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The Importance of Human Factors for Trusted Human-Robot Collaborations

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ABSTRACT

The next generation of robots is expected to work collaboratively with humans in natural (dynamic) settings. For this, it is important to properly study and model human factors, so that the AI and Robotic models can include them to enable robust Human-Robot Collaborations. This will enable safe and trustworthy hybrid decision-making approaches – Responsible AI – thereby streamlining robust collaborations (as per human-centred expectations). This interdisciplinary workshop will focus on the intersection of Cognitive Human Factors, Interpretable & Explainable AI methods, Social Interaction, and Human-Centred Robotics to stimulate novel long-range avenues for innovative human-centred collaborative methods in real-world contexts.

KEYWORDS

Human factors, Interpretable & Explainable AI methods, Human-Robot Interaction, Safety

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1 OVERVIEW

Artificial Intelligence and Autonomous Systems are key promising technologies whose merger has already begun to transform many domains, such as health, manufacturing, services, and mobility. To enable the collaborative capability of such autonomous systems, a crucial factor to consider is human factors, addressing: How may autonomous technologies work with humans to collaboratively solve problems and perform complex tasks? What are the legal, social, and ethical requirements that technology should recognise and explicitly address at the level of concrete, systematic methods?

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How can cognitive human factors influence the design of AI-based autonomous system methods?

2 GOALS AND OBJECTIVES

One of the goals of this interdisciplinary workshop will focus on investigating the importance of studying cognitive human factors, particularly within the intersection between AI for Robotics and the Autonomous Systems domain to stimulate novel long-range avenues for innovative human-centred collaborative methods in real-world contexts. We are proposing a workshop that will encourage diverse research discussions and knowledge exchange to address the following topics:

- Including the centrality of “humans” and their “needs” as prime significance in the technical design and implementation of the next generation of AI methods.
- Identifying challenges and research gaps to obtain trusted Human-Robot Collaborations.
- Exchanging insights on innovative cognitive human factors focusing on explainable AI methods to enable safe, trusted, and inclusive Human-Machine Interactions.

Within this workshop, we will bring together top established senior researchers as well as young and emerging talents to discuss and suggest new research ideas within the areas of Robotics, Machine Learning (ML), Explainable AI (XAI), Cognitive Vision, Social Interaction, and Human-Centred Design. Another important goal of this workshop is to expand the understanding of complex dynamics of multimodal interaction in collaborative teams which can potentially derive in novel interdisciplinary concepts.

Workshop website: <https://www.collaborative-autonomy.eu/actions/workshop-hai-2023/>

3 WORKSHOP STRUCTURE

The workshop is planned to be organized for in-person attendees and structured around invited speakers, poster sessions, and a panel discussion. We are planning for a full-day workshop with the following activities:

- **The invited speakers** will be split into different topic sessions. Each speaker will have 20 minutes for their talks and 5 minutes for Q&A.
- The attendees of the workshop may submit an extended abstract of recent results which they would like to **present as**

a **poster** and discuss with the other workshop participants. All accepted posters will give a 3-4 minute pitch presentation of their posters. The main aim of the poster session is to motivate our expert speakers to interact with our audience and further discuss how to address the main topics of this workshop.

- During the afternoon session of the workshop, we are planning to organize a **panel discussion** and we expect all the invited speakers to be the panelists. This will be a multidisciplinary discussion which will help to identify synergies between the different research areas.

The workshop is planned for a full day. Here is the proposed schedule, which will be readjusted based on the final confirmed number of speakers and the schedule of the conference:

Morning session	Welcome & Introduction by the Organizers Invited Talk 1 & 2 Coffee Break & Poster Session Poster Spotlight Talks
12:00 - 13:30	Lunch break
Afternoon session	Invited Talk 3 & 4 & 5 Coffee Break & Poster Session Panel Discussion Closing and Discussion of next steps

Here is a list of **invited speakers**, listed by different categories: **Confirmed:**

- Tetsunari Inamura, Tamagawa University (JP).
- Niki Kousi, EIT Manufacturing CLC South East (GR).
- Maximilian Diehl, Chalmers University of Technology (SE).
- Mehul Baht, Örebro University (SE).

Invited (but not yet confirmed):

- Alessandra Sciutti, Italian Institute of Technology (IT).

4 EXPECTED OUTCOMES

This proposed workshop will discuss and identify key challenges to foster the building of a new interdisciplinary research team that regards Human-Robot Collaboration as one of the most pressing and promising dimensions in the theoretical and practical design of next generation human-centred collaborative autonomous systems. It is important to highlight that this workshop is a strategic step to find potential collaborators of a new interdisciplinary consortium that is currently being built, called "Network on Human-Centered Collaborative Autonomy". Its aim is to investigate cognitive human factors, explainable AI methods, embodied solutions for expressing robots' intentions, and verifiable safety mechanisms enabling trusted Human-System Interactions.

5 EXPECTED AUDIENCE AND CALL FOR PAPERS PLAN

The co-organizers have a strong history of organizing successful workshops at premier conferences, including ICRA, IROS, and RSS.

In addition to advertising in the standard locations (robotics-worldwide, Euron, RAS TC mailing lists), the organizers will reach out to their colleagues across academic, industry, and government research to directly solicit participation from experts in areas applicable to robot teammates operating in dynamic, unstructured environments.

Based on previous workshops and the organizers' participation solicitation plans, we estimate an attendance of 30+ participants.

We will solicit submissions in the form of extended abstracts (2 pages). Submissions describing work in progress that authors would like to discuss with the workshop participants are encouraged and welcome. The workshop does not have official proceedings, but the submitted papers will be posted on the workshop website if the authors agree. Each submitted paper will receive at least two reviews, based on which an acceptance decision will be made. Papers should be submitted electronically.

6 ANY SPECIAL REQUIREMENTS NEEDED REGARDING THE LOGISTICS.

We will require around 10 (double-sided) poster stands and 80 pins for this workshop.

7 ORGANIZERS' LIST (WITH BIOGRAPHIES)

Karinne Ramirez-Amaro is an Associate Professor in the Department of Electrical Engineering at Chalmers University of Technology. She works in Explainable AI, Semantic Representations, Human Activity Recognition and Understanding. She has organized more than six different workshops at IEEE-RAS ICRA and IROS conferences. She is currently, the co-chair of workshops and tutorials of the IEEE-RAS IROS 2023 conference.

Ilaria Torre is an Assistant Professor in the Department of Computer Science and Engineering at Chalmers University of Technology. She works in Human-Robot Interaction, with a special focus on appropriate and efficient communication between humans and robots in different contexts. She organised several workshops including one at HAI 2018 and has served as local co-chair at HRI 2023.

Maximilian Diehl is a Ph.D. student in the Department of Electrical Engineering at Chalmers University of Technology since January 2020. His research interests include explainable and interpretable decision-making methods for robots, such as Causality and AI Planning. He has co-organized one workshop that took place at ICRA 2023 in London.

Emmanuel Dean is an Associate Professor in the Department of Computer Science and Engineering at Chalmers University of Technology. He works in physical Human-Robot Interaction, Rehabilitation Robotics, Adaptive Control Systems and Assistive Robotics. He has co-organized several workshops at IROS and ICRA.

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