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Editorial

Applications and Trends in Social Robotics

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1. Introduction

Social robots are intended to coexist with humans and engage in relationships that lead them to a better quality of life. The success of these relationships relies on a positive perception of the robots that their behavior can achieve through AI, computational models, or robot embodiments. This Special Issue brings together original contributions describing technically rigorous scientific and philosophical developments in social robotics and AI, that is, innovative ideas and concepts, discoveries and improvements, and novel applications of advances in social robotics technologies.

For this purpose, this Special Issue was open to receiving a variety of meaningful and valuable manuscripts concerning social robotics applications and trends. Participants were invited to write about one of the subjects listed below, but they were not limited to these.

- Affective and cognitive sciences for socially interactive robots
- Context awareness, expectation, and intention understanding
- Control architectures for social robotics
- Human augmentation, rehabilitation, and medical robots
- Interaction and collaboration among robots, humans, and environments
- Personal robots for the home
- Robot applications in education, entertainment, and gaming
- Robot ethics in human society
- Robots that can adapt to different users
- Robots to assist the elderly and persons with disabilities
- Robots with personality
- Safety in robots working in human spaces
- Socially assistive robots to improve quality of life
- Social acceptance and impact in the society
- Socially appealing design methodologies
- Real experiences with social robots
- Assessing interaction in social robotics

2. Review Papers

Martínez et al. [1], as part of an ongoing research project to develop an unmanned flying social robot to monitor dependents at home in order to detect the person's state and bring the necessary assistance, proposed an emotion recognition system that is able to detect a person's face in the image captured by the UAV's on-board camera and classify the emotion among seven possible ones (surprise, fear, happiness, sadness, disgust, anger, or neutral expression). For this purpose, the authors used a face detection algorithm and a convolutional neural network. The experimental results demonstrate the correct integration of this new computer vision module within the virtual reality platform, as well as the good performance of the designed convolutional neural network, with around 85% in the F1-score. The developed emotion detection system can be used in the future implementation of the assistance UAV that monitors dependent people in a real environment, since the methodology used is valid for images of real people.

Qbilat et al. [2] presented a proposal for accessibility guidelines for human–robot interaction. The guidelines have been evaluated by seventeen human–robot interaction designers and/or developers. The majority agreed that the guidelines are helpful for them to design and implement accessible robot interfaces and applications. Some of them had considered some ad hoc guidelines in their design practice, but none of them showed awareness of or had applied all the proposed guidelines in their design practice, and 72% of the proposed guidelines have been applied by fewer than or equal to eight participants for each guideline. Moreover, 16 of the participants would use the proposed guidelines in their future robot designs or evaluation. The participants recommended the importance of aligning the proposed guidelines with safety requirements, environment of interaction (indoor or outdoor), cost and users' expectations.

Zguda et al. [3] explored the role of trust and expectations towards Pepper robots in determining the success of the interactions in Polish and Japanese kindergartens and present several observations from the video recordings of their Child–Robot Interaction (CRI) events and the transcripts of free-format question-answering sessions with the robot using the Wizard-of-Oz (WOZ) methodology. From these observations, they identified children's behaviors that indicate trust (or lack thereof) towards the robot, e.g., challenging behavior of a robot or physical interactions with it. Additionally, they gathered insights into children's expectations, e.g., verifying expectations as a causal process and an agency or expectations concerning the robot's relationships, preferences and physical and behavioral capabilities. Based on their experiences, the authors suggested some guidelines for designing more effective CRI scenarios. Finally, the manuscript argued about the effectiveness of in-the-wild methodologies for planning and executing qualitative CRI studies.

Quiñonez et al. [4] proposed an algorithm to calculate an accuracy trajectory at any time of interest using an LCD touch screen to calculate the inverse kinematics and find the end point of the gripper; the trajectory is calculated using a proposed novel distribution function which provides an easy way to obtain fast results in the trajectory planning. The obtained results show improvements to generate a safe and fast trajectory of an anthropomorphic robotic arm using an LCD touch screen allowed to calculate short trajectories with minimal finger moves.

Garcia-Haro et al. [5] proposed a new category of robotics: catering robotics. This proposal is based on the technological advances that generate new multidisciplinary application fields and challenges. Waiter robots is an example of catering robotics. These robotic platforms might have social capacities to interact with the consumer and other robots, and at the same time, might have physical skills to perform complex tasks in professional environments such as restaurants. This paper explains the guidelines to develop a waiter robot, considering aspects such as architecture, interaction, planning, and execution.

Zhang et al. [6] proposed an improved algorithm to plan feasible paths in a home environment. The algorithm pre-builds a tree that covers the whole map and maintains the effectiveness of all nodes with branch pruning, reconnection, and regrowth processes. The method forms a path by searching the nearest node in the tree and then quickly accessing the nodes near the destination. Due to the effectiveness-maintaining process, the proposed method can effectively deal with the complex dynamic environment where the destination and multiple moving obstacles change simultaneously. In addition, their method can be extended to the path-planning problem in a 3D space. The simulation experiments verify the effectiveness of the algorithm.

Lytridis et al. [7] described some alternatives to implement synchronous and asynchronous therapeutic sessions for children already participating in a medical protocol to reduce the negative effects of the strict cessation of in-person sessions. The usefulness of the approach was assessed by recording the children's and the parents' satisfaction via questionnaires. In addition, they compare satisfaction between the synchronous and asynchronous sessions. The results show that the approach was satisfactory and useful for both children and parents, and that this was especially the case for the robot-based material.

Goenaga et al. [8] proposed an intelligent system that can hold an interview, using a NAO robot as the interviewer, playing the role of vocational tutor. For that, twenty behaviors within five personality profiles are classified and categorized into NAO. Five basic emotions are considered: anger, boredom, interest, surprise, and joy. The selected behaviors are grouped according to these five different emotions. Common behaviors (e.g., movements or body postures) used by the robot during vocational guidance sessions are based on a theory of personality traits called the "Five-Factor Model". The results show how the intelligent selection of behaviors can be successfully achieved through the proposed approach, making the Human–Robot Interaction friendlier.

Alonso et al. [9] presented a comparative study of eight off-the-shelf Text to Speech (TTS) systems used in social robots. In order to carry out the study, 125 participants evaluated the performance of the TTS systems: Google, Microsoft, Ivona, Loquendo, Espeak, Pico, AT&T, and Nuance. The evaluation was performed after observing videos where a social robot communicates verbally using one TTS system. The participants completed a questionnaire to rate each TTS system in relation to four features: intelligibility, expressiveness, artificiality, and suitability. In this study, four research questions were posed to determine whether it is possible to present a ranking of TTS systems in relation to each evaluated feature, or, on the contrary, there are no significant differences between them. Their study shows that participants found differences between the TTS systems evaluated in terms of intelligibility, expressiveness, and artificiality. The experiments also indicated that there was a relationship between the physical appearance of the robots (embodiment) and the suitability of TTS systems.

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