

Proposal for a Special Session at IEEE RO-MAN 2024

Human Modeling for Adaptive Interactions and Robot Autonomy

Aim and Scope of the Special Session

The growing reliability, efficiency, and computational capabilities of robotic platforms are pushing the design of innovative services that see robots acting and interacting with humans in both common-life and working scenarios. The effective use of robots in ecological environments is strictly connected to the capability of synthesizing safe and socially compliant robot behaviors as well as the skills, expectations, and needs of the humans they act or interact with. It is an emerging necessity to create human-mediated systems where a robot executes interactive or productive tasks autonomously under the human's supervision, possibly requiring the (occasional) intervention of users. Human knowledge is expected to directly (e.g., through shared control and shared autonomy) or indirectly (e.g., through requisite specification) guide robot autonomy to realize behaviors that are in line with the desired domain objectives, safe and acceptable by involved human users. Furthermore, robots need models of behavioral dynamics, mental states, expectations, and intentions of humans to realize smooth and acceptable interactions by tailoring their general skills to the specific needs and features of users and social contexts. The design of effective models capable of characterizing physical, cognitive, and behavioral features of humans, and combining them with the control and interacting strategies of robots still pose open research challenges. In this respect, research should investigate novel technologies, and methodologies facilitating communication, and sharing knowledge among the different stakeholders (e.g., roboticists, psychologists, cognitive scientists, domain experts, and end-users).

This special session, therefore, aims at fostering the dialogue among the different stakeholders involved in the design and deployment of novel human-mediated and socially aware robots with particular attention to the following topics: a) co-design and definition of requirements; b) modeling of human cognition and physical states as well as social dynamics; c) metrics and benchmarks to evaluate acceptability and efficacy of human-robot interactions; d) ethical regulations; e) hybrid approaches to improve legibility of robot behaviors and communication with humans in general. Given the multidisciplinary nature of the proposed Special Session and the scientific, technological, and ethical impact of such emerging human-robot interaction paradigms, it perfectly fits with the audience of RO-MAN and with the theme of the current edition focusing on Human-Centered HRI.

Topics of interest are (but not limited to):

- Adaptive and Personalized Interaction with Human
- Models of human behaviors, skills, and cognition, contextualized to Human-Robot Interaction
- Methods and Protocols for Safe and effective robot autonomy in human-centered studies, including semi-autonomous approaches (e.g., shared control, shared autonomy)
- Metrics for assessing custom human-robot interaction (e.g., based on the users' preference, culture, and attitude, but not limited to)
- Metrics to evaluate the acceptance and social compliance of semi-autonomous robot behaviors
- Situation awareness and human intention recognition
- Social navigation

- Human-Aware Robot Behaviors
- Theory of Mind and Cognitive Theories Applied to Robotics

Organizers

Rachid Alami Dr., Laboratory for Analysis and Architecture of Systems (LAAS-CNRS), Toulouse, France (e-mail: rachid.alami@laas.fr, phone: +33561336346). Short Bio: . Dr. Rachid Alami is Senior Scientist at LAAS-CNRS. He received an engineer diploma in computer science in 1978 from ENSEEIHT, a PhD in Robotics in 1983 from Institut National Polytechnique and an Habilitation HDR in 1996 from Paul Sabatier University. He contributed and took responsibilities in several national, European and international research and/or collaborative projects (ESPRIT: MARTHA, PROMotion, IST FP6 projects: COGNIRON, URUS, PHRIENDS, and FP7 projects: CHRIS, SAPHARI, ARCAS, SPENCER, H2020: MuMMER, Horizon Europe: EuRoBIN, France: VAP-RISP for planetary rovers, several ANR projects).

He is holding since 2019 the Academic Chair on Cognitive and Interactive Robotics at the Artificial and Natural Intelligence Toulouse Institute (ANITI). His main research contributions fall in the fields of Robot Decisional and Control Architectures, Task and motion planning, multi-robot cooperation, and human-robot interaction (<https://homepages.laas.fr/rachid/>)

Phani Teja Singamaneni, Dr., Laboratory for Analysis and Architecture of Systems (LAAS-CNRS), Toulouse, France (e-mail: phani-teja.singamaneni@laas.fr, phone: +33 - 561336348, web: <https://www.ptsingamaneni.com>). Short Bio: Phani Teja Singamaneni is a Postdoctoral researcher at LAAS-CNRS, working on Social navigation and human-robot interaction. His research interests include motion planning, control, robot design, human-robot interaction, and social robotics. He received his Master's degree from the International Institute of Information Technology, Hyderabad (IIIT-H), in electronics and communications in 2018 with a specialization in robotics. Having worked on robot design, manipulation, and whole-body motion planning of bipedal humanoid robots during his masters, he moved to France to continue his research on human-robot interaction and motion planning at LAAS-CNRS. He attained his Ph.D. in Robotics from Universite Toulouse III -Paul Sabatier in 2022 under the advice of Dr. Rachid Alami. During this time, he has been an active contributor to the MuMMER European Project and has worked on developing a human-aware navigation stack for mobile robots. He was a co-organizer for workshops on social navigation evaluation at IROS 2023 and the Joint-Action, Adaptation, and Entrainment workshop at HRI 2022.

Gloria Beraldo, Dr. National Research Council of Italy, Rome (e-mail: gloria.beraldo@istc.cnr.it, phone: +39- 3299786287). Short Bio: Gloria Beraldo received the M.Sc. degree cum laude in computer science engineering and the Ph.D. in information engineering with Doctor Europaeus mention from the University of Padova, Padua, Italy, in 2017 and 2021, respectively. She was a visiting researcher at École polytechnique fédérale de Lausanne in 2019 and at Institut de Robòtica i Informàtica Industrial, Universitat Politècnica de Catalunya under the TERRINet (European Robotics Research Infrastructures) initiative. She is currently a fixed-term researcher at the Institute of Cognitive Sciences and Technologies, Italian National Research Council. She has been involved in SI-ROBOTICS, FOCAAL and FAIR projects that aim at enhancing robots with AI for providing personalized assistance via human-mediated interactions. She is also a contract professor at the University of Padova. Her research is focused on

designing novel semi-autonomous human-robot interactions with particular attention to the case of brain-machine interface-driven robotics devices. She is investigating how to decode high-level user intention, for instance from his/her brain activity, through supervised machine learning techniques and fuse it with the perception of the robot to achieve advanced forms of human-robot interaction. Her research interests include human-robot interaction, shared control and shared autonomy, telepresence robots, neurorobotics, socially assistive robotics, and intelligent systems.

Riccardo De Benedictis, Dr., National Research Council of Italy, Rome (e-mail: riccardo.debenedictis@istc.cnr.it, phone: +39-3355334405. Short Bio: Riccardo De Benedictis (MALE) [M.Sc. in Computer Engineering in 2010 at University of Rome 'La Sapienza'; Ph.D. in Computing, Electronics, and Mathematics in 2019 at the University of Plymouth] is a researcher in Artificial Intelligence at the Institute of Cognitive Sciences and Technologies of CNR. His research topics concern the development of automated reasoning solvers aimed at addressing real-world applications while keeping a strong consideration for the human component that must interact with intelligent applications. Special attention is given to the efficiency of the reasoning processes, obtained through the development of domain-independent heuristics which, in an integrated way, allow solving semantic inference problems, planning, and scheduling problems, as well as their execution and adaptation in dynamic environments. From September to December 2015 Riccardo has been part of the Artificial Intelligence and Machine Learning group of the Pompeu Fabra University of Barcelona under the supervision of Hector Geffner. Riccardo has worked since 2010 on several projects under the FP7, H2020, and AAL research and innovation framework programs. He is currently studying the integration of different AI techniques for executing plans in nondeterministic environments.

Francesca Fracasso, Dr., National Research Council of Italy, Rome (e-mail: francesca.fracasso@istc.cnr.it, phone: +39-3498277559). Short Bio: Francesca Fracasso (Female) [M.S. 2011 in Psychology, Ph.D. 2015 in Psychology and Cognitive Science] is a research scientist at the Institute of Cognitive Sciences and Technologies of CNR. Her research activities focus on applying a co-design approach in technology development, also by studying usability, acceptance, the satisfaction of users, and the impact of technology on the quality of life. Her expertise spans psychophysiological evaluation, qualitative and quantitative methods for user evaluation, and long-term assessment of user interaction with innovative technologies. She was involved in the user modeling in the EU PANDORA project and has been a major contributor to the user requirements elicitation and design and implementation of the user evaluation for several national and international projects like the EU GiraffPlus project, the AAL TV-AssistDEM project, SI-Robotics (Italian MIUR project) and SmarSatCare (ESA funding for Covid-19 management) where she was as responsible for the experimental design and data analysis. She is currently involved in the EU PRE-ACT project where she leads the WP on Stakeholders' co-design and communication package. Since 2020 she is co-chair of the workshop AIxAS (conjunction with the AIxIA conference) and chair of the workshop Altruist (sociAL roboTs for peRsonalized, continUous, and adaptIve aSsisTance) held in conjunction with ICSR.

Alessandra Sciutti, Dr. Istituto Italiano di Tecnologia, Genova (e-mail: alessandra.sciutti@iit.it, phone: +39-010 2897327). Short Bio: Alessandra Sciutti is the head of the CONTACT (COgNiTive Architecture for Collaborative Technologies) Unit of the Italian Institute of Technology (IIT). After a master's degree in Bioengineering from the University of Genova and a Ph.D. in Humanoid Technologies,

she spent two research periods abroad, first at the Robotics Lab of the Rehabilitation Institute of Chicago (USA) and then at the Emergent Robotics Laboratory of Osaka University (Japan). In 2018 she was awarded an ERC Starting Grant, for the project wHiSPER (www.whisperproject.eu), focused on the investigation of shared perception between humans and robots. She published more than 100 papers in international journals and conferences and is currently Associate Editor for several journals on Cognitive Robotics and Human-Robot Interaction. She is the corresponding co-chair of the Technical Committee on Cognitive Robotics of the IEEE Robotics and Automation Society and a Scholar of the ELLIS Society. The scientific aim of her research is to investigate the sensory, motor, and cognitive mechanisms underlying human social interaction, with the technological goal of developing robots able to establish mutual understanding with humans.

Alessandro Umbrico, Dr. National Research Council of Italy, Rome (e-mail: alessandro.umbrico@cnr.it, phone: +39-3387721391). Short Bio: Alessandro Umbrico (MALE) [M.S. Engineering Computer Science 2012, Ph.D. Computer Science and Automation, 2017] is a researcher at CNR-ISTC. His research topics cover the development of AI-based planning and execution techniques in Human-Robot Interaction (HRI) scenarios. He investigates the integration of knowledge representation and planning to design novel cognitive-inspired control approaches supporting contextualized and adaptive interactions between humans and robots. He contributed to research projects addressing HRI issues for healthcare assistance and collaborative manufacturing. Concerning manufacturing, he participated in the H2020 research projects FourByThree and ShareWork (H2020 Factories of the Future). A parallel thread concerns the development of AI-based technologies for healthcare assistance. He participated in several projects e.g., AAL EU Projects EasyReach, MAESTRO, TV-AssistDem, and the ESA Project SmartSatCare. These projects represented valuable experience in gathering requirements from different stakeholders (e.g., end-users, and healthcare professionals) and designing AI-based services taking into account the different perspectives and needs.

Tentative Speakers

1. “I’m part of the robot’s group: evaluating engagement and group membership from an egocentric view” Alessandra Rossi (University of Naples Federico II), Silvia Rossi (University of Naples, Federico II)
2. “Improving Adaptation of Navigation Behaviors through Contextual Task and Motion Planning” Phani Teja Singamaneni (LAAS CNRS), Alessandro Umbrico (CNR - Institute of Cognitive Sciences and Technologies), Andrea Orlandini (CNR - Institute of Cognitive Sciences and Technologies), Rachid Alami (LAAS CNRS)
3. “Diversity-Aware Human-Robot Interaction using Large Language Models” Lucrezia Grassi (University of Genova), Carmine Tommaso Recchiuto (University of Genova), Antonio Sgorbissa (University of Genova)
4. “Mixed reality models for human-robot collaboration” Mohamad Shaaban (University of Genova), Simone Macciò (University of Genova), Alessandro Carfi (University of Genova), Fulvio Mastrogiovanni (University of Genova)