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Andrew Howard, Karl Iagnemma,
and Alonzo Kelly (Eds.)

Field and Service Robotics

Results of the 7th International Conference

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Foreword

Robotics is undergoing a major transformation in scope and dimension. From a largely dominant industrial focus, robotics is rapidly expanding into human environments and vigorously engaged in its new challenges. Interacting with, assisting, serving, and exploring with humans, the emerging robots will increasingly touch people and their lives.

Beyond its impact on physical robots, the body of knowledge robotics has produced is revealing a much wider range of applications reaching across diverse research areas and scientific disciplines, such as: biomechanics, haptics, neurosciences, virtual simulation, animation, surgery, and sensor networks among others. In return, the challenges of the new emerging areas are proving an abundant source of stimulation and insights for the field of robotics. It is indeed at the intersection of disciplines that the most striking advances happen.

The *Springer Tracts in Advanced Robotics (STAR)* is devoted to bringing to the research community the latest advances in the robotics field on the basis of their significance and quality. Through a wide and timely dissemination of critical research developments in robotics, our objective with this series is to promote more exchanges and collaborations among the researchers in the community and contribute to further advancements in this rapidly growing field.

The Seventh edition of *Field and Service Robotics* edited by Andrew Howard, Karl Iagnemma and Alonzo Kelly offers in its eleven-chapter volume a collection of a broad range of topics spanning: design, perception and control; tracking and sensing; localization and mapping; multi-robot cooperation and human-robot interaction; mining, maritime and planetary robotics. The contents of the forty-five contributions represent a cross-section of the current state of robotics research from one particular aspect: field and service applications, and how they reflect on the theoretical basis of subsequent developments. Pursuing technologies aimed at realizing robots operating in complex and dynamic environments, as well as robots working closely with humans, is the big challenge running throughout this focused collection.

Rich by topics and authoritative contributors, FSR culminates with this unique reference on the current developments and new directions in field and service robotics. A fine addition to the series!

Naples, Italy
March 2010

Bruno Siciliano
STAR Editor

Preface

Field and Service Robotics (FSR) is one of the (presently) five major conferences founded by the International Federation of Robotics Research (IFRR). As such, FSR is the leading single track conference dedicated to research related to development of robots that do real work, whether that work is hard labor or the performance of useful services. Field robots are often purpose-built machines that are highly adapted to their jobs, and hence their surroundings; they exhibit high mobility and they typically interact forcefully with their environments. By contrast, service robots are more adapted to assisting humans and they interact with their surroundings with a somewhat lighter touch.

The FSR conference is held every two years. Dating from 1997 it has followed a regular three continent rotation. It has been held in Canberra, Australia (1997), Pittsburgh, USA (1999), Helsinki, Finland (2001), Mount Fuji, Japan (2003), Port Douglas, Australia (2005), Chamonix, France (2007) and most recently in Cambridge, USA (2009).

This year we had 80 submissions of which 45 were selected for oral presentations.

The conference chairs were:

Alonzo Kelly (CMU), Karl Iagnemma (MIT) and Andrew Howard (Caltech-JPL)

The conference is overseen by members of the international organizing committee, who also serve on the program committee:

Hajime Asama	U Tokyo, Japan
Raja Chatila	LAAS/CNRS, France
Henrik Christensen	Georgia Tech, USA
Peter Corke	CSIRO, Australia
Aarne Halme	Helsinki U of Tech, Finland
John Hollerbach	U of Utah, USA
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Salah Sukkariéh	U Sydney, Australia
Chuck Thorpe	CMU, Qatar
Sebastian Thrun	Stanford, USA
David Wettergreen	CMU, USA
Kazuya Yoshida	Tohoku U, Japan
Alex Zelinsky	CSIRO Australia

The following researchers also served on the program committee for FSR09.

Timothy Barfoot	University of Toronto
Martin Beuller	iRobot Corp.
Wolfram Burgard	Albert-Ludwigs-Universität Freiburg
Toshio Fukuda	Nagoya University
Satoshi Kagami	AIST Digital Human Research Center
Simon Lacroix	LAAS-CNRS
David P Miller	University of Oklahoma
Paul Newman	Oxford University
Liam Pedersen	NASA Ames
Miguel Angel Salichs	Carlos III University of Madrid.
Gaurav S Sukhatme	University of Southern California
Satoshi Tadokoro	Tohoku University
Takashi Tsubouchi	University of Tsukuba
Arto Visala	Helsinki University of Technology
Uwe Zimmer	Australian National University

The conference was sponsored by the US Army Research Office, iRobot Corporation, the US Army TARDEC, and US Army Corps of Engineers ERDC.

Mihail Pivtoraiko, Colin Green, and Chris Ward gave generously of their time to help arrange many aspects of the social and technical program and publicity.

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