Hybrid Intelligence – Human-AI Co-Evolution and Learning in Multirealities (HI)

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Abstract. The presence of Artificial Intelligence (AI) is growing in all areas of life. However, current data-driven AI is still too narrow to help humans, lacking in social and emotional intelligence and restricted in reality (Fan, Xu, Cao et al. 2022). By placing the emphasis on mutual understanding and learning from each other, our research programme "Hybrid Intelligence – Human-AI co-evolution and learning in multirealities (HI)" aims at combining the strengths of both humans and machines in their co-evolutionary processes. We propose to build the idea of a metaversum (Rosas, 2021) by combining our physical and virtual realities towards a multi-reality.

1. Introduction

Hybrid Intelligence (HI) combines the strengths of both humans and machines to collaborate to learn from and reinforce each other (Järvelä, Nguyen & Hadwin, 2023). This is the key difference to AI, which is designed to work independently to perform tasks that normally require human intelligence, such as perception and learning (Russell & Norvig, 2010). The fundamental difference between HI and human-centered AI is that HI involves both humans and machines in the loop, emphasizing mutual understanding and learning from each other in their co-evolution.

2. HI research programme themes

HI research programme covers four multidisciplinary research themes (HI 1-4) and two cross-cutting themes to facilitate deep data and ethical discussions (H5):

Data and algorithm assisted HI (HI.1) develops advanced data processing and computing technology for assisting humans and machines to understand each other. It includes new machine learning methods for interpreting human emotions, intentions, preferences and decision making by analysing facial and body behaviours, and physiological signals; endowing machines capabilities of expressing emotions with advanced interactive behaviour synthesis algorithms; and helping humans to understand machines by visualizing and explaining the internal states and status of data, algorithms and models with multi-modality for mixed-reality interfaces. RQ: How to facilitate the information exchange and mutual learning between AI and humans with new data processing methods, computational models and VR/AR approaches?

Understanding humans in/for AI interaction (HI.2) strives for understanding human learning and interaction processes to build HI systems that augment rather than replace human intelligence, systems that leverage our strengths and compensate for our weaknesses. This theme will utilize the multimodal data based on the HI.3 multi-reality

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platforms and the "human-machine understanding" of HI.1 to train, work and collaborate with humans and AI and then transfer of responsibility to humans. HI may need new human skills which also need to be understood. RQ: How can human learning mechanisms be used to adapt and interact in dynamic Hybrid systems?

Extended human mind in multirealities (HI.3) investigates AI-methods for extending and changing human perception by means of digital spaces and realities that co-exist with our physical world. Virtual, mixed and augmented reality technologies enable interaction with various degrees of virtual content in cyber- and metaverses seamlessly integrating human senses with multiple concurrent realities, whereas intelligence augmentation can enhance the cognitive abilities of humans with virtual assistants and provide capabilities that go beyond the normal perception. Solutions will be developed to demonstrate how multi-realities and AI together can boost and bring human capabilities to the next level. RQ: How do humans learn, interact, work and collaborate in HI setting and what is the added value of multiple realities, possibly on multiple tasks in complex environments?

Emerging sustainable effects of HI to quality of life (HI.4) investigates the ways HI can impact wellbeing and utilize technology in new areas for quality of life, e.g, to improve health care with enhancement of augmented care and development of advanced continuous education. This theme will work with various underserved people and stakeholders to develop adaptive platforms implementing HI. It provides feedback to HI1-HI3 via cyclic processes which helps to push forward positive effects and mitigate negative ones in future development. The 6G connectivity expertise will facilitate the developments. RQ: What are the opportunities offered by HI with multiple realities and how related knowledge and concepts can be utilized to different applications, covering health, education, work-place teams, HCI and for enhancing quality of life?

The Ethics Forum and the Data Forum (HI.5) are cross sectional parts of HI1-H4. Various aspects of AI can be seen as intrusive and vulnerable to the purposes of control by both private and public actors. The Ethics Forum will facilitate new research and discussion in ethics, values and societal concerns of HI. The Data Forum will facilitate responsible use, open sharing and storage of data and provide methods and technological basis on responsible and productive data usage in HI. A short-term goal is to host data scientist who give practical guidance to HI research. A long-term goal is to build a network for training, tutorials, forums, etc., with other universities with similar infrastructures.

3. Implications

HI provides better understanding of human-human and human-machine interaction, which, in turn, facilitates novel solutions in areas of crucial societal importance, such as education, aging and care, global population changes, future work and skills (European Commission, 2020; UNISEF, 2021). For example, HI is well aligned to offer novel educational methods by blending AI-driven learning technologies and human interactive and creative skills, developing new AI-enabled multi-reality technologies and digital solutions for well-being and health, health care education and distant human-centred care (Ahuja et al., 2023). HI will target the digital divide by addressing how these problems will be affordable and actively engage with policy makers. It will pave the way for a new paradigm of HI-aided services in, e.g., healthcare and education, especially for people with difficulties, thus promoting equal prospects for well-being, enhancing quality of life and for human's effects in environment and resources.

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