ADVANCED ROBOTICS Call for Papers

Special Issue on
Nonverbal Cues for Human-Robot Cooperative Intelligence

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Publication in Vol. 40, Issue 1 (January 2026)

SUBMISSION DEADLINE: 30 May 2025

It is desirable for intelligent systems like robots, virtual agents, human-machine interfaces to collaborate and interact seamlessly with humans in the era of Industry 5.0, where intelligent systems must work alongside humans to perform a variety of tasks anywhere at home, factories, offices, transit, etc. The underlying technologies to achieve efficient and intelligent collaboration between humans and ubiquitous intelligent systems can be realized by cooperative intelligence, spanning interdisciplinary studies between robotics, AI, human-robot and -computer interaction, computer vision, cognitive science, etc.

One of the main considerations to achieve cooperative intelligence between humans and intelligent systems is to enable everyone and everything to know each other well, like how humans can trust or infer the implicit internal states like intention, emotion, and cognitive states of each other. The importance of empathy to facilitate human-robot interaction has been highlighted in previous studies. However, it is difficult for intelligent systems to estimate the internal states of humans because they are dependent on the complex social dynamics and environment contexts. This requires intelligent systems to be capable of sensing the multi-modal inputs, reasoning the underlying abstract knowledge, and generating the corresponding responses to collaborate and interact with humans.

There are many studies on estimating internal states of humans through measurements of wearables and non-invasive sensors, but it would be difficult to implement these solutions in the wild because of the additional sensors to be worn by humans. One promising solution is to use audiovisual data like nonverbal behavior cues consisting of gaze interaction, facial expression, body language and paralanguage to infer the internal states of humans. Researchers in cognitive and social psychology have long advocated that these nonverbal behaviors are subconsciously generated by humans and reflect the internal states of humans under different contexts. Some salient examples are studies on emotion recognition using facial and body language in controlled environment. It remains an open question for intelligent systems to sense and recognize nonverbal cues and reason the rich underlying internal states of humans in the wild and noisy environments.

As an extension to IROS2024's Workshop on Nonverbal Cues for Human-Robot Cooperative Intelligence, this special issue proposal is dedicated to discussing computational methods for sensing and recognition of nonverbal cues and internal states in the wild to realize cooperative intelligence between humans and intelligent systems. We welcome submissions of extended papers from the conferences and workshops, and any new submissions related to the common goal, motivation, and resolve to explore and tackle this delicate issue considering the practicality of industrial applications. We are calling for papers to discuss novel methods to realize human-robot cooperative intelligence by sensing and understanding humans' behavior, internal states, and to generate empathetic interactions.

- Human internal state inference, e.g., cognitive, emotional, intention models.
- Recognition of nonverbal cues, e.g., gaze and attention, body language, paralanguage.
- Multi-modal sensing fusion for scene perception.
- Nonverbal behavior generation for robots/agents, e.g., gaze salience, gesture.
- Synchronization of nonverbal and verbal behavior
- Learning algorithms for cooperative intelligence, e.g., cross-embodiment and cross-context learning, imitation learning.
- Generative and adversarial algorithms to enhance human-robot interaction, e.g., LLMs, diffusion models, VLMs.
- Empathetic interaction between humans and intelligent systems.
- Robust sensing of facial and body key points.
- Social interaction dynamics modeling, e.g., harmony level, engagements.
- Personalization of intelligent systems from nonverbal cues and trust evaluation.
- Applications of cooperative intelligence in the wild.

Submission:

The full-length manuscript (either in PDF or Microsoft Word format) should be sent to the editorial office of Advanced Robotics, the Robotics, Society of Japan, through its website at: https://www.rsj.or.jp/pub/ar/submission.html. Manuscript templates and author instructions are available on the website.