Requirements and Challenges for Hybrid Intelligence: a Case-study in Education

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Abstract. The potential for Artificial Intelligence is widely proclaimed. Yet, in everyday educational settings the use of this technology is limited. Particularly, if we consider smart systems that actually interact with learners in a knowledgeable way and as such support the learning process. It illustrates the fact that teaching professionally is a complex challenge that is beyond the capabilities of current autonomous robots. On the other hand, dedicated forms of Artificial Intelligence can be very good at certain things. For example, computers are excellent chess players and automated route planners easily outperform humans. To deploy this potential, experts argue for a hybrid approach in which humans and smart systems collaboratively accomplish goals. How to realize this for education? What does it entail in practice? In this contribution, we investigate the idea of a hybrid approach in secondary education. As a case-study, we focus on learners acquiring systems thinking skills and the pedagogical approach that we recently developed for this purpose. Particularly, we discuss the kind of Artificial Intelligence that is needed in this situation, as well as which tasks the software can perform well and which tasks are better, or necessarily, left with the teacher.

Keywords: Science education, Systems thinking with qualitative representations, real-world application problems, hybrid human-AI systems

1 Short introduction

Instead of aiming for Artificial General Intelligence, the idea of Hybrid Intelligence is being proposed [1]. Hybrid Intelligence combines human intelligence with machine intelligence, with the goal of augmenting human capabilities as opposed to replacing them, while simultaneously harvesting the potential of smart machines.

In this contribution, we report on a case study that uses smart tutoring software in secondary education. While Intelligent Tutoring examples often focus on problem solving, we focus on learning by creating qualitative representations. Learners learn systems thinking by creating a diagram that captures a causal understanding of how a system works. Different from typical problem assignments, in which case the solution amounts to a specific answer such as a number after having performed the required calculations, learners create and deliver a structure consisting of a set of ingredients and relationships among these [3].

The organization of the original paper [2] is as follows. Firstly, it reviews the field of Artificial Intelligence research in order to define what we mean when we refer to an Artificial Intelligence system. Next, it moves on to the case study in which learners in secondary education acquire systems thinking skills and the hybrid teacher-software arrangement to support that. The third Section describes our recently developed intelligent tutoring system and the accompanying pedagogical approach that supports learners in creating their cause-and-effect diagrams. The fourth Section discusses the role of the teacher and how it complements and intertwines with the actions of the tutoring system. The final two sections conclude the contribution and highlight directions for future research.

References

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