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Verification, Model Checking, and Abstract Interpretation

22nd International Conference, VMCAI 2021 Copenhagen, Denmark, January 17–19, 2021 Proceedings

Springer

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ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-030-67066-5 ISBN 978-3-030-67067-2 (eBook)
https://doi.org/10.1007/978-3-030-67067-2

LNCS Sublibrary: SL1 – Theoretical Computer Science and General Issues

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Preface

Welcome to the proceedings of VMCAI 2021, the 22nd International Conference on Verification, Model Checking, and Abstract Interpretation.

Nonlocation. VMCAI 2021 was held January 17–19, 2021, jointly with the 48th ACM SIGPLAN Symposium on Principles of Programming Languages (POPL 2021). In contrast to previous years, VMCAI took place entirely online due to the COVID-19 pandemic, after originally being planned to be held at Hotel Scandic Copenhagen in Copenhagen, Denmark, colocated with POPL 2021.

Conference description. VMCAI provides a forum for researchers working on verification, model checking, and abstract interpretation and facilitates interaction, cross-fertilization, and advancement of hybrid methods that combine these and related areas.

The topics of the conference include program verification, model checking, abstract interpretation, program synthesis, static analysis, type systems, deductive methods, decision procedures, theorem proving, program certification, debugging techniques, program transformation, optimization, and hybrid and cyber-physical systems.

Focus on reproducibility of research sesults. For the second time, VMCAI 2021 included an optional artifact evaluation (AE) process for submitted papers. Reproducibility of results is of the utmost importance to the VMCAI community. Therefore, we encouraged all authors to submit an artifact for evaluation. An artifact is any additional material (software, data sets, machine-checkable proofs, etc.) that substantiates the claims made in a paper and ideally makes them fully replicable. The evaluation and archiving of artifacts improves replicability and traceability for the benefit of future research and the broader VMCAI community.

Paper selection. VMCAI 2021 received a total of 50 paper submissions, of which 2 were rejected without a full review for being out of scope and 1 was withdrawn during the reviewing period. After a rigorous review process, with each paper reviewed by at least three program committee members and a subsequent online discussion, the program committee eventually accepted 23 papers for publication in the proceedings and for presentation at the conference: 20 regular papers, 2 case studies, and 1 tool paper. The main selection criteria were quality, relevance, and originality.

Invited talks and papers. The conference program included three invited keynote presentations. They were by Bernd Finkbeiner (Universität des Saarlandes and CISPA Helmholtz Center for Information Security) on *Model Checking Algorithms for Hyperproperties*, by Laura Kovács (TU Wien) on *Algebra-Based Synthesis of Loops and their Invariants*, and by Bernhard Steffen (TU Dortmund) on *Generative Program Analysis and Beyond: The Power of Domain-Specific Languages*.

Each of the keynote presentations is accompanied by a paper the speakers were invited to contribute to these proceedings. David Schmidt (Kansas State University), who was jointly invited, elected to defer to and support Bernhard Steffen's invited talk and paper.

No winter school. In contrast to previous years there was no winter school preceding the conference. The organizers figured that the interactive spirit and intensity of a winter school would be too difficult to achieve in the purely online setting necessitated by COVID-19.

Artifact evaluation process. VMCAI 2021 continued the artifact evaluation process established by VMCAI 2020. The goals of artifact evaluation are: (1) to get more substantial evidence for the claims in the papers, (2) to simplify the replication of results in the paper, and (3) to reward authors who create artifacts. Artifacts are any additional material that substantiates the claims made in the paper. Examples of artifacts are software, tools, frameworks, data sets, test suites, and machine-checkable proofs.

Authors of submitted papers were encouraged to submit an artifact to the VMCAI 2021 artifact evaluation committee (AEC). We also encouraged the authors to make their artifacts publicly and permanently available. Artifacts had to be provided as `.zip` or `.tar.gz` files and had to contain all necessary software for artifact evaluation as well as a `README` file that describes the artifact and provides instructions on how to replicate the results. Artifact evaluation had to be possible in the VMCAI 2021 virtual machine, which ran Ubuntu 20.04 and was made publicly and permanently available on Zenodo[1].

All 22 submitted artifacts were evaluated in parallel with the papers. We assigned three members of the AEC to each artifact and assessed it in two phases. First, the reviewers tested whether the artifacts were working, e.g. there were no corrupted or missing files and the evaluation did not crash on simple examples. For those artifacts that did not work, we sent the issues to the authors. The authors' answers to the reviewers were distributed among the reviewers, and the authors were allowed to submit an updated artifact to fix issues found during the test phase. In the second phase, the assessment phase, the reviewers aimed at reproducing any experiments or activities and evaluated the artifact based on the following questions:

1. Is the artifact consistent with the paper and the claims made by the paper?
2. Are the results of the paper replicable through the artifact?
3. Is the artifact well documented?
4. Is the artifact easy to use?

21 of the 22 submitted artifacts passed this second phase. Of these, 12 artifacts also had their corresponding paper accepted, and were rewarded with the 'Functional' VMCAI artifact evaluation badge. Ten of these further consisted of artifacts that were made permanently and publicly available; they were awarded the 'Available' VMCAI artifact evaluation badge. Four of these were further considered remarkably well structured, well documented and easy to adapt to future experiments or comparisons, and received the 'Reusable' badge.

Acknowledgments. We would like to thank, first of all, the authors for submitting their papers and, in many cases, supporting artifacts to VMCAI 2021.

[1] https://zenodo.org/record/4017293.

The program committee and the artifact evaluation committee did a great job of reviewing: they contributed informed and detailed reports and engaged conscientiously in the discussions and, in 3 cases, shepherding that eventually led to the decisions which submissions to accept for presentation at the conference and for inclusion in the present proceedings.

We warmly thank the keynote speakers for their participation and contributions.

We also thank the organizational committee of POPL 2021, in particular POPL General Chair Andreas Podelski, for the umbrella organization they provided for the entire POPL 2021 conference week.

Special thanks go to Clowdr for providing an online conference platform that not only provided live audio/video transmission of the presentations, but also facilitated low-carbon interactive and social participation from around the world.

We thank Christine Reiss and her publication team at Springer for their support, and EasyChair for facilitating an efficient reviewing process.

The VMCAI steering committee and the previous year's PC co-chairs, Dirk Beyer and Damien Zufferey, have provided helpful advice, assistance, and support. Special thanks go to Andreas Podelski for his experienced supervision and support from initial planning to execution and finalization of VMCAI 2021.

Last but not least, we thank the sponsors, Amazon Web Services, Cadence, and Springer, for their financial contributions. They made it possible for students and others without the financial means to cover the registration fee to participate in VMCAI 2021.

November 2020

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