Robotics: Science and Systems IV

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■ The conference Robotics: Science and Systems (RSS) was held at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland, from June 25 to June 28, 2008. More than 280 international researchers attended this single-track conference to learn about the most exciting robotics research and most advanced robotic systems. The program committee, led by 16 area chairs, selected 40 papers out of 163 submissions. The program also included seven invited talks and two Early Career Spotlight presentations. The plenary presentations were complemented by 13 workshops.

The conference Robotics: Science and Systems (RSS) was held at the Swiss Federal Institute of Technology (ETH) in Zurich Switzerland, from June 25 to June 28, 2008. Robotics: Science and Systems is a single-track conference that aims to showcase the best research and the most exciting systems from all areas of robotics at a single conference to a broad audience. Special provisions are made to enable students to participate in this conference. This year, there were two different kinds of travel awards available to students.

Robotics: Science and Systems was technically cosponsored by the IEEE Robotics and Automation Society, the International Foundation of Robotics Research, and AAAI. Funding for the conference was provided by the National Science Foundation, the Naval Research Laboratory, ABB, Microsoft Research, Microsoft Robotics, Evolution Robotics, Willow Garage, and Intel. Springer sponsored the best student paper award. The 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, microrobotic 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 magnetic resonance imaging (MRI).

The program committee convened for an in-person meeting to select 40 of the 163 submissions for the technical program. Twenty of the accepted papers were presented orally; the remaining 20 were presented as posters. One of the important features of Robotics: Science and Systems is that the mode of presentation (oral or poster) is not determined by the quality of the paper but by the most suitable way to communicate its content to other researchers. Each poster was introduced to the plenary audience in a two-minute spotlight presentation.

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 with relevance to or overlap with the robotics community. These talks were intended to give the audience new motivating perspectives on what is possible and on new ways to approach robotics problems. 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. 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 bioinspired robot controllers. Jean Louis Deneubourg of the Université 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. Kevin O'Regan, director of research of the Laboratory of the Psychology of Perception at Centre National de la Recherche Scientifique (CNRS) Paris, discussed robot consciousness in "How to Build Consciousness into a Robot: the Sensorimotor 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. Howard Berg of Harvard University described his research on *Escherichia coli* in "Motile Behavior of *E. coli*: a Remarkable Robot." He showed detailed pictures of the inner workings of the remarkable nanomachines called "flagella," how they are constructed by bacteria, and how they provide propulsion and directional control. Finally, 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.

The two Early Career Spotlight talks were presented by Rob Wood of Harvard University and by Eric Klavins of the University of Washington. Rob Wood gave an engaging Early Career Spotlight presentation on his progress on mesoscale bioinspired vehicles that fly, walk, and swim. These would be useful in many applications ranging from environmental monitoring to border surveillance. He covered aspects of design, fabrication, analysis, and control. Professor 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 macroscale test bed and discussed DNA applications.

The best student paper award sponsored by Springer on behalf of the journal *Autonomous Robots* was awarded to Thomas Vose, Paul Umbanhowar, and Kevin Lynch for their paper "Friction-Induced Velocity Fields for Point Parts Sliding on a Rigid Oscillated Plate."

The conference also included a number of well-attended workshops.

Oliver Brock is a professor of computer science at Technische Universität Berlin. His research focuses on autonomous mobile manipulation and the application of robotic algorithms to problems in structural molecular biology.

Jeff Trinkle is a professor of computer science at Rensselaer Polytechnic Institute. His research focuses on planning and analysis of dexterous manipulation.

Fabio Ramos is a senior research fellow at the Australian Centre for Field Robotics (ACFR). His research focuses on statistical learning techniques for dimensionality reduction, stochastic processes modeling, and object recognition with applications in robotics and mining.