic HCAI systems.

2) Enhancement of the HCAI framework to include end-user personalization, e.g., to keep the person “in the loop” and in control.

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 the identified educational contexts.

To provide two examples of possible use cases in very different educational contexts, one can mention: a) an intelligent tool to allow university professors to create personalized learning paths for their courses/students, in terms of creating dedicated tutoring assistants through block programming interfaces; b) a system for detecting harmful patterns and recommending possible alternatives within user interfaces during their design, aimed at design students (for example, integrated into existing tools like Figma, <https://www.figma.com>).

[1] Ben Shneiderman (2020) Human-Centered Artificial Intelligence: Reliable, Safe & Trustworthy, International Journal of Human-Computer Interaction, 36:6, 495-504

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 AI, especially around machine learning and/or deep learning.

The candidate should also have a knowledge of Human-Computer Interaction methods and techniques.