

Algorithmic Foundations Of Robotics IX Selected Contributions Of The Ninth International Workshop On The Algorithmic Foundations Of Robotics Springer Tracts In Advanced Robotics

Algorithms are a fundamental component of robotic systems. Robot algorithms process inputs from sensors that provide noisy and partial data, build geometric and physical models of the world, plan high- and low-level actions at different time horizons, and execute these actions on actuators with limited precision. The design and analysis of robot algorithms raise a unique combination of questions from many fields, including control theory, computational geometry and topology, geometrical and physical modeling, reasoning under uncertainty, probabilistic algorithms, game theory, and theoretical computer science. The Workshop on Algorithmic Foundations of Robotics (WAFR) is a single-track meeting of leading researchers in the field of robot algorithms. Since its inception in 1994, WAFR has been held every other year, and has provided one of the premiere venues for the publication of some of the field's most important and lasting contributions. This book contains the proceedings of the tenth WAFR, held on June 13-15, 2012 at the Massachusetts Institute of Technology. The 37 papers included in this book cover a broad range of topics, from fundamental theoretical issues in robot motion planning, control, and perception, to novel applications.

This carefully edited volume is the outcome of the eleventh edition of the Workshop on Algorithmic Foundations of Robotics (WAFR), which is the premier venue showcasing cutting edge research in algorithmic robotics. The eleventh WAFR, which was held August 3-5, 2014 at Boğaziçi University in Istanbul, Turkey continued this tradition. This volume contains extended versions of the 42 papers presented at WAFR. These contributions highlight the cutting edge research in classical robotics problems (e.g. manipulation, motion, path, multi-robot and kinodynamic planning), geometric and topological computation in robotics as well novel applications such as informative path planning, active sensing and surgical planning. This book - rich by topics and authoritative contributors - is a unique reference on the current developments and new directions in the field of algorithmic foundations.

At the dawn of the new millennium, robotics is undergoing a major transformation in scope and dimension. From a largely dominant industrial focus, robotics is rapidly expanding into the challenges of unstructured environments. Interacting with, assisting, serving, and exploring with humans, the emerging robots will increasingly touch people and their lives. The goal of the Springer Tracts in Advanced Robotics (STAR) series is to bring, in a timely fashion, the latest advances and developments in robotics on the basis of their significance and quality. It is our hope that the wider dissemination of research developments will stimulate more exchanges and collaborations among the research community and contribute to further advancement of this rapidly growing field. The European Robotics Symposium (EUROS) was launched in 2006 as an international scientific single-track event promoted by EURON, the European Robotics Network linking most of the European research teams since its inception in 2000. Since then, EUROS has found its parental home under STAR, together with the other thematic symposia devoted to excellence in robotics research: FSR, ISER, ISRR, WAFR.

The five-volume set LNCS 10111-10115 constitutes the thoroughly refereed post-conference proceedings of the 13th Asian Conference on Computer Vision, ACCV 2016, held in Taipei, Taiwan, in November 2016. The total of 143 contributions presented in these volumes was carefully reviewed and selected from 479 submissions. The papers are organized in topical sections on Segmentation and Classification; Segmentation and Semantic Segmentation; Dictionary Learning, Retrieval, and Clustering; Deep Learning; People Tracking and Action Recognition; People and Actions; Faces; Computational Photography; Face and Gestures; Image Alignment; Computational Photography and Image Processing; Language and Video; 3D Computer Vision; Image Attributes, Language, and Recognition; Video Understanding; and 3D Vision.

Musical Robots and Interactive Multimodal Systems

Recent Advances in Designing Service Robots for Complex Tasks in Everyday Environments

Software Engineering for Experimental Robotics

Towards Autonomous Robotic Systems

The 19th International Symposium ISRR

Science and Systems VII

The Sense of Touch and Its Rendering

This unique reference represents a cross-section of forefront robotics research, ranging from robotics and systems to learning, autonomy and failure detection, from vision and navigation to localization and mapping, which are based on the papers presented at the 1st European Robotics Symposium (EUROS-06) held in Palermo, Italy from 16-18 March, 2006. The European Robotics Symposium (EUROS) is a brand-new International scientific event promoted by EURON, the European Robotics Network.

This work presents a new concept of a Collaborative Assistance Vehicle with high interaction capabilities for collaboration with external users outside the vehicle. This work proposes a functional architecture for level 4 automated driving that focuses on an interaction framework, along with algorithmic solutions for implementing core function modules. Perception, command extraction, and behavior planning are part of the core function modules. All of these modules will be implemented and evaluated.

Algorithms are a fundamental component of robotic systems: they control or reason about motion and perception in the physical world. They receive input from noisy sensors, consider geometric and physical constraints, and operate on the world through imprecise actuators. The design and analysis of robot algorithms therefore raises a unique combination of questions in control theory, computational and differential geometry, and computer science. This book contains the proceedings from the 2006 Workshop on the Algorithmic Foundations of Robotics. This biannual workshop is a highly selective meeting of leading researchers in the field of algorithmic issues related to robotics. The 32 papers in this book span a wide variety of topics: from fundamental motion planning algorithms to applications in medicine and biology, but they have in common a foundation in the algorithmic problems of robotic systems.

This book gathers the outcomes of the thirteenth Workshop on the Algorithmic Foundations of Robotics (WAFR), the premier event for showcasing cutting-edge research on algorithmic robotics. The latest WAFR, held at Universidad Politécnica de Yucatán in Mérida, México on December 9-11, 2018, continued this tradition. This book contains fifty-four papers presented at WAFR, which highlight the latest research on fundamental algorithmic robotics (e.g., planning, learning, navigation, control, manipulation, optimality, completeness, and complexity) demonstrated through several applications involving multi-robot systems, perception, and contact manipulation. Addressing a diverse range of topics in papers prepared by expert

contributors, the book reflects the state of the art and outlines future directions in the field of algorithmic robotics.

Selected Contributions of the Ninth International Workshop on the Algorithmic Foundations of Robotics

Runtime Verification

3D-Position Tracking and Control for All-Terrain Robots

Atomic Force Microscopy Based Nanorobotics

3D Robotic Mapping

The 9th International Symposium on Experimental Robotics

Algorithmic Foundations of Robotics XIV

Probabilistic Reasoning and Decision Making in Sensory-Motor Systems by Pierre Bessiere, Christian Laugier and Roland Siegwart provides a unique collection of a sizable segment of the cognitive systems research community in Europe. It reports on contributions from leading academic institutions brought together within the European projects Bayesian Inspired Brain and Artifact (BIBA) and Bayesian Approach to Cognitive Systems (BACS). This fourteen-chapter volume covers important research along two main lines: new probabilistic models and algorithms for perception and action, new probabilistic methodology and techniques for artefact conception and development. The work addresses key issues concerned with Bayesian programming, navigation, filtering, modelling and mapping, with applications in a number of different contexts.

Algorithmic Foundations of Robotics IX Selected Contributions of the Ninth International Workshop on the Algorithmic Foundations of Robotics Springer

This book constitutes the refereed proceedings of the 14th Conference on Advances in Autonomous Robotics, TAROS 2013, held in Oxford, UK, in August 2013. The 36 revised full papers presented together with 25 extended abstracts were carefully reviewed and selected from 89 submissions. The papers cover various topics such as artificial intelligence, bio-inspired and aerial robotics, computer vision, control, humanoid and robotic arm, swarm robotics, verification and ethics.

The monograph written by John Mullane, Ba-Ngu Vo, Martin Adams and Ba-Tuong Vo is devoted to the field of autonomous robot systems, which have been receiving a great deal of attention by the research community in the latest few years. The contents are focused on the problem of representing the environment and its uncertainty in terms of feature based maps. Random Finite Sets are adopted as the fundamental tool to represent a map, and a general framework is proposed for feature management, data association and state estimation. The approaches are tested in a number of experiments on both ground based and marine based facilities.

Algorithmic Foundations of Robotics X

Probabilistic Reasoning and Decision Making in Sensory-Motor Systems

16th International Conference, RV 2016, Madrid, Spain, September 23–30, 2016, Proceedings

Algorithmic Foundations of Robotics XIII

The 14th International Symposium ISRR

Distributed Autonomous Robotic Systems

This book contains selected contributions to WAFFR, the highly-competitive meeting on the algorithmic foundations of robotics. They address the unique combination of questions that the design and analysis of robot algorithms inspires.

This volume presents a collection of papers presented at the 14th International Symposium of Robotic Research (ISRR). ISRR is the biennial meeting of the International Foundation of Robotic Research (IFRR) and its 14th edition took place in Lucerne, Switzerland, from August 31st to September 3rd, 2009. As for the previous symposia, ISRR 2009 followed up on the successful concept of a mixture of invited contributions and open submissions.

Half of the 48 presentations were therefore invited contributions from outstanding researchers selected by the IFRR officers, and half were chosen among the 66 submissions after peer review. This selection process resulted in a truly excellent technical program which, we believe, featured some of the very best of robotic research. Out of the 48 presentations, the 42 papers which were finally submitted for publication are organized in 8 sections that encompass the major research orientations in robotics: Navigation, Control & Planning, Human-Robot Interaction, Manipulation and Humanoids, Learning, Mapping, Multi-Robot Systems, and Micro-Robotics. They represent an excellent snapshot of cutting-edge research in robotics and outline future directions.

This book reports on the concepts and ideas discussed at the well attended ICRA2005 Workshop on "Principles and Practice of Software Development in Robotics", held in Barcelona, Spain, April 18 2005. It collects contributions that describe the state of the art in software development for the Robotics domain. It also reports a number of practical applications to real systems and discuss possible future developments.

It is man's ongoing hope that a machine could somehow adapt to its environment by reorganizing itself. This is what the notion of self-organizing robots is based on. The theme of this book is to examine the feasibility of creating such robots within the limitations of current mechanical engineering. The topics comprise the following aspects of such a pursuit: the philosophy of design of self-organizing mechanical systems; self-organization in biological systems; the history of self-organizing mechanical systems; a case study of a self-assembling/self-repairing system as an autonomous distributed system; a self-organizing robot that can create its own shape and robotic motion; implementation and instrumentation of self-organizing robots; and the future of self-organizing robots. All topics are illustrated with many up-to-date examples, including those from the authors' own work. The book does not require advanced knowledge of mathematics to be understood, and will be of great benefit to students in the robotics

discipline, including in the areas of mechanics, control, electronics, and computer science. It is also an important source for researchers who wish to investigate the field of robotics or who have an interest in the application of self-organizing phenomena.

Self-Organizing Robots

Algorithmic Foundations of Robotics XII

Algorithmic Foundations of Robotics VIII

Algorithmic Foundations of Robotics VI

The Simultaneous Localization and Mapping Problem with Six Degrees of Freedom

Proceedings of the Tenth Workshop on the Algorithmic Foundations of Robotics

Cable-Driven Parallel Robots

This book demonstrates benefits of abstract and qualitative reasoning that have not received much attention in the context of autonomous robotics before. Bremen, Christian Freksa December 2007 Director of the SFB/TR 8 Spatial Cognition Preface

This book addresses spatial representations and reasoning techniques for - bile robot mapping, providing an analysis of fundamental representations and processes involved. A spatial representation based on shape information is p- posed and shape analysis techniques are developed to tackle the correspondence problem in robot mapping. A general mathematical formulation is presented to provide the formal ground for an e?cient matching of configurations of objects. This book is a slightly revised version of my doctoral thesis submitted to the Faculty of Mathematics and Computer Science of the University of Bremen, Germany. Manycontributeto the developmentofa dissertation, butsomeofthemstand out. Christian Freksa, I thank you for supporting and encouraging my work, for introducing me to interdisciplinary work, for giving me the freedom to develop this dissertation, and for providing an enjoyable atmosphere to work in. Longin Jan Latecki, thank you for countless in-depth discussions helping me to develop andtopositionmywork,forthefruitfulcollaboration,andformakingaresearch stay possible that has been very valuable to me. I thank the research groups in Bremen and Philadelphia for helpful discussions and feedback, in particular Jan Oliver Wallgrun. I also thank Kai-Florian Richter, Sven Bertel, and Lutz Frommberger for feedback on this work. Robert Ross, thank you for helping to proof-read this dissertation.

This book constitutes the refereed proceedings of the 16th International Conference on Runtime Verification, RV 2016, held in Madrid, Spain, in September 2016. The 18 revised full papers presented together with 4 short papers, 3 tool papers, 2 tool demonstration papers, and 5 tutorials, were carefully reviewed and selected from 72 submissions. The RV conference is concerned with all aspects of monitoring and analysis of hardware, software and more general system executions. Runtime verification techniques are lightweight techniques to assess correctness, reliability, and robustness; these techniques are significantly more powerful and versatile than conventional testing, and more practical than exhaustive formal verification. Gathering presentations to the First International Conference on Cable-Driven Parallel Robots, this book covers classification and definition, kinematics, workspace analysis, cable modeling, hardware/prototype development, control and calibration and more.

The atomic force microscope (AFM) has been successfully used to perform nanorobotic manipulation operations on nanoscale entities such as particles, nanotubes, nanowires, nanocrystals, and DNA since 1990s. There have been many progress on modeling, imaging, teleoperated or automated control, human-machine interfacing, instrumentation, and applications of AFM based nanorobotic manipulation systems in literature. This book aims to include all of such state-of-the-art progress in an organized, structured, and detailed manner as a reference book and also potentially a textbook in nanorobotics and any other nanoscale dynamics, systems and controls related research and education. Clearly written and well-organized, this text introduces designs and prototypes of the nanorobotic systems in detail with innovative principles of three-dimensional manipulation force microscopy and parallel imaging/manipulation force microscopy.

14th Annual Conference, TAROS 2013, Oxford, UK, August 28--30, 2013, Revised Selected Papers

Volume 2

Algorithmic Foundations of Robotics XI

Computer Vision - ECCV 2014 Workshops

Random Finite Sets for Robot Mapping & SLAM

Zurich, Switzerland, September 6-7 and 12, 2014, Proceedings, Part I

Robotics

This book gathers the proceedings of the 15th IFToMM World Congress, which was held in Krakow, Poland, from June 30 to July 4, 2019. Having been organized every four years since 1965, the Congress represents the world's largest scientific event on mechanism and machine science (MMS). The contributions cover an extremely diverse range of topics, including biomechanical engineering, computational kinematics, design methodologies, dynamics of machinery, multibody dynamics, gearing and transmissions, history of MMS, linkage and mechanical controls, robotics and mechatronics, micro-mechanisms, reliability of machines and mechanisms, rotor dynamics, standardization of terminology, sustainable energy systems, transportation machinery, tribology and vibration. Selected by means of a rigorous international peer-review process, they highlight numerous exciting advances and ideas that will spur novel research directions and foster new multidisciplinary collaborations.

This proceedings book helps bring insights from this array of technical sub-topics together, as advanced robot algorithms draw on the combined expertise of many fields—including control theory, computational geometry and topology, geometrical and physical modeling, reasoning under uncertainty, probabilistic algorithms, game theory, and theoretical computer science.

Intelligent robots and autonomous systems depend on algorithms that efficiently realize functionalities ranging from perception to decision making, from motion planning to control. The works collected in this SPAR book represent the state of the art in algorithmic robotics. They originate from papers accepted to the 14th International Workshop on the Algorithmic Foundations of Robotics (WAFR), traditionally a biannual, single-track meeting of leading researchers in the field of robotics. WAFR has always served as a premiere venue for the publication of some of robotics' most important, fundamental, and lasting algorithmic contributions, ensuring the rapid

circulation of new ideas. Though an in-person meeting was planned for June 15-17, 2020, in Oulu, Finland, the event ended up being canceled owing to the infeasibility of international travel during the global COVID-19 crisis.

The fully automated estimation of the 6 degrees of freedom camera motion and the imaged 3D scenario using as the only input the pictures taken by the camera has been a long term aim in the computer vision community. The associated line of research has been known as Structure from Motion (SfM). An intense research effort during the latest decades has produced spectacular advances; the topic has reached a consistent state of maturity and most of its aspects are well known nowadays. 3D vision has immediate applications in many and diverse fields like robotics, videogames and augmented reality; and technological transfer is starting to be a reality. This book describes one of the first systems for sparse point-based 3D reconstruction and egomotion estimation from an image sequence; able to run in real-time at video frame rate and assuming quite weak prior knowledge about camera calibration, motion or scene. Its chapters unify the current perspectives of the robotics and computer vision communities on the 3D vision topic: As usual in robotics sensing, the explicit estimation and propagation of the uncertainty hold a central role in the sequential video processing and is shown to boost the efficiency and performance of the 3D estimation. On the other hand, some of the most relevant topics discussed in SfM by the computer vision scientists are addressed under this probabilistic filtering scheme; namely projective models, spurious rejection, model selection and self-calibration. The International Symposium on Experimental Robotics (ISER) is a series of bi-annual meetings which are organized in a rotating fashion around North America, Europe and Asia/Oceania. The goal of ISER is to provide a forum for research in robotics that focuses on novelty of theoretical contributions validated by experimental results. The meetings are conceived to bring together, in a small group setting, researchers from around the world who are in the forefront of experimental robotics research. This unique reference presents the latest advances across the various fields of robotics, with ideas that are not only conceived conceptually but also verified experimentally. It collects contributions on the current developments and new directions in the field of experimental robotics, which are based on the papers presented at the Ninth ISER held in Singapore.

Experimental Robotics IX

*Proceedings of the 13th Workshop on the Algorithmic Foundations of Robotics
Computer Vision - ACCV 2016*

Visual Perception and Robotic Manipulation

New Concepts in Autonomous Robotic Map Representations

European Robotics Symposium 2006

Results of the 5th International Conference

Musical robotics is a multi- and trans-disciplinary research area involving a wide range of different domains that contribute to its development, including: computer science, multimodal interfaces and processing, artificial intelligence, electronics, robotics, mechatronics and more. A musical robot requires many different complex systems to work together; integrating musical representation, techniques, expressions, detailed analysis and controls, for both playing and listening. The development of interactive multimodal systems provides advancements which enable enhanced human-machine interaction and novel possibilities for embodied robotic platforms. This volume is focused on this highly exciting interdisciplinary field. This book consists of 14 chapters highlighting different aspects of musical activities and interactions, discussing cutting edge research related to interactive multimodal systems and their integration with robots to further enhance musical understanding, interpretation, performance, education and enjoyment. It is dichotomized into two sections: Section I focuses on understanding elements of musical performance and expression while Section II concentrates on musical robots and automated instruments. *Musical Robots and Interactive Multimodal Systems* provides an introduction and foundation for researchers, students and practitioners to key achievements and current research trends on interactive multimodal systems and musical robotics.

The four-volume set LNCS 8925, 8926, 8927, and 8928 comprises the refereed post-proceedings of the Workshops that took place in conjunction with the 13th European Conference on Computer Vision, ECCV 2014, held in Zurich, Switzerland, in September 2014. The 203 workshop papers were carefully reviewed and selected for inclusion in the proceedings. They were presented at workshops with the following themes: where computer vision meets art; computer vision in vehicle technology; spontaneous facial behavior analysis; consumer depth cameras for computer vision; "chlearn" looking at people: pose, recovery, action/interaction, gesture recognition; video event categorization, tagging and retrieval towards big data; computer vision with local binary pattern variants; visual object tracking challenge; computer vision + ontology applies cross-disciplinary technologies; visual perception of affordance and functional visual primitives for scene analysis; graphical models in computer vision; light fields for computer vision; computer vision for road scene understanding and autonomous driving; soft biometrics; transferring and adapting source knowledge in computer vision; surveillance and re-identification; color and photometry in computer vision; assistive computer vision and robotics; computer vision problems in plant phenotyping; and non-rigid shape analysis and deformable image alignment. Additionally, a panel discussion on video segmentation is included. .

This book moves toward the realization of domestic robots by presenting an integrated view of computer vision and robotics, covering fundamental topics including optimal sensor design, visual servo-ing, 3D object modelling and recognition, and multi-cue tracking, emphasizing robustness throughout. Covering theory and implementation, experimental results and comprehensive multimedia support including video

clips, VRML data, C++ code and lecture slides, this book is a practical reference for roboticists and a valuable teaching resource.

ISRR, the "International Symposium on Robotics Research", is one of robotics pioneering Symposia, which has established over the past two decades some of the field's most fundamental and lasting contributions. This book presents the results of the seventeenth edition of "Robotics Research" ISRR15, offering a collection of a broad range of topics in robotics. The content of the contributions provides a wide coverage of the current state of robotics research: the advances and challenges in its theoretical foundation and technology basis, and the developments in its traditional and new emerging areas of applications. The diversity, novelty, and span of the work unfolding in these areas reveal the field's increased maturity and expanded scope and define the state of the art of robotics and its future direction.

Selected Contributions of the Eleventh International Workshop on the Algorithmic Foundations of Robotics

Nature-Inspired Mobile Robotics

Proceedings of the Twelfth Workshop on the Algorithmic Foundations of Robotics

The 12th International Symposium

Algorithmic Foundation of Robotics VII

Motion Planning in Medicine: Optimization and Simulation Algorithms for Image-Guided Procedures

Proceedings of the Fourteenth Workshop on the Algorithmic Foundations of Robotics

Robot algorithms are abstractions of computational processes that control or reason about motion and perception in the physical world. Because actions in the physical world are subject to physical laws and geometric constraints, the design and analysis of robot algorithms raise a unique combination of questions in control theory, computational and differential geometry, and computer science. Algorithms serve as a unifying theme in the multi-disciplinary field of robotics. This volume consists of selected contributions to the sixth Workshop on the Algorithmic Foundations of Robotics. This is a highly competitive meeting of experts in the field of algorithmic issues related to robotics and automation.

Rough terrain robotics is a fast evolving field of research and a lot of effort is deployed towards enabling a greater level of autonomy for outdoor vehicles. This book demonstrates how the accuracy of 3D position tracking can be improved by considering rover locomotion in rough terrain as a holistic problem. Although the selection of appropriate sensors is crucial to accurately track the rover's position, it is not the only aspect to consider. Indeed, the use of an unadapted locomotion concept severely affects the signal to noise ratio of the sensors, which leads to poor motion estimates. In this work, a mechanical structure allowing smooth motion across obstacles with limited wheel slip is used. In particular, it enables the use of odometry and inertial sensors to improve the position estimation in rough terrain. A method for computing 3D motion increments based on the wheel encoders and chassis state sensors is developed. Because it accounts for the kinematics of the rover, this method provides better results than the standard approach. To further improve the accuracy of the position tracking and the rover's climbing performance, a controller minimizing wheel slip is developed. The algorithm runs online and can be adapted to any kind of passive wheeled rover. Finally, sensor fusion using 3D-Odometry, inertial sensors and visual motion estimation based on stereovision is presented. The experimental results demonstrate how each sensor contributes to increase the accuracy and robustness of the 3D position estimation.

Written by Ron Alterovitz and Ken Goldberg, this monograph combines ideas from robotics, physically-based modeling, and operations research to develop new motion planning and optimization algorithms for image-guided medical procedures.

The proceedings provide state-of-the-art scientific and engineering research findings and developments in the area of mobile robotics and assistive technologies. The proceedings collected together peer reviewed articles presented at the CLAWAR 2013 conference. It contains a strong showing of articles on legged locomotion with numbers of legs from two onwards. There is also a good collection of articles on systems that walls climbing, poles balancing, and other more complex structures following the traditional of CLAWAR themes. In addition, the proceedings also cover the subject of robot-human interaction, which focus on a more "human" way of communicating with humanoid robots. As for human assistive devices, proceedings also cover exoskeletal and prosthetic devices, robots for personal and nursing cares to address the issues of ageing population in our society. Finally, the issue of the deployment of robots in society, its social and ethically consideration are also addressed in the proceedings.

Contents: Plenary Presentations Assistive Robotics Autonomous Robots Biologically-Inspired Systems and Solutions HMI, Inspection and Learning Innovative Design of CLAWAR Locomotion Manipulation and Gripping Modelling and Simulation of CLAWAR Planning and Control Positioning, Localization and Perception Sensing and Sensor Fusion Service Robot Standards and Standardization Readership: Systems and control engineers, electrical engineers,

mechanical engineers in academic, research and industrial settings; engineers and practitioners in the public services sectors in health care, manufacturing, supply and delivery services. Keywords: Assistive Robotics; Autonomous Robots; Biologically Inspired Robotics; CLAWAR; Climbing and Walking Robots; Design of CLAWAR; Hybrid Locomotion; Legged Locomotion; Mobile Robots; Modeling and Simulation; Planning and Control; Robot Standardization; Service Robotics; Wheeled Locomotion

Robotics Research

European Robotics Symposium 2008

Conception and Development of an Interaction Framework for a Collaborative Assistance Vehicle

13th Asian Conference on Computer Vision, Taipei, Taiwan, November 20–24, 2016, Revised Selected Papers, Part IV

Advances in Mechanism and Machine Science

Proceedings of the 15th IFTOMM World Congress on Mechanism and Machine Science

Selected Contributions of the Seventh International Workshop on the Algorithmic Foundations of Robotics

Papers from a flagship conference reflect the latest developments in the field, including work in such rapidly advancing areas as human-robot interaction and formal methods. Robotics: Science and Systems VII spans a wide spectrum of robotics, bringing together researchers working on the algorithmic or mathematical foundations of robotics, robotics applications, and analysis of robotics systems. This volume presents the proceedings of the seventh annual Robotics: Science and Systems conference, held in 2011 at the University of Southern California. The papers presented cover a wide range of topics in robotics, spanning mechanisms, kinematics, dynamics and control, human-robot interaction and human-centered systems, distributed systems, mobile systems and mobility, manipulation, field robotics, medical robotics, biological robotics, robot perception, and estimation and learning in robotic systems. The conference and its proceedings reflect not only the tremendous growth of robotics as a discipline but also the desire in the robotics community for a flagship event at which the best of the research in the field can be presented.

Focuses on acquiring spatial models of physical environments through mobile robots The robotic mapping problem is commonly referred to as SLAM (simultaneous localization and mapping). 3D maps are necessary to avoid collisions with complex obstacles and to self-localize in six degrees of freedom (x-, y-, z-position, roll, yaw and pitch angle) New solutions to the 6D SLAM problem for 3D laser scans are proposed and a wide variety of applications are presented

People have dreamed of machines, which would free them from unpleasant, dull, dirty and dangerous tasks and work for them as servants, for centuries if not millennia. Service robots seem to finally let these dreams come true. But where are all these robots that eventually serve us all day long, day for day? A few service robots have entered the market: domestic and professional cleaning robots, lawnmowers, milking robots, or entertainment robots. Some of these robots look more like toys or gadgets rather than real robots. But where is the rest? This is a question, which is asked not only by customers, but also by service providers, care organizations, politicians, and funding agencies. The answer is not very satisfying. Today's service robots have their problems operating in everyday environments. This is by far more challenging than operating an industrial robot behind a fence. There is a comprehensive list of technical and scientific problems, which still need to be solved. To advance the state of the art in service robotics towards robots, which are capable of operating in an everyday environment, was the major objective of the DESIRE project (Deutsche Service Robotik Initiative – Germany Service Robotics Initiative) funded by the German Ministry of Education and Research (BMBF) under grant no. 01IME01A. This book offers a sample of the results achieved in DESIRE.

The 5th International Conference on Field and Service Robotics (FSR05) was held in Port Douglas, Australia, on 29th - 31st July 2005, and brought together the worlds' leading experts in field and service automation. The goal of the conference was to report and encourage the latest research and practical results towards the use of field and service robotics in the community with particular focus on proven technology. The conference provided a forum for researchers, professionals and robot manufacturers to exchange up-to-date technical knowledge and experience. Field robots are robots which operate in outdoor, complex, and dynamic environments. Service robots are those that work closely with humans, with particular applications involving indoor and structured environments. There are a wide range of topics presented in this issue on field and service robots including: Agricultural and Forestry Robotics, Mining and Exploration Robots, Robots for Construction, Security & Defence Robots, Cleaning Robots, Autonomous Underwater Vehicles and Autonomous Flying Robots. This meeting was the fifth in the series and brings FSR back to Australia where it was first held. FSR has been held every 2 years, starting with Canberra 1997, followed by Pittsburgh 1999, Helsinki 2001 and Lake Yamanaka 2003.

Structure from Motion using the Extended Kalman Filter

Selected Contributions of the Eighth International Workshop on the Algorithmic Foundations of Robotics

3D Object Recognition, Tracking and Hand-Eye Coordination

Algorithmic Foundations of Robotics IX

Progress in Haptics Research

A Shape-Based Approach

Towards Service Robots for Everyday Environments

"Sense of Touch and its Rendering" presents a unique and interdisciplinary approach highlighting the field of haptic research from a neuropsychological as well as a technological point of view. This edited book is the outcome of the TOUCH-HapSys European research project and provides an important contribution towards a new generation of high-fidelity haptic display technologies. The book is structured in two parts: A. Fundamental Psychophysical and Neuropsychological Research and B. Technology and Applications. The two parts are not however separated, and the many connections and synergies between the two complementary domains of research are highlighted in the text. The eleven chapters discuss the recent advances in the study of human haptic (kinaesthetic, tactile, temperature) and multimodal (visual, auditory, haptic) perception mechanisms. Besides the theoretical advancement, the contributions survey the state of the art in the field, report a number of practical applications to real systems, and discuss possible future developments.

This book presents the outcomes of the 12th International Workshop on the Algorithmic Foundations of Robotics (WAFR 2016). WAFR is a prestigious, single-track, biennial international meeting devoted to recent advances in algorithmic problems in robotics. Robot algorithms are an important building block of robotic systems and are used to process inputs from users and sensors, perceive and build models of the environment, plan low-level motions and high-level tasks, control robotic actuators, and coordinate actions across multiple systems. However, developing and analyzing these algorithms raises complex challenges, both theoretical and practical. Advances in the algorithmic foundations of robotics have applications to manufacturing, medicine, distributed robotics, human-robot interaction, intelligent prosthetics, computer animation, computational biology, and many other areas. The 2016 edition of WAFR went back to its roots and was held in San Francisco, California – the city where the very first WAFR was held in 1994. Organized by Pieter Abbeel, Kostas Bekris, Ken Goldberg, and Lauren Miller, WAFR 2016 featured keynote talks by John Canny on "A Guided Tour of Computer Vision, Robotics, Algebra, and HCI," Erik Demaine on "Replicators, Transformers, and Robot Swarms: Science Fiction through Geometric Algorithms," Dan Halperin on "From Piano Movers to Piano Printers: Computing and Using Minkowski Sums," and by Lydia Kavraki on "20 Years of Sampling Robot Motion." Furthermore, it included an Open Problems Session organized by Ron Alterovitz, Florian Pokorny, and Jur van den Berg. There were 58 paper presentations during the three-day event. The organizers would like to thank the authors for their work and contributions, the reviewers for ensuring the high quality of the meeting, the WAFR Steering Committee led by Nancy Amato as well as WAFR's fiscal sponsor, the International Federation of Robotics Research (IFRR), led by Oussama Khatib and Henrik Christensen. WAFR 2016 was an enjoyable and memorable event.

This volume of proceedings includes 32 original contributions presented at the 12th International Symposium on Distributed Autonomous Robotic Systems (DARS 2014), held in November 2014. The selected papers in this volume are authored by leading researchers from Asia, Australia, Europe, and the Americas, thereby providing a broad coverage and perspective of the state-of-the-art technologies, algorithms, system architectures, and applications in distributed robotic systems.

Robotics is at the cusp of dramatic transformation. Increasingly complex robots with unprecedented autonomy are finding new applications, from medical surgery, to construction, to home services. Against this background, the algorithmic foundations of robotics are becoming more crucial than ever, in order to build robots that are fast, safe, reliable, and adaptive. Algorithms enable robots to perceive, plan, control, and learn. The design and analysis of robot algorithms raise new fundamental questions that span computer science, electrical engineering, mechanical engineering, and mathematics. These algorithms are also finding applications beyond robotics, for example, in modeling molecular motion and creating digital characters for video games and architectural simulation. The Workshop on Algorithmic Foundations of Robotics (WAFR) is a highly selective meeting of leading researchers in the field of robot algorithms. Since its creation in 1994, it has published some of the field's most important and lasting contributions. This book contains the proceedings of the 9th WAFR, held on December 13-15, 2010 at the National University of Singapore. The 24 papers included in this book span a wide variety of topics from new theoretical insights to novel applications.

Spatial Representation and Reasoning for Robot Mapping

Modelling, Simulation, Setup Building and Experiments

Field and Service Robotics