Invited Keynote GI 2023

Myra B. Cohen (Iowa State University, USA)

It's all in the Semantics: When are Genetically Improved Programs Still Correct?

Genetic improvement (GI) is a powerful technique to automatically optimize programs, often for non-functional properties. As such, we expect to retain the original program semantics, hence GI is guided by both a functional test suite and at least one other objective such as program efficiency, memory usage, energy efficiency, etc. An assumption made is that it is possible to improve a program's non-functional objective while retaining the program's correctness, however, this assumption may not hold for all types of non-functional properties. In this talk I show why GI is naturally a multi-objective optimization problem and argue that it may be necessary to relax part of the program correctness to satisfy our non-functional goals. I discuss a few recent examples where we have had to balance functional correctness and non-functional objectives and demonstrate how this may lead to programs that are of higher quality in the end. This raises an important question about when it is possible to completely satisfy multiple (potentially competing) program objectives during GI, and when it is semantically impossible. This leads to the ultimate question of what it means for a program to be correct when using GI.

Prof. Cohen is a full professor at Iowa State University (USA), where she holds the Lanh and Oanh Nguyen Chair in Software Engineering in the Department of Computer Science. She is head of Iowa State's LaVA-Ops, Laboratory for Variability-Aware Assurance and Testing of Organic Programs. As well as genetic improvement, her research covers software testing of highly-configurable software, SBSE, applications of combinatorial designs (CIT), and the synergy between systems and synthetic biology and software engineering. She has served on many software engineering conferences, including this year as the Technical Briefings-track chair of ICSE 2023.

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Sebastian Baltes (SAP SE, Germany & University of Adelaide, Australia)

All about the money: Cost modeling and optimization of cloud applications

Cost is an essential non-functional property of cloud applications and is often a primary reason for companies to move to the cloud. One significant advantage of cloud platforms is the possibility to scale compute, storage, and networking resources up and down based on demand. However, as an application scales, so does the cost. Cost transparency of cloud applications is a common problem, and cloud providers have responded by providing means for detecting cost anomalies. However, detecting anomalies after billing is a workaround rather than a solution addressing the core problem. After introducing central cloud computing concepts and typical pricing approaches in the cloud, this talk outlines our vision of a vendor-agnostic cost model enabling reasoning about cost-optimal infrastructure and platform configurations based on expected workloads. The overall goal is to shift cost transparency left, i.e., to the developers and platform engineers who frequently provision cloud environments using web portals or Infrastructure-as-Code (IaC) files. The talk concludes by summarizing the current trend towards Infrastructure-from-Code (IfC), where programming languages and cloud infrastructure descriptions converge into one paradigm, intending to automate infrastructure provisioning as much as possible. This area has huge potential for genetic improvement to optimize the IfC code and the provisioning mechanisms while balancing non-functional properties such as performance and cost.

Dr. Sebastian Baltes is a Principal Expert for Empirical Software Engineering at SAP SE in Germany and an Adjunct Lecturer at the University of Adelaide in Australia. He received his Ph.D. in Computer Science from the University of Trier, Germany, in 2019. His work focuses on software analytics, i.e., processing, analyzing, and visualizing software engineering data to monitor, govern, and improve software development processes and tools. He is further interested in interdisciplinary research and methodological aspects of empirical software engineering. For him, thoroughly analyzing and understanding the state-of-practice is an essential first step towards improving how software is being developed. Dr. Baltes' research has been published in leading software engineering venues, including ICSE, FSE, TSE, and EMSE. He was awarded a Google Faculty Research Award in 2020 and two ACM SIGSOFT Distinguished Paper Awards (at ICSE 2021 and 2023). For more information, please visit https://empirical-software.engineering.