Editorial

Special Issue on the Fourteenth International Symposium on Robotics Research, 2009

From its historical background and its focus on quality, the International Symposium of Robotics Research (ISRR) is one of the most prestigious conferences in the field of robotics. Sponsored by the International Foundation of Robotics Research (IFRR), the goal of ISRR is to bring together active leading robotics researchers from academia, public institutions and industry to assess and share their views and ideas about the state-of-the-art of robotics and the future of the field.

The Fourteenth ISRR took place from August 31st to September 3rd 2009 in Lucerne, Switzerland. The Technical Program featured 48 regular papers, half of them invited, half of them carefully selected out of 66 submissions, with the objective to cover some of the most important and fast emerging research topics in robotics. The presentations of these papers were arranged in 12 thematic sessions, each of which was chaired by members of the Program Committee. In addition, six invited presentations were given by Hugh Durrant-Whyte, Daniela Rus, Brad Nelson, Stefan Schaal, Sebastian Thrun and Makoto Kaneko during the Blue Sky session, held on top of Mount Pilatus, a 2132-meter-high peak in the vicinity of Lucerne. These talks and the following discussions endeavored to identify and explore the challenges that robotic research will have to address in the coming years. As a tradition of the ISRR, one evening was dedicated to an open video session, sponsored by Maxon Motors. Under the chairmanship of Oussama Khatib, the participants showed brief videos of their recent work and achievements, as well as amusing failures. The technical program of the 14th ISRR was complemented by a rich social program, which included a banquet on Mount Pilatus and a dinner on the shore of Lake Lucerne with robotic demonstrations.

After the symposium, 12 papers were selected for this special issue of The International Journal of Robotics Research (IJRR). After review by at least two specialists for each paper, we decided to publish the following nine papers.

- In **Stable Dynamic Walking over Uneven Terrain**, I. Manchester, U. Mettin, F. Iida and R. Tedrake present a walking system with the specific focus of exploiting the natural dynamics of an under-actuated system. The key contribution of the approach is to provide a systematic way to stabilize such a system to a target orbit, with local exponential stability.

- In **Place-dependent People Tracking**, M. Luber, G-D. Tipaldi and K.O. Arras take an alternative viewpoint on the mapping problem. The main challenge addressed by this article is mapping the motion pattern of people based on their position in the environment. Such a map could then be used to predict people’s motion and integrate this information in a motion planner.

- In **Learning Visual Representations for Perception-Action Systems**, J. Piater, S. Jodogne, R. Detry, D. Kraft, N. Krüeger, O. Krömer and J. Peters use a reinforcement learning approach to learn how to grasp objects of diverse shapes. An important aspect of this type of learning is the absence of supervision: the robot tries to grasp objects and move them around by itself and, from this experience, learns what the best grasping configurations are.

- In **Motion Planning under Uncertainty for Robotic Tasks with Long Time Horizons**, H. Kurniawati, Y. Du, D. Hsu and W. Sun Lee focus on another source of complexity in robotic planning, namely the management of uncertainties. By proposing a new point-based POMDP solver they succeed in planning for long-time-horizon tasks, which were not solvable with existing planners.

- In **Planning and Control for Cooperative Manipulation and Transportation with Aerial Robots**, J. Fink, N. Michael, S. Kim and V. Kumar consider the problem of transporting a payload using multiple quad-copters. Individual robot control laws and motion plans are developed. This article reports results in simulation and with a set-up made of three quad-copters.

- In **Applications of Hybrid Reachability Analysis to Robotic Aerial Vehicles**, J.H. Gillula, G.M. Hoffmann, H. Huang, M.P. Vitus and C.J. Tomlin consider the transition between basic motion primitives for the control of a small helicopter doing acrobatics. They use the Hamilton-Jacobi differential game formulation to find transitions between control modes which are provably safe.

- In **Landing, Perching and Taking Off from Vertical Surfaces**, A. Lussier, D. Alan, T. Asbeck and M. Cutkosky present a very different approach to control for a small airplane trying to land on a vertical wall. By integrating intelligence into the mechanical design, they can
simplify the sensing requirements and manoeuvre planning complexity to a minimum, while still being able to successfully field-test the resulting system.

- In *Unifying Geometric, Probabilistic, and Potential Field Approaches to Multi-Robot Deployment*, M. Schwager, D. Rus and J-J. Slotine consider the case of multiple robots and focus on a coverage task. This work is particularly interesting because it brings together various existing coverage algorithms in a common framework.

- In *Real-Time Photorealistic Virtualized Reality Interface for Remote Mobile Robot Control*, A. Kelly, N. Chan, H. Herman, D. Huber, R. Meyes, P. Rander, R. Warner, J. Ziglar and E. Capstick describe the challenges related to the remote control of a mobile platform using only the transmitted sensor data. The main contributions are, on the one hand, the insight on the importance of latency compensation for high-speed remote driving, validated by user studies, and, on the other hand, the report on the technologies required to achieve this impressive integration effort.

The symposium would not have been possible without the diligent work of a great number of people, including the various committee members and technical reviewers. Special thanks are due to the members of the Autonomous Systems Lab from ETH Zürich for taking care of most of the logistics required for organizing and running the conference. Oussama Khatib, President of IFRR, provided helpful advice throughout and was once again a central driving force behind the scene. Finally, we thank all of the participants of the 14th ISRR for making the symposium such an enjoyable and inspiring event, both from the technical and social point of view.

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