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Dependable Software Engineering

Theories, Tools, and Applications

7th International Symposium, SETTA 2021
Beijing, China, November 25–27, 2021
Proceedings

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Preface

This volume contains the papers presented at SETTA 2021: the 7th International Symposium on Dependable Software Engineering Theories, Tools and Applications held during November 25–27, 2021 in Beijing.

The purpose of SETTA is to bring international researchers together to exchange research results and ideas on bridging the gap between formal methods and software engineering. The interaction with the Chinese computer science and software engineering community is a central focus point. The aim is to show research interests and results from different groups so as to initiate interest-driven research collaboration. Past SETTA symposiums were successfully held in Nanjing (2015), Beijing (2016), Changsha (2017), Beijing (2018), Shanghai (2019), and Guangzhou (2020).

SETTA 2021 included a main track and a journal first track. Its main track attracted 39 submissions co-authored by researchers from 12 countries. Each submission was reviewed by at least 3 Program Committee members with help from additional reviewers. The Program Committee discussed the submissions online and 16 papers were finally accepted for presentation at the conference. The journal first track of SETTA 2021 was organized in partnership with the Journal of Computer Science and Technology. It attracted 14 eligible submissions. Those accepted by the journal following a standard review process were expected to be presented as part of the SETTA 2021 conference program. The program also included three keynote speeches given by Joost-Pieter Katoen from RWTH Aachen University, Frits Vaandrager from Radboud University, and Charles Zhang from the Hong Kong University of Science and Technology.

SETTA 2021 was sponsored and organized by the Institute of Software, Chinese Academy of Sciences. We are grateful to the local organizing committee for their hard work in making SETTA 2021 a successful event. Our warmest thanks go to the authors for submitting their papers to the conference. We thank the members of the steering committee for their support in organizing this event. We thank all the members of Program Committee for completing reviews on time, and being active in discussions during the review process. We also thank the additional reviewers for their effort that helped the Program Committee to decide which submissions to accept. Special thanks go to our invited speakers for presenting their research at the conference. Finally, we thank the conference general chair, Chen Zhao, the publicity chair, Fu Song, and the local organization chair, Zhilin Wu.

October 2021

Shengchao Qin
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Organization

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Abstracts of Keynote Speeches

Mechanically Finding the Right Probabilities in Markov Models

Joost-Pieter Katoen

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Aachen, Germany

Markov chains are central in performance and dependability analysis, whereas Mark-ov decision processes are key in stochastic decision making and planning in AI. A standard assumption in these models is that all probabilities are precisely known a priori. In many cases, this assumption is too severe. System quantities such as component fault rates, molecule reaction rates, packet loss ratios, etc. are often not, or at best partially, known.

This talk surveys the analysis of parametric Markov models whose transitions are labelled with functions over a finite set of parameters. These models are symbolic representations of uncountably many concrete probabilistic models, each obtained by instantiating the parameters. We consider various analysis problems for a given logical specification φ: do all parameter instantiations within a given region of parameter values satisfy φ?, which instantiations satisfy φ and which ones do not?, and how can all such instantiations be characterised, either exactly or approximately?

We address theoretical complexity results and describe the main ideas underlying state-of-the-art algorithms that established an impressive leap over the last decade enabling the fully automated analysis of models with millions of states and thousands of parameters. Examples from distributed computing, satellites and AI illustrate the applicability of these parameter synthesis techniques.

A New Approach for Active Automata Learning Based on Apartness

Frits W. Vaandrager

Institute for Computing and Information Sciences, Radboud University,
Netherlands

We present $L^{\#}$, a new and simple approach to active automata learning. Instead of focusing on equivalence of observations, like the L^{*} algorithm and its descendants, $L^{\#}$ takes a different perspective: it tries to establish apartness, a constructive form of inequality. $L^{\#}$ does not require auxiliary notions such as observation tables or discrimination trees, but operates directly on tree-shaped automata. $L^{\#}$ has the same asymptotic query and symbol complexities as the best existing learning algorithms, but we show that adaptive distinguishing sequences can be naturally integrated to boost the performance of $L^{\#}$ in practice. Experiments with a prototype implementation, written in Rust, suggest that $L^{\#}$ outperforms existing algorithms.[1]

[1] (Based on joint work with Bharat Garhewal, Jurriaan Rot & Thorsten Wissmann)

Enterprise-Scale Static Analysis: A Pinpoint Experience

Charles Zhang

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Despite years of research and practice, modern static analysis techniques still cannot detect oldest and extremely well understood software bugs such as the Heartbleed, one of the most spectacular security flaws of the recent decade. A remedy, as what we have attempted through the successful commercialization of the Pinpoint platform (PLDI s18), is to make static program analysis aware of the basic characteristics of the modern enterprise-scale software system. The talk focuses on discussing these characteristics and how Pinpoint addresses them pragmatically as well as its future directions. Pinpoint is a LLVM-based cross-language static analysis platform and deployed in major Chinese tech companies such as Tencent, Baidu, Huawei, and Alibaba.

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