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PREFACE

Special Issue on Humanoid Robotics

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Many people have dreamed that humanoid robots will be integrated into our daily lives. This hope for humanoid robots can be attributed to our anthropomorphism. Humans understand the world through perceiving and acting on the environment. Anthropomorphism is automatically active as part of this understanding mechanism, especially during interactions with animals and objects similar to ourselves in appearance. More generally, anthropomorphism underlies this cognitive mechanism, and anthropomorphic robots can perform human-like actions and enhance human viewers' understanding of the intended effects of these actions. Humanoid robotics may therefore be a pathway to realizing easy-to-understand artificial systems.

Research into humanoid robotics pursues this capability from multiple viewpoints, such as designing robot bodies similar to those of humans, synthesizing human-like motion, enabling motor skill learning and semantic perception, and developing artificial systems able to communicate with humans. This research field has received significant attention over the last few decades and will continue to play a central role in robotics and cognitive systems research. This special issue presents theoretical and technical achievements related to humanoid robotics; these achievements range from mechanical design to artificial intelligence.

Six papers are included in Vol. 29, Issue 5. In the first paper, Morante et al. present a programming-by-demonstration framework for learning motor skills. In their framework, a motion encoder handles the features of an object on which the motion acts. Goal-directed actions can be performed by a humanoid robot through using the system. The second paper, by Gonzalez-Fierro, presents an imitative learning approach to transferring a complex behavior composed of multiple motion primitives from a human demonstrator to a humanoid robot. This approach is formulated as a Markov decision process, where a reward function is defined for each subtask, and optimizes a sequential policy to generate full body motions in a humanoid robot. In the third paper, Berger et al. present a machine learning approach to detecting, estimating, and compensating for external perturbations using standard sensors only. Their machine learning approach uses dynamic-mode decomposition, which was originally developed in the context of fluid dynamics. This technique enables robots to react to perturbations caused by a human partner.

In the fourth paper, Ramirez Amaro et al. present a system for inferring the intention of human activities from observation. This system extracts low-level information from sensor data and uses this to draw high-level inferences. The fifth paper, by Bimbo et al., presents a novel method of estimating the posture of an object by analyzing force, tactile, and proprioceptive data. This pose estimator can be useful for a robot that needs to grasp or manipulate objects even when the objects are visually occluded. In the sixth paper, Sabaapour proposes the extension of passive–dynamic walking during straight-to-curved walking and turning. The simplest bipedal walking model, a rimless spoked wheel model, is studied. The analysis improves the understanding of its three-dimensional dynamics and provides insight into handling its natural stability.

Humanoid robotics is a broad research field, and many interesting papers on various topics have been submitted. Several papers are still under revision and will be published in Vol. 29, Issue 9. We hope our many readers will be interested in this special issue and be spurred on to further study humanoid robotics in order to realize a society coexisting with humanoid robots.

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