The Promises and Challenges of Socially Assistive Robotics

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Introduction

Human-Robot Interaction (HRI) for *socially assistive* applications is a growing and increasingly popular research area at the intersection of robotics, health science, psychology, social science, and cognitive science. Assistive robotics has the potential to enhance the quality of life for large populations of users. In response to the rapidly growing elderly population, a great deal of research attention has been dedicated toward the study and development of robot pets and companions aimed at reducing stress and depression [6, 11]. Individuals with physical impairments and those in rehabilitation therapy are also potential beneficiaries of socially assistive technology, both for improved mobility [13] and for improved outcomes in recovery. Finally, individuals with cognitive disabilities and developmental and social disorders (e.g., autism [2, 12]) constitute another growing population that could benefit from assistive robotics in the context of special education, therapy, and training. An effective socially assistive robot must understand and interact with its environment, exhibit social behavior, and focus its attention and communication on the user in order to assist in achieving specific goals.

Socially Assistive Robotics

A defining property of *socially assistive robotics* is its focus on the *social interaction,* rather than the *physical interaction* between the robot and the human user. This is a challenging domain because the robots are interacting with vulnerable users, resulting in ethical issues. Our work addresses a new niche: contact-free social robotic assistance. The physical embodiment of the robot plays a key role in its socially assistive effectiveness. It is well established that people attribute intentions, goals, emotions, and personalities to even the simplest of machines with life-like movement or form [9]. Because of this combination of properties, embodiment constitutes a key means of establishing human-robot interaction, specifically with the goals of having the user respond to the robot and become engaged in a goal-driven interaction with it. Some social robotics research has already been performed [1, 3, 6, 8]. However, social robotics has not yet tackled the complex challenges of assistive tasks, where the overall goal is to achieve measurable progress toward improved health, education, or training. Socially assistive robotics, our field of research focus, presents a new paradox: the goal of retaining user engagement can be in conflict with the health/training/education goals. The robot's physical embodiment, its physical presence, and its shared context with the user, all play fundamental roles in time-extended, sustained, goal-driven interactions in assistive domains.

Figure 1: Our therapist robot

As part of physical presence, the appearance of the robot is one of the important issues in human-robot interaction; it must be appropriately matched to the robot's cognitive and interactive capabilities. The more human-like the robot appears, the higher the expectations of people interacting with it are. In socially assistive robotics, *believability* plays a more important role than realism. Hence, a child-like appearance or anthropomorphic but not highly realistic appearance is typically more suitable for assistive tasks. Our therapist robot, shown in Figure 1, is designed with this philosophy in mind; even more standard mobile robots have already been successfully applied in our work toward therapist robots that assist, encourage and socially interact with users in the context of convalescence, rehabilitation, and education [4, 5, 7, 10]. Our work to date shows that the robot's personality and its social competence, expressed

through body language and verbal interaction, are likely more important than its physical appearance. Our robots are equipped with a basic set of task-oriented and social basic behaviors that explicitly express their desires and intentions physically and verbally [10].

Summary

Our work to date demonstrates the promises of socially assistive robotics, a new research area with large horizons of fascinating and much needed research. Our ongoing efforts are aimed at developing effective embodied assistive systems, and extending our understanding of human social behavior. Hence, even as socially assistive robotic technology is still in its early stages of development, the next decade promises assistive robotic platforms and systems that will be used in hospitals, schools, and homes in therapeutic programs that monitor, encourage, and assist their users. It is therefore important that potential users, well beyond the technical community, become familiar with this growing technology and help shape its development toward its intended positive impact on numerous lives.

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