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EDITORIAL

Themenheft Offroad-Robotik

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Liebe Leserinnen, liebe Leser,

die Offroad-Robotik beschäftigt sich mit dem Einsatz teil- oder vollautonomer Systeme abseits von Straßen in natürlichen und typischerweise rauen, variablen und hochgradig unstrukturierten Umgebungen. Diese Variabilität und Unstrukturiertheit sowie die unvollständigen und oft fehlerbehafteten Sensordaten erschweren die Erkennung von Hindernissen, den Aufbau von Umweltmodellen und die sichere Navigation. Ausgefeilte, hochgradig adaptive Ansätze sind daher notwendig, um den zahlreichen Herausforderungen begegnen zu können. Nur durch den Einsatz innovativer Ideen aus der KI ist es möglich, komplexe Systeme sicher und zuverlässig in Offroad-Umgebungen zu betreiben.

In Europa und speziell in Deutschland hat sich eine sehr aktive Offroad-Robotik-Szene gebildet. Dies ist nicht zuletzt der ELROB (The European Robot Trial) geschuldet, einer Leistungsschau, die alljährlich die auf diesem Gebiet aktiven Forschungsgruppen zusammenbringt, um den aktuellen Stand ihrer Forschung zu demonstrieren und den wissenschaftlichen Austausch zu fördern. So überrascht es nicht, dass eine ganze Reihe von Beiträgen dieses Themenhefts von Wissenschaftlern verfasst wurden, die schon mehrfach an der ELROB teilgenommen haben.

Die Einführung in das Thema dieses Hefts bildet ein Überblick über die Offroad-Robotik, den Prof. Kuhnert zusammen mit uns verfasst hat. Danach widmen sich Kuhnert et al. in einem Beitrag der Rekonstruktion und Analyse von 3D-Outdoor-Szenen in Echtzeit, während von Hundelshausen und seine Mitautoren eine neue, flexible Navigationsarchitektur vorstellen. Der Projektbeitrag von Joyeux et al. stellt das iMoby-Projekt des DFKI in Bremen vor, in dessen Rahmen die Asguard v3-Plattform entwickelt wurde. Vaskevicius und Birk beschäftigen sich mit effizienter Pfadplanung basierend auf 3D-Modellen unstrukturierter Umgebungen. Himmelsbach und seine Kollegen beschreiben die Navigation mit Hilfe von sog. Tentakeln, während Höller et al. ihren Ansatz zur Navigation basierend auf Bewegungsmustern vorstellen. Schließlich widmen sich Armbrust et al. einem Konzept zur verhaltensbasierten Navigation eines autonomen Offroad-Roboters. Ein Interview mit Dr. Reid (John Deere) beleuchtet die Beziehung zwischen Forschung im Bereich der Offroad-Robotik und möglichen Anwendungen in Forst- und Landwirtschaft. Den Abschluss dieses Themenhefts bildet die Vorstellung dreier Dissertationen aus den Bereichen Lokalisation, Umweltmodellierung und Navigation.

Obwohl in der Offroad-Robotik – auch dank des Einsatzes von neuen Methoden aus der KI – in den letzten Jahren bereits große Fortschritte erzielt werden konnten, so ist es doch noch ein langer Weg, bevor vollständig autonome Systeme allen Herausforderungen rauer, natürlicher Umgebungen gewachsen sein werden.

Wir wünschen Ihnen viel Vergnügen bei der Lektüre dieses Themenhefts!

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1 Inhalt des Thementeils Offroad-Robotik

1.1 Fachbeiträge

- Off-road Robotics – An Overview

  Karsten Berns, Klaus-Dieter Kuhnert, Christopher Armbrust

- Sensor-fusion based real-time 3D outdoor scene reconstruction and analysis on a moving mobile outdoor robot

  Lars Kuhnert, Klaus-Dieter Kuhnert

- Cognitive Navigation – An Overview of three Navigation Paradigms Leading to the Concept of an Affordance Hierarchy

  Felix v. Hundelshausen, Thorsten Luettel, Hans-Joachim Wuensche

1.2 Projekte

- Intelligent Mobility – Autonomous Outdoor Robotics at the DFKI

  Sylvain Joyeux, Jakob Schwendner, Frank Kirchner, Ajish Babu, Felix Grimminger, Janosch Machowinski, Patrick Paranhos, Christopher Gaudig

- Towards Pathplanning for Unmanned Ground Vehicles (UGV) in 3D Plane-Maps of Unstructured Environments

  Narunas Vaskevicius, Andreas Birk

- Autonomous Off-Road Navigation for MuCAR-3: Improving the Tentacles Approach: Integral Structures for Sensing and Motion

  Michael Himmelsbach, Thorsten Luettel, Falk Hecker, Felix von Hundelshausen, Hans-Joachim Wuensche

- Offroad Navigation using adaptable Motion Patterns

  Frank Hoeller, Timo Röhling, Dirk Schulz

- Behaviour-based Off-road Robot Navigation

  Christopher Armbrust, Martin Proetzsch, Karsten Berns

1.3 Interview

- Interview with John F. Reid Concerning the Future of Service Robots in Forestry and Agricultural Applications

1.4 Dissertationen

- Lokalisationsverfahren autonomer mobiler Systeme mittels 2D- und 3D-Umgebungsmodellen im industriellen Umfeld auf der Basis einer 3D-Umgebungserfassung

  Daniel Lecking, Bernardo Wagner

- Kombination und Klassifikation von partiellen Objektaufsichten eines mobilen Roboters mittels Aufsichtpunktketten

  Marko Reimer

- Cost-Efficient Global Robot Navigation in Rugged Off-Road Terrain

  Tim Braun

2 Serviceteil

2.1 Konferenzen

Mobile Machines 2011

March 29–30, 2011, Karlsruhe, Germany
http://www.hanser-tagungen.de/arbeitsmaschinen/
Conference about safety and assistance systems for machines and commercial vehicles.

ICRA 2011: IEEE International Conference on Robotics and Automation

May 9–13, 2011, Shanghai, China
http://www.icra2011.org/
Conference covering all areas of robotics and automation.

ICAR 2011: 15th International Conference on Advanced Robotics

June 20–23, 2011, Tallinn, Estonia
http://www.icar2011.org/
The conference theme is “New Boundaries for Robotics”. It will seek to share new ideas, weird connections, unexpected mixes of technologies, methods, and approaches which have been applied to solve new kinds of problems in new application areas.

RISE 2011: 5th IARP Workshop on Robots for Risky Interventions and Environmental Surveillance-Maintenance

June 21–24, 2011, Brussels – Leuven, Belgium
http://www.elrob.org/celrob/celrob2011.html
Workshop about theories, principles, and developments which have been explicitly designed for (terrestrial, aerial) robots, and carried sensor systems for environmental surveillance, risky interventions (safety, rescue, humanitarian de-mining, and other).

Robotics: Science and Systems

June 27–30, 2011, Los Angeles, California, USA
http://www.roboticsconference.org/
Conference that will bring together researchers working on algorithmic and mathematical foundations of robotics, robotics applications, and analysis of robotic systems.

CIOSTA & CIGR Section V Conference 2011

June 29–July 1, 2011, Vienna, Austria
http://www.nas.boku.ac.at/ciosta2011.html
The conference provides a forum to present and exchange ideas and to promote research, development, and application of efficient and safe technology and management in production processes of agriculture and forestry.

FSR 2011: The 8th International Conference on Field and Service Robotics

July 20–22, 2011, Matsushima, Miyagi, Japan
http://www.astro.mech.tohoku.ac.jp/FSR2011/
A conference on robotic applications in areas related (but not limited) to mining, agriculture, forestry, construction, and planetary exploration.

ICINCO 2011: 8th International Conference on Informatics in Control, Automation and Robotics

July 28–31, 2011, Noordwijkerhout, The Netherlands
http://www.icinco.org/
The purpose of the conference is to bring together researchers, engineers, and practitioners interested in the application of informatics to control, automation, and robotics. The topics are intelligent control systems, optimisation, robotics, automation, signal processing, sensors, systems modeling and control, and industrial engineering, production, and management.

TAROS 2011: 12th Conference Towards Autonomous Robotic Systems

August 31–September 2, 2011, Sheffield, UK
http://www.taros.org.uk/
Topics of interest include, but are not limited to, autonomous vehicles, field robotics, navigation, localization, robot vision, sensing, perception, planetary robotics.

IROS 2011: IEEE/RSJ International Conference on Intelligent Robots and Systems

September 25–30, 2011, San Francisco, California, USA
http://www.iros2011.org/
Conference dealing with all types of intelligent robots and systems.

SSRR2011: IEEE International Symposium on Safety, Security, and Rescue Robotics

November 1–5, 2011, Kyoto, Japan
http://ssrr2011.mif.sys.okayama-u.ac.jp/
The symposium addresses both the research challenges posed by search and rescue scenarios and the design of deployable robotic systems.

AgEng 2011: VDI/LAND.TECHNIK 69th International Conference on Agricultural Engineering

November 11–12, 2011, Hanover, Germany
http://www.vdi.de/landtechnik-ageng/
Main topics include agricultural information technology, precision farming, software engineering, data handling, automation, electronic components and sensors, locating, tracking, and navigation.

CVT 2012: 2nd Commercial Vehicle Technology Symposium

March 13–15, 2012, Kaiserslautern, Germany
http://www.cvt2012.de/
A symposium on various topics of commercial vehicles, including autonomous agricultural and construction machines.

2.2 Publikationen

Book: Autonomous Land Vehicles: Steps towards Service Robots

Vieweg+Teubner
Authors: K. Berns, E. v. Puttkammer, University of Kaiserslautern, Germany
http://www.viewegteubner.de/Buch/978-3-8348-0421-1/Autonomous-Land-Vehicles.html
The economic potential of autonomous mobile robots will increase tremendously during the next years. Service robots such as cleaning machines and inspection or assistance robots will bring us great support in our daily lives. This textbook provides an introduction to the methods of controlling these robotic systems.

Book: Using robots in hazardous environments: Landmine detection, de-mining and other applications

Woodhead Publishing Limited
Editors:
Y. Baudoin, Polytechnical Faculty Royal Military Academy, Belgium
and
M. K. Habib, American University in Cairo, Egypt
http://www.woodheadpublishing.com/EN/book.aspx?bookID=2041/
There have been major recent advances in robotic systems that can replace humans in undertaking hazardous activities in demanding or dangerous environments. This book reviews the development of robotic systems for de-mining and other risky activities such as fire-fighting.

2.3 Wettbewerbe

10th RoboCup German Open—RoboCupRescue

March 31–April 3, 2011, Magdeburg, Germany
http://www.robocupgermanopen.de/en/
International tournament that hosts the 11th German RoboCupJunior qualification competition for RoboCup 2011 in Istanbul (see below) and the open tournament for international teams in the RoboCup Major Leagues.

Lunabotics Mining Competition

May 23–28, 2011, Kennedy Space Center, Florida, USA
http://www.nasa.gov/offices/education/centers/kennedy/technology/lunabotics.html
University-level competition designed to engage and retain students in science, technology, engineering, and mathematics. The challenge is for students to design and build a remote-controlled or autonomous excavator, called a lunabot, that can collect and deposit a minimum of 10 kg of lunar simulant within 15 min.

ELROB—The European Robot Trial

June 20–24, 2011, Leuven, Belgium
http://elrob.org/
Trial with the aim to demonstrate and compare the capabilities of unmanned systems in realistic scenarios and terrains. ELROB is designed to assess current technology to solve problems at hand, using whatever strategy to achieve it.

Field Robot Event 2011

June 30–July 2, 2011, Herning, Denmark
http://www.fre2011.dk/program.htm
Annual and international open-air field robot contest, where students and professionals compete in a hands-on learning agricultural field domain. The vision of the Field Robot Event is to present the future of precision agriculture and horticulture.

Robocup 2011—RoboCupRescue

July 5–11, 2011, Istanbul, Turkey
http://www.robocup2011.org/en/
One major application of RoboCup technologies is the search and rescue in large-scale disaster situations. RoboCup initiated the RoboCupRescue project to specifically promote research in socially significant issues. It includes real robot and simulation leagues.