## 2019 12th IEEE Conference on Software Testing, Validation and Verification (ICST 2019)

Xi'an, China 22 – 27 April 2019



IEEE Catalog Number: CFP19TVV-POD ISBN: 978-1-7281-1737-9

## Copyright $\odot$ 2019 by the Institute of Electrical and Electronics Engineers, Inc. All Rights Reserved

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.

IEEE Catalog Number:CFP19TVV-PODISBN (Print-On-Demand):978-1-7281-1737-9ISBN (Online):978-1-7281-1736-2

ISSN: 2159-4848

#### Additional Copies of This Publication Are Available From:

Curran Associates, Inc 57 Morehouse Lane Red Hook, NY 12571 USA Phone: (845) 758-0400

Fax: (845) 758-2633

E-mail: curran@proceedings.com Web: www.proceedings.com



# 2019 12th IEEE Conference on Software Testing, Validation and Verification (ICST) ICST 2019

#### **Table of Contents**

Message from the General Chairs xii  Message from the Program Chairs xiv  Organization Committee xvi  Program Committees xviii  Keynote Speakers xxi  Conference Sponsors xxy
Research Track
Test Generation
XSTRESSOR: Automatic Generation of Large-Scale Worst-Case Test Inputs by Inferring Path Conditions .1 Charitha Saumya (Purdue University, West Lafayette, IN), Jinkyu Koo (Purdue University, West Lafayette, IN), Milind Kulkarni (Purdue University, West Lafayette, IN), and Saurabh Bagchi (Purdue University, West Lafayette, IN)
Automated Testing of Basic Recognition Capability for Speech Recognition Systems .13
Extension-Aware Automated Testing Based on Imperative Predicates .25
Parallel Many-Objective Search for Unit Tests .37
Fuzzing and Security
MemFuzz: Using Memory Accesses to Guide Fuzzing .48

SeqFuzzer: An Industrial Protocol Fuzzing Framework from a Deep Learning Perspective .59
Fixing of Security Vulnerabilities in Open Source Projects: A Case Study of Apache HTTP Server and Apache Tomcat .68.
Valentina Piantadosi (University of Molise), Simone Scalabrino (University of Molise), and Rocco Oliveto (University of Molise)
Empirical Studies and Benchmarking
Similarities Across Libraries: Making a Case for Leveraging Test Suites .79.  Devika Sondhi (IIIT Delhi), Divya Rani (Gandhi Institute for Technological Advancement, Bhubaneswar), and Rahul Purandare (IIIT Delhi)
BugsJS: a Benchmark of JavaScript Bugs 90
Péter Gyimesi (University of Szeged), Béla Vancsics (University of Szeged), Andrea Stocco (University of British Columbia), Davood
Mazinanian (University of British Columbia), Árpád Beszédes (University of Szeged), Rudolf Ferenc (University of Szeged), and Ali Mesbah (University of British Columbia)
You Cannot Fix What You Cannot Find! An Investigation of Fault Localization Bias in Benchmarking Automated Program Repair Systems 102
Kui Liu (University of Luxembourg), Anil Koyuncu (University of
Luxembourg), Tegawendé F. Bissyandé (University of Luxembourg), Dongsun Kim (University of Luxembourg), Jacques Klein (University of
Luxembourg), and Yves Le Traon (University of Luxembourg)
Comparing Mutation Testing at the Levels of Source Code and Compiler Intermediate Representation .1.14  Farah Hariri (University of Illinois at Urbana-Champaign), August Shi  (University of Illinois at Urbana-Champaign), Vimuth Fernando
(University of Illinois at Urbana-Champaign), Suleman Mahmood (University of Illinois at Urbana-Champaign), and Darko Marinov
(University of Illinois at Urbana-Champaign)
Machine Learning
Testing Machine Learning Algorithms for Balanced Data Usage .125
PySE: Automatic Worst-Case Test Generation by Reinforcement Learning .136.  Jinkyu Koo (Purdue University), Charitha Saumya (Purdue University),  Milind Kulkarni (Purdue University), and Saurabh Bagchi (Purdue  University)

Cristin (USI U	Anomaly Detector for the Cloud .148
Dongy. Univer	tive Study on Cross-Project Predictive Mutation Testing .160
Web ar	nd GUI Applications
Abduln (Unive	Repairing Internationalization Presentation Failures by Solving Layout Constraints .1.72
Ibrahir	e Visual Verification of Layout Failures in Responsively Designed Web Pages 183
Haruto	Less Debugging for Interactive and/or Realtime Programs .194
SAT an	nd Search Based Testing
Leonid	a Search Towards Execution Properties with a Learned Fitness Function .206
Xiangy (Feder	serving Test Repair .2.17
Wenxi Inc.), M	o Optimize the Alloy Analyzer .228
Quenti Rennes Xavier	Sampling of SAT Solutions for Configurable Systems: Are We There Yet? .240

#### Coverage

Do Pseudo Test Suites Lead to Inflated Correlation in Measuring Test Effectiveness? 252...... Jie M. Zhang (CREST, University College London), Lingming Zhang (University of Texas at Dallas), Dan Hao (Key Laboratory of High Confidence Software Technologies (PKU), China), Meng Wang (University of Bristol), and Lu Zhang (Key Laboratory of High Confidence Software Technologies (PKU), China) Coverage-Driven Test Generation for Thread-Safe Classes via Parallel and Conflict Dependencies .264....... Valerio Terragni (USI Università della Svizzera italiana), Mauro Pezzè (USI Università della Svizzera italiana, Università degli Studi di Milano-Bicocca), and Francesco Adalberto Bianchi (USI Università della Svizzera italiana) **Verification and Analysis** Precise Static Happens-Before Analysis for Detecting UAF Order Violations in Android 276.... Diyu Wu (University of New South Wales), Jie Liu (University of New South Wales), Yulei Sui (University of Technology Sydney), Shiping Chen (Commonwealth Scientific and Industrial Research Organisation, Data 61, Australia), and Jingling Xue (University of New South Wales) An Empirical Assessment of Machine Learning Approaches for Triaging Reports of a Java Static Analysis Tool 288 Ugur Koc (University of Maryland), Shiyi Wei (University of Texas at Dallas), Jeffrey S. Foster (Tufts University), Marine Carpuat (University of Maryland), and Adam A. Porter (University of Maryland) Techniques for Evolution-Aware Runtime Verification 300. Owolabi Legunsen (University of Illinois at Urbana-Champaign), Yi Zhang (University of Illinois at Urbana-Champaign), Milica Hadzi-Tanovic (University of Illinois at Urbana-Champaign), Grigore Rosu (University of Illinois at Urbana-Champaign), and Darko Marinov (University of Illinois at Urbana-Champaign) **Evolution and Maintenance** iDFlakies: A Framework for Detecting and Partially Classifying Flaky Tests .3.12..... Wing Lam (University of Illinois at Urbana-Champaign), Reed Oei (University of Illinois at Urbana-Champaign), August Shi (University of Illinois at Urbana-Champaign), Darko Marinov (University of Illinois at Urbana-Champaign), and Tao Xie (University of Illinois at *Urbana-Champaign*) Resurgence of Regression Test Selection for C++ .323. Ben Fu (The University of Texas at Austin), Sasa Misailovic (University of Illinois at Urbana-Champaign), and Milos Gligoric (The *University of Texas at Austin)* 

On the Evolution of Keyword-Driven Test Suites .335
Renaud Rwemalika (SnT, University of Luxembourg, Luxembourg), Marinos
Kintis (SnT, University of Luxembourg, Luxembourg), Mike Papadakis
(SnT, University of Luxembourg, Luxembourg), Yves Le Traon (SnT,
University of Luxembourg, Luxembourg), and Pierre Lorrach (BGL BNP Paribas, Luxembourg)
An Empirical Study on the Use of Defect Prediction for Test Case Prioritization .346
David Paterson (University of Sheffield), Jose Campos (University of
Washington), Rui Abreu (University of Lisbon), Gregory M. Kapfhammer
(Allegheny College), Gordon Fraser (University of Passau), and Phil
McMinn (University of Sheffield)
Poster Papers
Poster: ClearTH Test Automation Framework: A Running Example of a DLT-Based Post-Trade System .358. Vladimir Panarin (Exactpro), Alyona Bulda (Exactpro), Iosif Itkin (Exactpro), Alexey Zverev (Exactpro), Kirill Zagorouiko (Exactpro),
Murad Mamedov (Exactpro), Alyona Rybakova (Exactpro), Anna Gromova
(Exactpro), Elena Treshcheva (Exactpro), Sergey Tishin (Exactpro), and
Rostisłav Yavorskiy (Exactpro, Higher School of Economics)
Poster: Automatic Consistency Checking of Requirements with ReqV .363.
Simone Vuotto (Chemistry and Farmacy Dept., University of Sassari),
Massimo Narizzano (DIBRIS, University of Genoa), Luca Pulina
(Chemistry and Farmacy Dept., University of Sassari), and Armando
Tacchella (DIBRIS, University of Genoa)
Poster: Re-Testing Configured Instances in the Production Environment - A Method for Reducing the
Test Suite 367.
Oussama Jebbar (Concordia University), Mohamed Aymen Saied (Concordia University), Ferhat Khendek (Concordia University), and Maria Toeroe
(Ericsson)
Poster: Aiding Java Developers with Interactive Fault Localization in Eclipse IDE .3.71
Szeged), and Árpád Beszédes (University of Szeged)
Poster: Supporting JavaScript Experimentation with BugsJS 3.75.
Béla Vancsics (University of Szeged, Hungary), Péter Gyimesi (University of Szeged, Hungary), Andrea Stocco (University of British
Columbia), Davood Mazinanian (University of British Columbia), Árpád
Beszédes (University of Szeged, Hungary), Rudolf Ferenc (University of
Szeged, Hungary), and Ali Mesbah (University of British Columbia)

#### **Industry Track**

Automating Root Cause Analysis via Machine Learning in Agile Software Testing Environments .3.79..........

Julen Kahles (Ericsson Finland), Juha Törrönen (Ericsson Finland),
Timo Huuhtanen (Aalto University), and Alexander Jung (Aalto
University)

Classifying False Positive Static Checker Alarms in Continuous Integration Using Convolutional Neural Networks 391.
Seongmin Lee (KAIST, Daejeon, Republic of Korea), Shin Hong (Handong Global University, Pohang, Republic of Korea), Jungbae Yi (Samsung Electronics, Seoul, Republic of Korea), Taeksu Kim (Samsung Electronics, Seoul, Republic of Korea), Chul-Joo Kim (Samsung
Electronics, Seoul, Republic of Korea), and Shin Yoo (KAIST, Daejeon, Republic of Korea)
VCIPR: Vulnerable Code is Identifiable When a Patch is Released (Hacker's Perspective) .402
Automated Function Assessment in Driving Scenarios 414.  Christian King (FZI Forschungszentrum Informatik), Lennart Ries (FZI Forschungszentrum Informatik), Christopher Kober (Daimler AG), Christoph Wohlfahrt (Daimler AG), and Eric Sax (FZI Forschungszentrum Informatik)
Using Data Flow-Based Coverage Criteria for Black-Box Integration Testing of Distributed Software  Systems .420
TestSage: Regression Test Selection for Large-Scale Web Service Testing .430.  Hua Zhong (Google Inc., The University of Texas at Austin), Lingming  Zhang (University of Texas at Dallas), and Sarfraz Khurshid (The  University of Texas at Austin)
Testing Tool Track
Testing Android Incoming Calls 441.  Ana C. R. Paiva (University of Porto), Marco A. Gonçalves (University of Porto), and André R. Barros (University of Porto)
Why Does this App Need this Data? Automatic Tightening of Resource Access .449.  Nataniel P. Borges (CISPA - Helmholtz Center for Information Security)  and Andreas Zeller (CISPA - Helmholtz Center for Information Security)
Efficient Automated Decomposition of Build Targets at Large-Scale .457.  Lukas Jendele (Google Inc.), Markus Schwenk (Google Inc.), Diana  Cremarenco (Google Inc.), Ivan Janicijevic (Google Inc.), and Mikhail  Rybalkin (Google Inc.)
Program Repair at Arbitrary Fault Depth .465.  Besma Khaireddine (University of Tunis El Manar), Matias Martinez (University of Valenciennes, France), and Ali Mili (NJIT Newark NJ USA)
SmokeOut: An Approach for Testing Clustering Implementations .473

### **Doctoral Symposium**

AADL-Based Safety Analysis Approaches for Safety-Critical Systems .481
Testing for Implicit Inconsistencies in Documentation and Implementation .483.  **Devika Sondhi (IIIT Delhi)*
Automated Scenario-Based Integration Testing of Time-Constrained Distributed Systems 486
Using Testing to Repair Models .489.  Marco Radavelli (University of Bergamo)
Operational Profile and Software Testing: Aligning User Interest and Test Strategy .492.  Luiz Cavamura Júnior (Federal University of Sao Carlos (UFSCar))
A Model-Based Approach to Generate Dynamic Synthetic Test Data .495
Author Index 499