Hybrid Intelligence for Healthcare

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Abstract

We provide a summary of workshop Hybrid Intelligence for Healthcare, co-located with the third International Conference on Hybird Human-Artificial Intelligence (HHAI), held on June 10, 2024 in Malmö, Sweden.

Keywords
hybrid intelligence, healthcare, support systems

1. Introduction

This full-day workshop aims to build an interdisciplinary research community for people who are interested in developing hybrid intelligence (HI) systems for healthcare and well-being.

As intelligent systems become more integrated into people's daily life, so do systems designed to assist in lifestyle and behavior changes for health and well-being. However, there is still a gap between research that develops such support systems and its deployment in people's everyday life.

Particularly, challenges faced by the development and deployment of AI-based support systems call for a shift of the design process towards a human-centered approach. This approach can be addressed by HI. Specifically, human capabilities are augmented by their complementary AI capabilities, thus achieving improved results overall. This workshop aims to obtain a better understanding of how HI systems can benefit healthcare and well-being and to identify the accompanying challenges. This workshop will focus on addressing why we need HI and how HI differs from simply using AI-based systems for healthcare.

Developing HI systems for healthcare and well-being is an interdisciplinary research effort by nature. This requires people from various related fields such as computer science, human-computer interaction, psychology, medicine, etc., to exchange their perspectives and collaborate. Therefore, in this workshop, we focus on community building, interdisciplinary exchange, and discussion among participants.

The workshop will include two keynotes, lightning talks, and plenary discussions to address the challenges and requirements for HI for health care. Topics of interest This workshop calls

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for contribution and participation from several fields, including computer science, artificial intelligence, human-computer interaction, cognitive science, healthcare, etc.

The workshop aims to understand better how HI systems can support healthcare and what the main challenges are. We welcome work on any of the main topics of the HHAI conference (see below) applied to the healthcare domain:

- Human-AI interaction and collaboration
- Adaptive human-AI co-learning and co-creation
- Learning, reasoning and planning with humans and machines in the loop
- User modeling and personalisation
- Integration of learning and reasoning
- Transparent, explainable, and accountable AI
- Fair, ethical, responsible, and trustworthy AI
- Societal awareness of AI
- Multimodal machine perception of real world settings
- Social signal processing
- Representations learning for Communicative or Collaborative AI
- Symbolic and narrative-based representations for human-centric AI
- Role of Design and Compositionality of AI systems in Interpretable / Collaborative AI

This could be in any field of healthcare. We are particularly interested in research that investigates how AI and humans can work together in this domain over a longer period of time, for instance in lifestyle related support (diabetes, obesitas, etc.), mental health (stress, anxiety, etc.), doctor-patient relationships, decision support systems for health care providers, and similar.

2. Organization

2.1. Workshop Chairs

- Chenxu Hao, Delft University of Technology (Netherlands)
- Myrthe Tielman, Delft University of Technology (Netherlands)
- Jasper van der Waa, TNO (Netherlands)
- Maaike de Boer, TNO (Netherlands)
- Mark Neerincx, Delft University of Technology (Netherlands)

2.2. Program Committee

- André Tiago Abelho Pereira, KTH Royal Institute of Technology (Sweden)
- Somaya Ben Allouch, Amsterdam University of Applied Sciences (Netherlands)
- Pietro Camin
- Isabella Saccardi, Utrecht University (Netherlands)
- Michael Strange, Malmö University (Sweden)
- Stefani Tsaneva, Vienna University of Economics and Business (Austria)

3. Summary of the workshop

The workshop was a highly interdisciplinary workshop that brought researchers interested in the field of hybrid intelligence and healthcare from various backgrounds.

The workshop consisted of two keynotes. The first one was *Towards inclusive human-centric AI for mental health: Co-creating intelligent digital health assistants for socially disadvantaged youth* from Dr. Caroline Figueroa, a medical doctor by background and an assistant professor in digital health at the Delft University of Technology (Netherlands).

The second one was *Human-AI coupled systems - redefining the (micro)surgical environment* from Dr. Dalibor Vasilic and Dr. Chirag Raman, who co-lead a case study on robotic digital microscopy as part of the Hybrid Intelligence Center, an initiative funded by the Zwaartekracht grant from the Dutch Ministry of Education, Culture and Science. As a microsurgeon certified by the European Board, Dr. Vasilic established the supramicrosurgical unit at ErasmusMC, dedicated to addressing lymphedema caused by cancer. Dr. Chirag Raman is an Assistant Professor in the Department of Intelligent Systems at Delft University of Technology, where he leads the Tapri Lab, focusing on embodied social intelligence.

In addition, the workshop also consisted a session of lightening talks with Q&A, and a group discussion session and a plenary session to formulate challenges for hybrid human-artificial intelligence in behavior change support.

3.1. Submissions

The Program Committee (PC) received a total of 4 submissions (extended abstracts/short papers). Each submission was peer-reviewed by two PC members, by following a double-blind reviewing process. The submissions could be either work in progress or perspectives/opinion pieces. Three submissions are included in the post-proceedings.

3.2. Detailed Program

To facilitate the understanding of each participant's background and finding a common ground for further discussions, the workshop program was organized into various sessions of talks and discussions. A detailed program is presented in Table 1 below.

The presentations of submitted work were:

- Mohammed Ali Tahtali and Corné Dirne. *A Beyond Diagnosis Approach: Fostering Trust in AI's Supportive Role in Healthcare.*
- Gizem Gezici, Carlo Metta, Andrea Beretta, Roberto Pellungrini, Salvatore Rinzivillo, Dino Pedreschi and Fosca Giannotti. *XAI in Healthcare.*
- Quirine Smit, Pei-Yu Chen, Floris den Hengst, Selene Baez Santamaria, Johanna Wolff, Shihan Wang and Maaike de Boer. *Harnessing Hybrid Intelligence to Improve Diabetes Care.*
- Michael Strange. *(Dis)trust and participatory obstacles within the AI-healthcare ecosystem*

Time	Activity
9:00 - 9:15	Welcome
9:15 - 10:15	Keynote 1
10:15 - 10:3 0	Introduction of group discussion
10:30 - 11:00	Break
11:00 - 12:00	Pitches of participants (15 min each group)
12:00 - 13:00	Keynote 2
13:00 - 14:00	Lunch
14:00 - 15:30	Group discussion
15:30 - 16:00	Break
16:00 - 17:00	Plenary session to formulate challenges of Health in HHAI
17:00 - 17:15	Closure

Table 1
Hybrid intelligence for healthcare workshop schedule.

4. Conclusion and Remarks

During the workshop, participants from various backgrounds and fields had fruitful discussions regarding the challenges for creating hybrid intelligent systems for lifestyle support and behavior change support. The discussions highlighted the challenges from different perspectives: from individual roles and context to technical problems and ethical implications. The discussions also emphasized that to address such multifaceted challenges, interdisciplinary effort in future research is required.

Acknowledgments