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Thao Dang · Volker Stolz (Eds.)

# Runtime Verification

## 22nd International Conference, RV 2022 Tbilisi, Georgia, September 28–30, 2022 Proceedings

Springer

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# Preface

This volume contains the peer-reviewed proceedings of the 22nd International Conference on Runtime Verification (RV 2022), a hybrid event held during September 28–30, 2022. The conference was part of the Computational Logic Autumn Summit (CLAS 2022), running during September 19–30, 2022, on the campus of the Ivane Javakhishvili Tbilisi State University in Tbilisi, Georgia.

The RV series is a sequence of annual meetings that brings together scientists from both academia and industry interested in investigating novel lightweight formal methods to monitor, analyze, and guide the runtime behavior of software and hardware systems. Runtime verification techniques are crucial for system correctness, reliability, and robustness; they provide an additional level of rigor and effectiveness compared to conventional testing, and are generally more practical than exhaustive formal verification. Runtime verification can be used prior to deployment, for testing, verification, and debugging purposes, and after deployment for ensuring reliability, safety, and security, for providing fault containment and recovery, and for online system repair.

RV started in 2001 as an annual workshop and turned into a conference in 2010. The workshops were organized as satellite events of established forums, including the Conference on Computer-Aided Verification and ETAPS. The proceedings of RV from 2001 to 2005 were published in Electronic Notes in Theoretical Computer Science. The RV proceedings have been published in Springer's Lecture Notes in Computer Science since 2006. Previous RV conferences took place in Istanbul, Turkey (2012); Rennes, France (2013); Toronto, Canada (2014); Vienna, Austria (2015); Madrid, Spain (2016); Seattle, USA (2017); Limassol, Cyprus (2018); and Porto, Portugal (2019). The conferences in 2020 and 2021 were held virtually due to the ongoing COVID-19 pandemic.

This year we received 40 submissions, 33 as regular contributions and seven as short or tool papers. Each of these submissions went through a rigorous single-blind review process as a result of which all papers except for a desk-reject received at least three review reports. The Program Committee selected 12 regular and five short/tool papers for presentation during the conference and inclusion in these proceedings. At the suggestion of the reviewers, the authors of five regular contributions that were not initially selected for publication were invited to provide short papers summarizing their ideas and providing pointers to their tools, and these have been included in the proceedings after a final short review. The evaluation and selection process involved thorough discussions among the members of the Program Committee and external reviewers through the EasyChair conference manager, before reaching a consensus on the final decisions.

The conference featured two keynote speakers:

- Serdar Tasiran, Amazon Web Services, USA
- Michal Valko, DeepMind and Inria, France

We are grateful for the support provided by the many people who contributed to RV 2022, including the Steering Committee members. We also thank the members of the Program Committee and their sub-reviewers for their timely and high-quality reviews as well as their contributions to the discussions. The conference organization was partially supported through sponsorship from Runtime Verification Inc., Amazon Web Services, and Springer.

Besik Dundua as local organizing chair assured the smooth organization and running of RV and the other affiliated events at CLAS. Finally, we appreciate the support and assistance provided by the team at Springer, as well as Ana Cavalcanti's and Marie-Claude Gaudel's confidence for including these proceedings into the Formal Methods subline. Volker Stolz is supported by the Norwegian Research Council through grant 309527 – COEMS Training Network.

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August 2022

Thao Dang
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# Learning by Bootstrapping of Latents (Abstract)

Michal Valko[1,2]

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[2] Inria, Lille, France

**Abstract.** We will discuss self-supervised representation learning and a new paradigm for it based on bootstrapping of latents. We first present BYOL ("Bootstrap Your Own Latent") for images, which relies on two neural networks, referred to as *online* and *target*, that interact and learn from each other: From an augmented view of an image, we train the online network to predict the target network representation of the same image under a different augmented view. At the same time, we update the target network with a slow-moving average of the online network. While prior methods had intrinsically relied on negative pairs, BYOL achieved a new state of the art without them. We will also describe follow-ups of BYOL that we have explored within DeepMind, BGRL for graphs, MYOW for new uncharted domains such as neural readings, and BraVe for videos. We finally apply the paradigm to reinforcement learning and discuss curiosity-driven exploration when the rewards are sparse or absent. For this setting, we give a brand new algorithm BYOL-Explore that jointly learns a world representation, the world dynamics, and an exploration policy.

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