Robotics

Science and Systems IV

edited by Oliver Brock, Jeff Trinkle, and Fabio Ramos

Preface

 This volume contains the papers presented at *Robotics: Science and Systems 2008*, held at the Swiss Federal Institute of Technology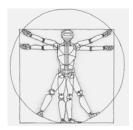 (ETH) in Zurich Switzerland, from June 25 to June 28, 2008. This year's meeting brought together more than 280 researchers from Europe, Asia, North America, and Australia. The papers presented at the meeting and compiled here cover a wide range of topics in robotics spanning computer vision, mapping, terrain identification, distributed systems, localization, manipulation, collision avoidance, multibody dynamics, obstacle detection, micro-robotic systems, pursuit-evasion, grasping and manipulation, tracking, spatial kinematics, machine learning, sensor networks, and applications such as autonomous driving and design of manipulators for use in functional-MRI.

Following the RSS tradition, there were a number of invited talks: two Early Career Spotlight talks by rising stars in the robotics community, one banquet speaker, and six invited talks on topics on the fringes of robotics. The latter talks were chosen to give the audience new motivating perspectives on what is possible and on new ways to approach robotics problems.

- Prof. Armin Gruen of ETH delivered "Positioning Modeling and Navigation with Photogrammetric Techniques," in which he argued convincingly for the use of photogrammetric techniques in robotics and showed impressive results in which accuracy on the order of one part per million was obtained.

- Prof. Miguel Nicolelis of Duke University spoke about "Computing with Neural Ensembles." In this excellent talk, he discussed the functioning of neural ensembles in animals providing evidence that the ensemble of neurons that controls a given task is not fixed, thus raising questions about the design of bio-inspired robot controllers.

- Prof. Jean-Louis Deneubourg of the Universit Libre de Bruxelles shared his thoughts on "Shared Decision-Making in Mixed Societies of Animals and Robots." He provided deep insights into the "emergent" global behavior of large colonies of small animals capable of only simple local communication.

- Dr. Kevin O'Regan, Director of Research of the Laboratory of the Psychology of Perception at CNRS Paris discussed robot consciousness in his talk "How to Build Consciousness into a Robot: the Sensori-motor Approach." This was a highly engaging talk, in which it was conjectured that given today's computing power, it is only a matter of time before robots become self-aware, which gives rise to many complex questions of ethics.

- Prof. Howard Berg of Harvard University presented "Motile Behavior of E-coli: a Remarkable Robot." He showed detailed pictures of the inner workings of the remarkable nano-machines called "flagella," how they are constructed by bacteria, and how they provide propulsion and directional control.

- Prof. Toshio Yanagida of Osaka University described the engineering principles behind biological molecular motors in his talk "Mechanism Involved in Utilizing Thermal Fluctuations by Muscle Molecular Motor." He showed how molecular motors exploit thermal noise to achieve energy efficiency and talked about the implications for building artificial muscles.

- Prof. Rob Wood of Harvard University gave an engaging Early Career Spotlight presentation on his progress on meso-scale bio-inspired vehicles, that fly, walk, and swim. These would be useful in many many applications ranging from environmental monitoring to border surveillance. He covered aspects of design, fabrication, analysis, and control.

- Prof. Eric Klavins of the University of Washington was the second Early Career Spotlight speaker. He spoke about the motivations behind his Self-Organizing Systems Lab and a string of results. Along the way, he provided insights into the aspects of systems that lead to self-organization and robustness of global behaviors He showed the application of these ideas to a macro-scale testbed and discussed DNA applications.

- In an extremely engaging banquet talk, Prof. Luis von Ahn of Carnegie Mellon Institute focused on the unwitting use of humans to solve difficult problems while playing games on the Web. Among many other intriguing ideas, his talk, "Human Computation," described how the use of capchas to verify that a real human is interacting with a web application, is also providing free labor to translate old texts, not amenable to optical character recognition.

Thanks to the efforts of Workshop Chair Charlie Kemp of Georgia Tech., the fourth day of RSS 2008 was devoted to the following well-attended workshops:

- *Control of Locomotion: From Animals to Robots* organized by Auke Ijspeert, Paolo Dario, Sten Grillner;

- *Underwater Robotics ... at the Microscale* organized by Brad Nelson, Vijay Kumar, Sylvain Martel, Metin Sitti, Lixin Dong;

- *Topology and Minimalism in Robotics and Sensor Networks* organized by Robert Ghrist, Steve LaValle, George J. Pappas;

- *Teaching with Robots* organized by Chris Rogers, Pedro Lima, Roland Siegwart, Illah Nourbakhsh, Aaron Dollar;

- *Design and Control of Variable Impedance Actuators for Physical Interaction of Robots with Humans and their Environment* organized by Antonio Bicchi, Alin Albu Schaeffer, Bram Vanderborght;

- *Robot Manipulation: Intelligence in Human Environments* organized by Robert Platt, Sami Haddadin, Charlie Kemp, Lorenzo Natale, Neo Ee Sian;

- *Interactive Robot Learning* organized by Andrea Thomaz, Geert-Jan M. Kruijff, Henrik Jacobsson, Danijel Skocaj;

- *Inside Data Association* organized by Udo Frese, Jose Neira, Diedrich Wolter, Jorg Kurlbaum;

- *Quantitative Performance Evaluation of Navigation Solutions for Mobile Robots* organized by Raj Madhavan, Chris Scrapper, Alex Kleiner;

- *Experimental Methodology and Benchmarking in Robotics Research* organized by Fabio Bonsignorio, John Hallam, Angel P. del Pobil;

- *Advances in Simulation of Robot and Task Dynamics* organized by Evan Drumwright, Kurt Anderson, Roy Featherstone; and

- *Grand Challenges in Microrobotics and Microassembly* organized by Pierre Lambert, Stephane Regnier, Metin Sitti.

RSS 2008 was a success thanks to the efforts of many people. We gratefully acknowledge the enormous time spent by the area chairs, who each handled about 20 papers and flew to Zurich for the in-person area chair meeting. The area chairs were: Antonio Bicchi (University of Pisa), Karl Bohringer (University of Washington), Jaydev P. Desai (University of Maryland, College Park), Hugh Durrant-Whyte (University of Sydney), Shin-ichi Hirai (Ritsumeikan University), Atsushi Konno (Tohoku University), Kevin Lynch (Northwestern University), Yoky Matsuoka (University of Washington), Michael McCarthy (UC Irvine), Jose Neira (University of Zaragoza), Giuseppe Oriolo (University of Rome), Nick Roy (Massachusetts Institute of Technology), Thierry Simeon (LAAS-CNRS, Toulouse), Metin Sitti (Carnegie Mellon University), Frank van der Stappen (Utrecht University), and Kazuhito Yokoi (AIST). Together, their expertise covered an extraordinarily broad swath of the robotics landscape.

Paper reviewing was rigorous. All but two papers received four or more double-blind reviews (neither the authors nor the reviewers knew each others' identities) - that's over 650 reviews from 196 program committee members. After the reviews were completed, the program committee members and area chairs discussed reviews for each paper in an on-line forum within the conference management system. Then the authors were invited to rebut the reviews. Following the rebuttals, the program committee members reconsidered and finalized their reviews. Final acceptance decisions and presentation categories were made at the area chair meeting in Zurich, also attended by the program chair and general chair. Of the 163 submissions, 20 were selected for poster presentation and 20 were selected for oral presentation.

The local arrangement chairs were Roland Siegwart and Brad Nelson of ETH. They and their support staff did a fantastic job in organizing everything from the Travel Kit to the poster session at the faculty club to the alphorn player in the opening ceremony to the banquet in the restaurant overlooking the lake and the city. We particularly want to thank Cornelia Della Casa and Luciana Borsatti for sweating all the details with such grace and efficiency. We cannot thank them enough.

We sincerely thank Rudi Triebel and Ralf Kästner for taking the roles of general Webmaster for the Conference. Finally our thanks go out to Janosch Nikolic and Stefan Bertschi for dealing with all computer and wireless issues and to Markus Bhler and Dario Fenner for setting up the welcoming reception.

RSS 2008 had many sponsors; thanks to ABB, Evolution Robotics, Intel, Microsoft Research, and Willow Garage, for providing funds for general conference use and to the National Science Foundation and the Naval Research Lab for providing funds to support student travel. Last, but not least, we thank Springer for providing a $2500 prize for the best student paper award. The competition was fierce.

Finally, we would like to express our gratitude to the members of the robotics community who have adopted RSS and its philosophy, and who have made RSS 2008 an outstanding meeting by submitting manuscripts, participating in the review process, and by attending the Conference. We look forward to many more exciting meetings of RSS in the years to come.

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