Auton Robot (2015) 39:219–220
DOI 10.1007/s10514-015-9482-8

Editorial: special issue on the 2014 "Robotics: Science & Systems" conference

Lydia E. Kavraki[1] · **Maxim Likhachev**[2]

Published online: 28 August 2015

Welcome to this special edition of *Autonomous Robots* (*AURO*) that features some of the papers from the tenth Robotics: Science & Systems (RSS) conference. The conference was held in June 2014 at the University of California, Berkeley. The papers were carefully selected for this edition out of the conference papers that had already gone through a highly competitive selection process. We hope that readers will enjoy this edition as these papers illustrate some of the most advanced research in Robotics. In addition, the reader of this edition is encouraged to look at the special issue of The International Journal of Robotics Research (IJRR) that assembles the second set of papers from RSS 2014.

There are thirteen papers in this edition. These papers can roughly be split into five different topics:

- Vision, Perception, and Localization
- Human–Robot Interaction
- Robot Learning
- Planning and Coordination
- Robotic Systems

Under the topic Vision, Perception, and Localization, we have four papers. The paper titled "Batch Nonlinear Continuous-Time Trajectory Estimation as Exactly Sparse Gaussian Process Regression" by Sean Anderson, Timothy D. Barfoot, Chi Hay Tong, and Simo Särkkä explores batch state estimation by viewing it as a Gaussian Process regression. It shows how querying a trajectory in this framework can be formulated as a nonlinear Gaussian Process regression and can be accomplished efficiently. The paper "DART: Dense Articulated Real-Time Tracking" by Tanner Schmidt, Richard Newcombe, and Dieter Fox introduces a single framework for tracking a broad class of articulated objects ranging from furniture to human and robot bodies. This framework formulates a signed distance function representation that lends itself well to articulated objects and makes it easy to use highly parallel GPU algorithms for data association and pose optimization. The paper "Self-Calibration and Visual SLAM with a Multi-Camera System on a Micro Aerial Vehicle" by Lionel Heng, Gim Hee Lee, and Marc Pollefeys proposes a novel visual SLAM-based self-calibration method for a multi-camera system that includes at least one calibrated stereo camera, and an arbitrary number of monocular cameras. Furthermore, the authors introduce an efficient method for estimating a global pose of a vehicle via a multi-camera visual SLAM with loop closures and demonstrate its real-time implementation on-board a Micro-Aerial Vehicle. Finally, the paper "Incorporating Scene Priors to Dense Monocular Mapping" by Alejo Concha, Wajahat Hussain, Luis Montano, and Javier Civera presents a dense monocular mapping algorithm. The algorithm improves the accuracy of the state-of-the-art stereo methods by showing how to incorporate scene priors into its formulation.

Under the topic Human–Robot Interaction, there are also four papers. The paper "Decision-Making Authority, Team Efficiency and Human Worker Satisfaction in Mixed Human–Robot Teams" by Matthew C. Gombolay, Reymundo A. Gutierrez, Shanelle N. Clarke, Giancarlo F. Sturla, and Julie A. Shah studies the efficiency of human–robot teams and willingness of human teammates to work with robotic teammates. The authors conduct an extensive set of experiments towards these questions, make a number of interesting conclusions and provide guidance for roboticists and industry practitioners for how to design robotic assistants

✉ Maxim Likhachev
maxim@cs.cmu.edu

[1] Rice University, Houston, USA

[2] Carnegie Mellon University, Pittsburgh, USA

that integrate better into the human workplace. The paper "Effective Task Training Strategies for Human and Robot Instructors" by Allison Sauppé and Bilge Mutlu presents an autonomous instructional robot and investigates how different instructional strategies affect user performance and experience. Their analysis of human instructor-trainee interactions identifies several key instructional strategies such as grouping instructions together and summarizing the outcome of subsequent instructions. The authors implement these strategies on the robot and study their benefits in a human–robot interaction. The paper "Deceptive Robot Motion: Synthesis, Analysis and Experiments" by Anca Dragan, Rachel Holladay, and Siddhartha Srinivasa investigates the concept of deception in robots. It presents an analysis of a deceptive motion, formulates its mathematical model and studies the effect of deceptive motions in human-robot interactions. The last paper under this topic is "Recovering from Failure by Asking for Help" by Ross A. Knepper, Stefanie Tellex, Adrian Li, Nicholas Roy, and Daniela Rus. It develops an approach that enables a robot to recover from failures by asking a human for help in natural language. To accomplish this, the authors introduce a novel inverse semantics algorithm for generating effective help requests.

Under the Robot Learning topic we have three papers. The first paper, "Learning Place-Dependant Features for Long-Term Vision-Based Localisation" by Colin McManus, Ben Upcroft, and Paul Newman, presents an alternative approach to the problem of long-term visual localization in outdoor environments. The approach leverages experience to learn place-dependent feature detectors with the idea that the learnt features would allow the system to maintain localization across significant appearance changes. The paper "Active Reward Learning with a Novel Acquisition Function" by Christian Daniel, Oliver Kroemer, Malte Viering, Jan Metz, and Jan Peters studies how to avoid specifying a reward function. To this end, it introduces a learning framework, wherein the robot simultaneously learns an action policy and a model of the reward function by actively querying a human expert for ratings. The authors evaluate the approach in the context of a grasping task. The paper "Learning State Representations with Robotic Priors" by Rico Jonschkowski and Oliver Brock explores methods for learning effective state representation. The proposed method exploits the fact that learning occurs in a physical world and thereby facilitates learning by maintaining consistency with the relevant aspects of physics.

The last two topics have one paper each. Under the topic Planning and Coordination, we have the paper "Communication Constrained Task Allocation with Optimized Local Task Swaps" by Lantao Liu, Nathan Michael, and Dylan A. Shell. It proposes a fully decentralized method to task allocation that respects communication constraints and minimizes interactions. The properties of the method are analyzed in a novel way using tools from group theory. Under the topic Robotic Systems, we have the paper "Vision-based Landing Site Evaluation and Informed Optimal Trajectory Generation Toward Autonomous Rooftop Landing" by Vishnu R. Desaraju, Nathan Michael, Martin Humenberger, Roland Brockers, Stephan Weiss, Jeremy Nash, and Larry Matthies. It presents an approach to autonomous rooftop landing by micro-aerial vehicles. The approach employs an active perception strategy that enables micro-aerial vehicles with limited onboard sensing and processing capabilities to assess feasible rooftop landing sites with a vision-based perception while generating trajectories that balance continued landing site assessment and the requirement to provide visual surveillance of a point of interest.

We would like to thank the reviewers who provided excellent reviews of the papers selected for this edition. We would also like to thank Gaurav Sukhatme for letting us assemble this edition and Nithya Nagarajan for helping with the process and maintaining all the interactions with the reviewers and the authors. Once again, we hope the readers will enjoy the papers selected for this special edition devoted to RSS 2014.