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AUTHOR INFORMATION

Adriana Tapus
Cognitive Robotics Lab
ENSTA-ParisTech, Paris, France

DIALOG COLUMN

Is Developmental Robotics a Solution for Socially Assistive Robotics?

The Human-Robot Interaction (HRI) field for assistive applications focuses on how to provide long-term/lifelong social interaction for vulnerable populations (e.g., children with autism, post-stroke patients, and individuals suffering of cognitive impairments) [1]. Due to the sensitive nature of their interactions with humans, socially assistive robots need a thorough and targeted training, similar to that received by nurses/trainers/therapists, before they are released in the wild. They also need to continuously and incrementally learn and adapt their behavior to the user's profile (i.e., personality, preferences, and disability) and to the environmental changes in order to deliver a personalized, engaging, and motivating social interaction and useful feedback to their "users".

Different perceptual modalities and cognitive and behavioral capabilities need to be explored so that a robot can develop through continuous interaction with, learning of, and adaptation in the social environment. The robot's decisional abilities require taking into account context, user's profile and disability level while performing its tasks [1]. It has to take initiative to establish and conduct a fruitful therapeutical session with humans, and change its interaction styles depending on context and scenarios [2], [3]. The point raised by Rohlfing and Wrede regarding the necessity of a long-term memory to facilitate knowledge assimilation and consolidation is one that I also share. I would go even further and argue that sharing learned concepts between robots, in a distributed fashion, and make some of that knowledge innate to the next generation is extremely valuable. However, due to the sensitive nature of the tasks and interactions between socially assistive robots and the vulnerable users that require their assistance, I believe that a traditional machine learning approach that allows for manual intervention in the learning process, as opposed to the "skull closed" approach advocated by the autonomous mental development community, is more appropriate.

The multimodal sensing capabilities that are required to move and act for long periods of time in continuously changing, human-centered environments have highlighted the importance of the autonomous mental development of robots. Moreover, developing robots capable of expressing intentionality and spontaneity in social interaction is another problem, where the developmental process is more appropriate [4]. Nevertheless, in the assistive context, one difficulty encountered in lifelong learning robots is to measure what the robot has learned and its evolution in time. A qualitative and quantitative answer to this question could provide the possibility for the human to act on and to influence the robot decisional processes and vice versa.

Rohlfing and Wrede discuss also the importance of incorporating some high-level abstract representation of tasks and object affordances in the system. This implies to have or to construct some semantic representation and/or ontological schema. Most of the existing works in robotics have tried to learn the affordances [5] and very little have addressed the key problem of inferring affordance parameters from multimodal perceptual measurements [6]. This is of high importance and more research

should be pursued in this direction.

To conclude this short response, recent works in socially assistive robotics show the importance of long-term interaction in having a personalized adaptive behavior based on the experience achieved and the interaction episodes [7], [3]. In this context, developmental robotics, still in its infancy, can perhaps bring some new solutions to assistive robotics and therefore an interdisciplinary collaboration that creates the marriage between these two fields is required.

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