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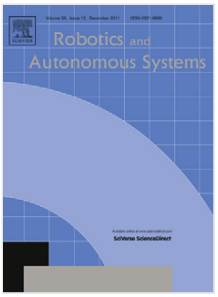

Guest editorial

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The Fifth European Conference on Mobile Robots (ECMR'11) was held on September 7th-9th, 2011, in Örebro, Sweden. The conference follows a tradition dating back to the first ECMR meeting held in September 2003 in Radziejowice, Poland, followed by ECMRs in September 2005 in Ancona, Italy; September 2007 in Freiburg, Germany; and September 2009 in Mlini/Dubrovnik, Croatia. A priority of ECMR is to attract young researchers to present their work to an international audience. ECMR is organized in single track mode to favour discussions.

This special issue is a selection of the best papers presented at ECMR '11. Based on an election of the best contributions by the ECMR participants and suggestions from the Program Committee, a number of papers were tentatively selected. The corresponding authors were requested to extend and revise their work according to the discussions during the conference and the revised papers then underwent the standard review process for journal publications. As a result of this process, which involved at least five reviews per paper, nine articles were finally selected for this special issue.

The first paper, entitled *Probabilistic Terrain Classification in Unstructured Environments* by Marcel Häselich, Nicolai Wojke, Frank Neuhaus and Dietrich Paulus[t1], describes a terrain classification approach for an autonomous robot based on Markov Random Fields on fused 3D laser and camera image data. The authors use a 2D grid representation to classify the terrain with regard to its traversability, and knowledge of the robot's egomotion and previous classification results in order to fill gaps and regions outside the current sensor data. Experiments were carried out using IMU, GPS and wheel odometry in outdoor environments, with results showing a recall ratio of around 90% for detecting streets and obstacles.

The following paper, entitled *Effective Landmark Placement for Accurate and Reliable Mobile Robot Navigation* by Maximilian Beinhofer, Jörg Müller and Wolfram Burgard, considers the problem of selecting an optimal placement of artificial landmarks for mobile robots that repeatedly carry out certain navigation tasks. Their method aims to find the minimum number of landmarks for which a bound on the maximum deviation of the robot from its desired trajectory can be guaranteed with high confidence. Experiments were carried out using both simulation and real robots, with results showing that the method outperforms other approaches and is suitable for long-term operation of mobile robots.

The following paper, entitled *Visiting Convex Regions in a Polygonal Map* by Jan Faigl, Vojtěch Vonásek and Libor Přeučil, [t2]presents a solution to the multi-goal path planning problem where goals are represented as convex polygons. Their proposed solution is based on a self-organising map (SOM) algorithm for the travelling salesman problem. Experiments were carried out using a reference set of simulated inspection and patrolling tasks, with results showing that the method outperforms other SOM based approaches.

The following paper, entitled *Multi-Robot Cooperative Spherical-Object Tracking in 3D Space Based on Particle Filters* by Aamir Ahmad and Pedro Lima, presents a cooperative approach for tracking a moving ball in 3D space by a team of mobile robots. The method is based on a particle filter with modifications to accommodate the problems of occlusions and inconsistencies due to observation errors and self-localization errors by individual robots. Experiments were carried out with a team of four soccer robots tracking a ball, with results showing robust tracking performance with respect to ground truth on a new dataset, which has also been made publicly available.

The following paper, entitled *Comparative evaluation of range sensor accuracy for indoor mobile robotics and automated logistics applications* by Todor Stoyanov, Rasoul Mojtahedzadeh, Henrik Andreasson and Achim J. Lilienthal[t3], presents an experimental comparison of three integrated 3D range sensors against various sources of 3D reference data, including the point cloud data provided by an actuated (tilting) laser range finder. A novel method for comparing range sensor output to a set of reference measurements, without requiring a precise ground-truth model of the environment, is proposed. Results for several different scenarios, including a realistic application in logistics, are presented.

The following paper, entitled *Efficient 3D Object Perception and Grasp Planning for Mobile Manipulation in Domestic Environments* by Jörg Stückler, Ricarda Steffens, Dirk Holz, and Sven Behnke[t4], presents a complete robotic system for mobile perception and manipulation of typical household objects in several different operating scenarios. The method combines state-of-the-art techniques for 3D object segmentation from depth images and efficient grasp planning, with many novel aspects. Results on the bespoke mobile manipulation platform *Cosero* demonstrate the robust performance of the system, with impressive results in winning a number of competitions including RoboCup@Home.

The following paper, entitled *Efficient Grid-Based Spatial Representations for Robot Navigation in Dynamic Environments* by Boris Lau, Christoph Sprunk and Wolfram Burgard,[t5] presents novel algorithms for efficient updating of grid-based representations such as distance maps, generalised Voronoi diagrams and configuration space maps. The approach is based on performing incremental updates to only the cells affected by changes, and also includes update algorithms for non-circular robots. Results on real-world datasets show that the proposed update strategies require less computation than existing approaches and deal better with non-convex structure, such as indoor areas.

The following paper, entitled *Inferring Robot Goals from Violations of Semantic Knowledge* by Cipriano Galindo and Alessandro Saffiotti, presents an approach for using semantic knowledge to encode expected norms in human living spaces and to detect deviations from these norms in order to generate goals for a robot. The approach is based on encoding norms into the robot's ontology so that violations of the norms can be detected, and a planner is then used to generate actions to bring the world back into the desired state. Proof-of-concept examples are presented to illustrate the system behaviour on a service robot operating in an apartment-type environment.

The following paper, entitled *Real-time 6-DOF Multi-session Visual SLAM over Large Scale Environments* by J. McDonald, M. Kaess, C. Cadena, J. Neira and J.J. [t6]Leonard, presents a system for performing real-time multi-session visual mapping in large-scale environments. The method combines many state-of-the-art techniques for 6-DOF SLAM and appearance-based place recognition both within single mapping sessions and across multiple sessions. Extensive real-world results are presented demonstrating the robustness and accuracy of the approach.