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Leveraging Applications of Formal Methods, Verification, and Validation

International Workshops
SARS 2011 and MLSC 2011
Held Under the Auspices of ISoLA 2011
in Vienna, Austria, October 17-18, 2011
Revised Selected Papers

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Preface

This issue contains a selection of revised papers that were presented at the Software Aspects of Robotic Systems (SARS 2011) Workshop and the Machine Learning for System Construction (MLSC 2011) Workshop held during October 17–18 in Vienna, Austria, under the auspices of the International Symposium Series on Leveraging Applications of Formal Methods, Verification, and Validation (ISoLA).

Both workshops are in line with the general mission statement of the ISoLA Symposium series. That is to provide a forum for developers, users, and researchers for discussing issues related to the adoption and the use of rigorous tools for specification, analysis, verification, certification, construction, test, and maintenance of systems from their domain-specific point of view. Thereby, the ISoLA symposia contribute to bridging the gap between designers and developers of (formal methods based) rigorous tools, and users in engineering and in other disciplines.

The SARS workshop and the MLSC workshop pursue this mission within the domains of software aspects of robotic systems and machine learning for system construction.

The timeliness of the SARS workshop stems from the fact that development of autonomous robotic systems experienced a remarkable boost within the last few years. Away from stationary manufacturing units, current robots have grown up into autonomous, mobile systems that not only interact with real-world environments, but also fulfill mission critical tasks in collaboration with human individuals on a reliable basis. Typical fields of application are unmanned vehicles for exploration but also for transportation, reconnaissance and search-and-rescue in hazardous environments, and ambient-assisted living for elderly or disabled people.

Hence, algorithms in cognition, computer vision, and locomotion have become hot-spots of research and development. In addition, modern concepts like evolutionary and bio-inspired design have entered the stage to tackle open issues in robotics and to cope with domain-specific properties such as inherent indeterminism.

The back-side of this boost is an even larger increase in complexity of modern robotic systems. Numerous actuators and sensors have to be controlled simultaneously. Complex actions have to be performed via timed parallel execution of multiple instruction streams on distinct electronic control units. Autonomy, especially long-term autonomy as required by deep-sea or space exploration missions, necessitates features of fault-tolerance, error recovery, or at least well-defined fallbacks. Owing to the physical interaction of robots with the real world, safety violations are extremely harmful, in the worst case they might lead to severe damage and even to casualties.

The timeliness of the MLCS workshop follows from the fact that even state-of-the-art systems often lack adequate specifications or make use of un/under-specified components. In fact, the popular component-based software design paradigm naturally leads to under-specified systems, as most libraries only provide very partial specifications of their components. Moreover, revisions and last-minute changes typically hardly enter the system specification.

As observable in many practical contexts, revision cycles are often extremely short, making the maintenance of specifications unrealistic, and at the same time necessitating extensive testing effort. More generally, the lack of documentation is sadly perceived in many places, among which quality control is one of the most prominent.

Machine learning has been proposed to overcome this situation by automatically "mining" and then updating the required information. Promising results have been obtained here using active automata-learning technology, and there seems to be a high potential to also exploit other maching-learning techniques.

Both the SARS workshop and the MLSC workshop attracted researchers and practioners from academia and industry and provided a lively forum for them to present and discuss their most recent research results in the respective fields of the two workshops.

The present issue of *Communications in Computer and Information Science* contains the revised versions of selected papers that were presented at the workshops. These papers have undergone a second round of reviewing, and reflect the suggestions of the reviewers as well as feedback from the presentation and discussion of the papers at the workshops.

The topics covered by the papers of the SARS and the MLSC workshop demonstrate the breadth and the richness of the respective fields of the two workshops stretching from robot programming to languages and compilation techniques, to real-time and fault tolerance, to dependability, software architectures, computer vision, cognitive robotics, multi-robot coordination, and simulation to bio-inspired algorithms, and from machine learning for anomaly detection, to model construction in software product lines to classification of Web service interfaces.

In addition the SARS workshop hosted a special session on the recently launched KOROS project on *collaborating robot systems* that is borne by a consortium of researchers of the faculties of architecture and planning, computer science, electrical engineering and information technology, and mechanical and industrial engineering at the *Vienna University of Technology*. The four papers devoted to this session highlighted important research directions pursued in this interdisciplinary research project.

Finally, we would like to thank the many individuals who contributed to making the ISoLA 2011 worshops a success. First of all, we thank the members of the SARS and MLSC Program Committees for their dedicated and diligent work of selecting the papers for presentation at the two workshops. We also thank the authors who submitted a paper to one of the workshops. Our special thanks go to the invited keynote speakers at the SARS workshop, Davide Brugali

(Università degli Studi di Bergamo), Rick Middleton (National University of Ireland Maynooth), Daniele Nardi (Sapienza Università di Roma), and Trevor Taylor (Microsoft, Redmond). Last but not least, we thank Alfred Hofmann, Anna Kramer, and Leonie Kunz at Springer for publishing these proceedings in the CCIS series and for the smooth co-operation.

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Table of Contents

Software Aspects of Robotic Systems (SARS 2011)

Special Session on KOROS

Machine Learning for System Construction (MLSC 2011)