Academic Corner
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In this issue, we interview IEEE SMC member Marta Lagomarsino. She is a Postdoctoral Researcher at the Human-Robot Interfaces and Interaction (HRII) Laboratory of the Italian Institute of Technology. She completed her PhD in 2023, obtaining the diploma cum Laude from the Electronic, Information and Bioengineering Department of Politecnico di Milano in collaboration with the HRII lab. She received her master's degree in Robotics Engineering in 2020 and her bachelor's degree in biomedical engineering in 2018, both with honors from the University of Genoa. She spent a semester at the University of Twente (Enschede, Netherlands), and her master's thesis project was awarded by GNB and UBCM of Rome. She was honored as the Most Promising Researcher in Robotics and AI (RomeCup2023) during her PhD and received the AI and Robotics mention of the Solution Award 2025 (MECSPE2025). She has contributed to the Horizon-2020 project SOPHIA and the ERC project Ergo-Lean, and is involved in the Horizon Europe project TORNADO, the National INAIL project VIVA, the INAIL BRIC grant CoRoMan, and technology transfer initiatives with industrial partners. She is currently an Associate Editor for IEEE Robotics and Automation Letters. Her research interests include online cognitive ergonomics assessment, socio-physical human-robot interaction, and mutual human-robot adaptation.

(1) Can you briefly tell us about your academic and research background?
I hold a Bachelor's degree in Biomedical Engineering and a Master's degree in Robotics Engineering, both from the University of Genova in Italy. From the very beginning, I have been drawn to the intersection between technological innovation and human well-being.

I carried out my Master's thesis at the Robotics and Mechatronics Department of the University of Twente (Netherlands), where I developed a robot-assisted system to support radiologists in targeting breast tumours, using multi-modal feedback. Following this, I started a PhD at the Human-Robot Interfaces and Interaction (HRII) Laboratory of the Istituto Italiano di Tecnologia, in collaboration with the Department of Electronics, Information and Bioengineering at Politecnico di Milano. My doctoral research aimed to rethink cognitive ergonomics in industrial environments by exploiting artificial intelligence and collaborative robotics.

Since then, my research has focused on how robots can adapt their interaction styles, timing, and task support to individual users by accounting for human psycho-physical state, personal preferences, and specific mobility impairments, as well as how they can learn effectively from demonstrations and feedback. My broader goal is to enable seamless, personalised, and human-aware robot behaviours and interactions, an essential capability across a wide range of domains, from industrial settings to assistive care environments.

(2) What are the key challenges you're addressing in socio-physical human-robot interaction?
One of the primary challenges I tackle in my research is the **modelling and online monitoring of the human psycho-physical state**. This involves meeting the requirements for online measurement while ensuring non-invasive, fit-for-workplace solutions that respect individual variability in behaviour, attitude, and needs. To this end, I proposed a novel approach to online estimate cognitive load through **mind-induced motor behaviours** using a cost-effective, industry-compliant stereo camera. The system tracks workers' head pose and upper-body kinematics to monitor attention distribution and detect behavioural indicators of stress, such as hyperactivity and self-touching, enabling to anticipate excessive mental demands and deliver timely feedback.

This links directly to the second major challenge: **can collaborative robots actively contribute to improving human working conditions?** More specifically, can they implement **anticipatory strategies** that prevent mental overload, align with human preferences, and even mitigate long-term mental health risks in the workplace? My research has shown that this is feasible. By dynamically adjusting safety zones and modifying its path based on the human's estimated awareness and mental effort, the robot promoted physical safety (e.g., collision avoidance) and socio-cognitive wellbeing (e.g., enhanced perceived safety and reduced stress). To support these adaptive behaviours, I implemented a multi-objective optimisation framework and a human-aware decision-making system, allowing the robot to balance productivity with the need to avoid excessive psycho-physical stress on the human. Furthermore, to account for **individual preferences and trust**, data-driven learning strategies (such as reinforcement learning and preference-based optimisation) were employed to enable the robot to learn user-specific needs on the fly, given the complexity of representing those using mathematical models.

More recently, I have extended these concepts to understand how robots can online adapt the interaction to the needs of upper-body impaired individuals. This includes mitigating the adoption of compensatory movements and adjusting robot behaviour to better suit users with mobility limitations. I see great potential in this direction, not only for supporting daily assistance but also for **promoting return-to-work opportunities** for injured or disabled individuals.

(3) How do you see this field evolving over the next 5–10 years?
Robots are increasingly proving their ability to operate safely and effectively alongside humans. Over the next 5 to 10 years, I see the field of human-robot interaction and collaboration evolving toward greater generalisation and adaptability, allowing robots to function in unstructured environments and tailor their behaviour to diverse user needs. A key step in this direction will be the **continuous monitoring of user perception** and the integration of **online user feedback** to inform adaptive behaviour. Additionally, we need to **streamline robot programming for non-experts** through multimodal inputs (e.g. video demonstrations and natural language instructions), making robot functionalities more **intuitive, accessible, and human-aware**. These advancements will be essential for the deployment of robots in real-world applications.

(4) What advice would you give to other young researchers (like PhD students) working across engineering, cognition, and robotics?
My main advice is to **actively engage with the research community**: attend conferences, participate in workshops and seminars, and share your work and ideas as much as possible. Networking opens up learning opportunities and promotes enjoyment throughout the research journey.
Moreover, do not shy away from **interdisciplinary collaborations**. They can be challenging because different fields often use distinct terminologies and approaches, but they frequently lead to the most innovative ideas and rewarding experiences.

(5) Has IEEE or the IEEE SMC community played a role in your professional development?
Absolutely! IEEE has supported my professional growth by providing opportunities to put the advice I mentioned earlier into practice.