# 2018 IEEE/ACM 40th International Conference on Software Engineering (ICSE 2018)

Gothenburg, Sweden 27 May – 3 June 2018

Pages 1-631



**IEEE Catalog Number: ISBN:** 

CFP18018-POD 978-1-5386-5293-0

# **Copyright © 2018, Association for Computing Machinery (ACM) 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:
 CFP18018-POD

 ISBN (Print-On-Demand):
 978-1-5386-5293-0

 ISBN (Online):
 978-1-4503-5638-1

ISSN: 0270-5257

### 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



# 2018 ACM/IEEE 40th International Conference on Software Engineering ICSE 2018

### **Table of Contents**

essage from the General Chair .xxiii
essage from the Program Chairs .xxvi
essage from the Journal First Chair .xxviii.
ganizing Committee xxix
ogram Board .xxxiii
ogram Committee .xxxvi
onsors and Supporters xly
ession 1: Software Repair I
ntext-Aware Patch Generation for Better Automated Program Repair .1
wards Practical Program Repair with On-demand Candidate Generation .12
urnal First] A Correlation Study Between Automated Program Repair and Test-Suite Metrics .24  Jooyong Yi (Innopolis University), Shin Hwei Tan (National University of Singapore), Sergey Mechtaev (National University of Singapore), Marcel Böhme (National University of Singapore), and Abhik Roychoudhury (National University of Singapore)
urnal First] Do Automated Program Repair Techniques Repair Hard and Important Bugs? .25

## **Session 2: Apps and App Stores I**

Software Protection on the Go: A Large-Scale Empirical Study on Mobile App Obfuscation 26.  Pei Wang (The Pennsylvania State University), Qinkun Bao (The Pennsylvania State University), Li Wang (The Pennsylvania State University), Shuai Wang (The Pennsylvania State University), Zhaofeng Chen (Baidu X-Lab), Tao Wei (Baidu X-Lab), and Dinghao Wu (The Pennsylvania State University)
GUILeak: Tracing Privacy Policy Claims on User Input Data for Android Applications 37.  Xiaoyin Wang (University of Texas at San Antonio), Xue Qin (University of Texas at San Antonio), Mitra Bokaei Hosseini (University of Texas at San Antonio), Rocky Slavin (University of Texas at San Antonio),  Travis D. Breaux (Carnegie Mellon University), and Jianwei Niu (University of Texas at San Antonio)
Online App Review Analysis for Identifying Emerging Issues .48  Cuiyun Gao (The Chinese University of Hong Kong), Jichuan Zeng (The Chinese University of Hong Kong), Michael R. Lyu (The Chinese University of Hong Kong), and Irwin King (The Chinese University of Hong Kong)
[Journal First] EARMO: An Energy-Aware Refactoring Approach for Mobile Apps .59
Session 3: Software Evolution and Maintenance I
Neuro-Symbolic Program Corrector for Introductory Programming Assignments .60.  Sahil Bhatia (Netaji Subhas Institute of Technology), Pushmeet Kohli (Google Deepmind), and Rishabh Singh (Microsoft Research)
Automated Localization for Unreproducible Builds 71.  Zhilei Ren (Dalian University of Technology), He Jiang (Dalian University of Technology), Jifeng Xuan (Dalian University of Technology), and Zijiang Yang (Western Michigan University)
Enlightened Debugging .82  Xiangyu Li (Georgia Institute of Technology), Shaowei Zhu (Georgia  Institute of Technology), Marcelo d'Amorim (Federal Univesity of  Pernambuco), and Alessandro Orso (Georgia Institute of Technology)
[Journal First] Experiences and Challenges in Building a Data Intensive System for Data Migration .93

# **Session 4: Human and Social Aspects of Computing I**

Sentiment Analysis for Software Engineering: How Far Can We Go? 94.  Bin Lin (Università della Svizzera italiana), Fiorella Zampetti (University of Sannio), Gabriele Bavota (Università della Svizzera italiana (USI)), Massimiliano Di Penta (University of Sannio), Michele Lanza (Faculty of Informatics), and Rocco Oliveto (STAKE Lab - University of Molise)	•••
Identifying Features in Forks 105  Shurui Zhou (Carnegie Mellon University), Stefan Stanciulescu (IT University of Copenhagen), Olaf Leßenich (University of Passau), Yingfei Xiong (Peking University), Andrzej Wasowski (IT University of Copenhagen), and Christian Kästner (Carnegie Mellon University)	
Roles and Impacts of Hands-on Software Architects in Five Industrial Case Studies .1.17.  Inayat Rehman (Rochester Institute of Technology), Mehdi Mirakhorli (Rochester Institute of Technology), Meiyappan Nagappan (University of Waterloo), Azat Aralbay Uulu (Rochester Institute of Technology), and Matthew Thornton (Rochester Institute of Technology)	
[Journal First] Sentiment Polarity Detection for Software Development .128	•••
Session 5: Software Repair II	
Session 5: Software Repair II  Semantic Program Repair Using a Reference Implementation .129	
Semantic Program Repair Using a Reference Implementation .129  Sergey Mechtaev (National University of Singapore), Manh-Dung Nguyen (National University of Singapore), Yannic Noller (Humboldt University of Berlin), Lars Grunske (Humboldt University of Berlin), and Abhik	
Semantic Program Repair Using a Reference Implementation .129  Sergey Mechtaev (National University of Singapore), Manh-Dung Nguyen (National University of Singapore), Yannic Noller (Humboldt University of Berlin), Lars Grunske (Humboldt University of Berlin), and Abhik Roychoudhury (National University of Singapore)  Automated Repair of Mobile Friendly Problems in Web Pages .140  Sonal Mahajan (University of Southern California), Negarsadat Abolhassani (University of Southern California), Phil McMinn (University of Sheffield), and William G. J. Halfond (University of	

# Session 6: Apps and App Stores II

[Journal First] Studying the Dialogue Between Users and Developers of Free Apps in the Google Play Store .164
Automated Reporting of GUI Design Violations for Mobile Apps .165
Leveraging Program Analysis to Reduce User-Perceived Latency in Mobile Applications .1.76
Repairing Crashes in Android Apps .187
Session 7: Regression Testing
Hybrid Regression Test Selection .199.  Lingming Zhang (The University of Texas at Dallas)
Fine-Grained Test Minimization 210.  Arash Vahabzadeh (University of British Columbia), Andrea Stocco (University of British Columbia), and Ali Mesbah (University of British Columbia)
FAST Approaches to Scalable Similarity-Based Test Case Prioritization .222.  Breno Miranda (Federal University of Pernambuco), Emilio Cruciani (Gran Sasso Science Institute), Roberto Verdecchia (Gran Sasso Science Institute), and Antonia Bertolino (ISTI - CNR)
Towards Refactoring-Aware Regression Test Selection 233  Kaiyuan Wang (University of Texas at Austin), Chenguang Zhu (University of Texas at Austin), Ahmet Celik (University of Texas at Austin), Jongwook Kim (Iona College), Don Batory (University of Texas at Austin), and Milos Gligoric (University of Texas at Austin)
Session 8: Open-Source Systems
Inheritance Usage Patterns in Open-Source Systems .245.  Jamie Stevenson (University of Strathclyde) and Murray Wood (University of Strathclyde)

Almost There: A Study on Quasi-Contributors in Open-Source Software Projects .256	,
[Journal First] Analyzing a Decade of Linux System Calls .267	
To Distribute or Not to Distribute? Why Licensing Bugs Matter .268	
Session 9: Test Generation	
Augusto: Exploiting Popular Functionalities for the Generation of Semantic GUI Tests with Oracles .280 Leonardo Mariani (University of Milano-Bicocca), Mauro Pezzè (USI Università della Svizzera italiana), and Daniele Zuddas (USI Università della Svizzera italiana)	)
Towards Optimal Concolic Testing .291.  Xinyu Wang (Zhejiang University), Jun Sun (Singapore University of Technology and Design), Zhenbang Chen (National University of Defense Technology), Peixin Zhang (Zhejiang University), Jingyi Wang (Singapore University of Technology and Design), and Yun Lin (National University of Singapore)	
DeepTest: Automated Testing of Deep-Neural-Network-Driven Autonomous Cars .303	
Precise Concolic Unit Testing of C Programs Using Extended Units and Symbolic Alarm Filtering .3.15  Yunho Kim (Korea Advanced Institute of Science and Technology), Yunja  Choi (Kyungpook National University), and Moonzoo Kim (Korea Advanced  Institute of Science and Technology)	
Session 10: Program Reduction Techniques	
Spatio-Temporal Context Reduction: A Pointer-Analysis-Based Static Approach for Detecting Use-After-Free Vulnerabilities 327	
Program Splicing .338	

Chopped Symbolic Execution .350
Perses: Syntax-Guided Program Reduction 361.  Chengnian Sun (University of California Davis), Yuanbo Li (University of California Davis), Qirun Zhang (University of California Davis),  Tianxiao Gu (University of California Davis), and Zhendong Su (University of California Davis)
Session 11: Security, Privacy and Trust I
Secure Coding Practices in Java: Challenges and Vulnerabilities 3.72.  Na Meng (Virginia Tech), Stefan Nagy (Virginia Tech), Danfeng (Daphne)  Yao (Virginia Tech), Wenjie Zhuang (Virginia Tech), and Gustavo  Arango-Argoty (Virginia Tech)
EnMobile: Entity-Based Characterization and Analysis of Mobile Malware .384.
Wei Yang (University of Illinois at Urbana-Champaign), Mukul Prasad
(Fujitsu Laboratories of America), and Tao Xie (University of Illinois at Urbana-Champaign)
[Journal First] Model Comprehension for Security Risk Assessment: An Empirical Comparison of Tabular vs. Graphical Representations .395.
Katsiaryna Labunets (Delft University of Technology), Fabio Massacci
(University of Trento), Federica Paci (University of Southampton),
Sabrina Marczak (Pontifícia Universidade Catòlica do Rio Grande do Sul), and Flávio Moreira de Oliveira (Pontifícia Universidade Catòlica
do Rio Grande do Sul)
[Journal First] Privacy by Designers: Software Developers' Privacy Mindset 396.
Irit Hadar (University of Haifa), Tomer Hasson (University of Haifa),
Oshrat Ayalon (Tel Aviv University), Eran Toch (Tel Aviv University),
Michael Birnhack (Tel Aviv University), Sofia Sherman (University of
Haifa), and Arod Balissa (Tel Aviv University)
Session 12: Empirical Software Engineering
Session 12. Empirical Software Engineering
Does the Propagation of Artifact Changes Across Tasks Reflect Work Dependencies? 397.  Christoph Mayr-Dorn (Johannes Kepler University) and Alexander Egyed (Johannes Kepler University)
Large-Scale Analysis of Framework-Specific Exceptions in Android Apps 408.
Lingling Fan (East China Normal University), Ting Su (Nanyang
Technological University), Sen Chen (East China Normal University),
Guozhu Meng (Chinese Academy of Sciences), Yang Liu (Nanyang Tachmological University), Libra Yu (East Ching Normal University)
Technological University), Lihua Xu (East China Normal University), Geguang Pu (East China Normal University), and Zhendong Su (University
of California)
[Journal First] Effect Sizes and their Variance for AB/BA Crossover Design Studies .420
Lech Madeyski (Wroclaw University of Science and Technology) and
Barbara Kitchenham (Keele University)

A Large-Scale Empirical Study on the Effects of Code Obfuscations on Android Apps and Anti-Malware Products .421
[Journal First] An Empirical Study on the Interplay Between Semantic Coupling and Co-change of Software Classes 432
Session 13: Test Improvement
DeFlaker: Automatically Detecting Flaky Tests .433
DetReduce: Minimizing Android GUI Test Suites for Regression Testing .445.  Wontae Choi (University of California, Berkeley), Koushik Sen (University of California, Berkeley), George Necul (University of California, Berkeley), and Wenyu Wang (University of Illinois, Urbana-Champaign)
Time to Clean Your Test Objectives .456.  Michaël Marcozzi (Imperial College London), Sébastien Bardin (CEA),  Nikolai Kosmatov (CEA), Mike Papadakis (University of Luxembourg),  Virgile Prevosto (CEA), and Loïc Correnson (CEA)
Prioritizing Browser Environments for Web Application Test Execution .468.  Jung-Hyun Kwon (KAIST), In-Young Ko (KAIST), and Gregg Rothermel  (University of Nebraska–Lincoln)
Session 14: Empirical Studies of Code
[Journal First] An Empirical Study of Early Access Games on the Steam Platform 480
[Journal First] Correctness Attraction: A Study of Stability of Software Behavior Under Runtime Perturbation .481
[Journal First] On the Diffuseness and the Impact on Maintainability of Code Smells: A Large Scale  Empirical Investigation 482

Accurate and Efficient Refactoring Detection in Commit History 483. Nikolaos Tsantalis (Concordia University), Matin Mansouri (Concordia University), Laleh Eshkevari (Concordia University), Davood Mazinanian (Concordia University), and Danny Dig (Oregon State University) **Session 15: Security, Privacy and Trust II** [Journal First] ENTRUST: Engineering Trustworthy Self-Adaptive Software with Dynamic Assurance Cases.495 Radu Calinescu (University of York), Danny Weyns (Katholieke Universiteit Leuven), Simos Gerasimou (University of York), M. Usman Iftikhar (Linnaeus University), Ibrahim Habli (University of York), and Tim Kelly (University of York) [Journal First] The Good, the Bad and the Ugly: A Study of Security Decisions in a Cyber-Physical Systems Game 496. Sylvain Frey (University of Southampton), Awais Rashid (University of Bristol), Pauline Anthonysamy (Google), Maria Pinto-Albuquerque (Instituto Universitario the Lisboa (ISCTE-IUL)), and Syad Asad Naqvi (Lancaster University) [Journal First] Lightweight, Obfuscation-Resilient Detection and Family Identification of Android Malware 497 Joshua Garcia (University of California, Irvine), Mahmoud Hammad (University of California, Irvine), and Sam Malek (University of California, Irvine) [Journal First] Are Vulnerabilities Discovered and Resolved Like Other Defects? .498. Patrick Morrison (North Carolina State University), Rahul Pandita (Phase Change Software), Xusheng Xiao (Case Western Reserve University), Ram Chillarege (Chillarege), and Laurie Williams (North Carolina State University) **Session 16: Communities and Ecosystems** How Modern News Aggregators Help Development Communities Shape and Share Knowledge .499..... Maurício Aniche (Delft University of Technology), Christoph Treude (University of Adelaide), Igor Steinmacher (Northern Arizona University), Igor Wiese (Technological University of Paraná (UTFPR)), Gustavo Pinto (University of Pará), Margaret-Anne Storey (University of Victoria), and Marco Aurélio Gerosa (Northern Arizona University) Adding Sparkle to Social Coding: An Empirical Study of Repository Badges in the npm Ecosystem .5.1...... Asher Trockman (University of Evansville), Shurui Zhou (Carnegie Mellon University), Christian Kästner (Carnegie Mellon University), and Bogdan Vasilescu (Carnegie Mellon University) "Was My Contribution Fairly Reviewed?" A Framework to Study the Perception of Fairness in Modern Code Reviews 523 Daniel German (University of Victoria), Gregorio Robles (Universidad Rey Juan Carlos), Germán Poo-Caamaño (University of Victoria), Xin Yang (Osaka University), Hajimu Iida (Nara Institute of Technology), and Katsuro Inoue (Osaka University)

[Journal First] Collaborative Model-Driven Software Engineering: A Classification Framework and a Research Map [Extended Abstract] .535
Session 17: Testing I
[Journal First] ChangeLocator: Locate Crash-Inducing Changes Based on Crash Reports .536
Are Mutation Scores Correlated with Real Fault Detection? A Large Scale Empirical Study on the Relationship Between Mutants and Real Faults .537.  Mike Papadakis (University of Luxembourg), Donghwan Shin (Korea Advanced Institute of Science and Technology), Shin Yoo (Korea Advanced Institute of Science and Technology), and Doo-Hwan Bae (Korea Advanced Institute of Science and Technology)
Efficient Sampling of SAT Solutions for Testing .549  Rafael Dutra (University of California, Berkeley), Kevin Laeufer  (University of California, Berkeley), Jonathan Bachrach (University of  California, Berkeley), and Koushik Sen (University of California,  Berkeley)
[Journal First] Are Fix-Inducing Changes a Moving Target?: A Longitudinal Case Study of Just-in-Time  Defect Prediction .560
Session 18: Studying Software Engineers I
Understanding Developers' Needs on Deprecation as a Language Feature .561.  Anand Ashok Sawant (Delft University of Technology), Mauricio Aniche (Delft University of Technology), Arie van Deursen (Delft University of Technology), and Alberto Bacchelli (University of Zurich)
On the Dichotomy of Debugging Behavior Among Programmers .5.72
[Journal First] Measuring Program Comprehension: A Large-Scale Field Study with Professionals .584
[Journal First] Data Scientists in Software Teams: State of the Art and Challenges .585

### Session 19: Program Analysis I

Dataflow Tunneling: Mining Inter-Request Data Dependencies for Request-Based Applications .586
Launch-Mode-Aware Context-Sensitive Activity Transition Analysis .598.  Yifei Zhang (UNSW Sydney), Yulei Sui (University of Technology Sydney), and Jingling Xue (UNSW Sydney)
UFO: Predictive Concurrency Use-After-Free Detection .609.  Jeff Huang (Texas A&M University)
Collective Program Analysis .620
Session 20: Human and Social Aspects of Computing II
Statistical Learning of API Fully Qualified Names in Code Snippets of Online Forums .632
When Not to Comment: Questions and Tradeoffs with API Documentation for C++ Projects .6.43
Deuce: A Lightweight User Interface for Structured Editing .654.  Brian Hempel (University of Chicago), Justin Lubin (University of Chicago), Grace Lu (University of Chicago), and Ravi Chugh (University of Chicago)
From UI Design Image to GUI Skeleton: A Neural Machine Translator to Bootstrap Mobile GUI Implementation .665

### **Session 21: Testing II**

When Testing Meets Code Review: Why and How Developers Review Tests .6.77.

Davide Spadini (Delft University of Technology / Software Improvement
Group), Maurício Aniche (Delft University of Technology),
Margaret-Anne Storey (University of Victoria), Magiel Bruntink
(Software Improvement Group), and Alberto Bacchelli (University of
Zurich)

Redefining Prioritization: Continuous Prioritization for Continuous Integration .688
Jingjing Liang (University of Nebraska - Lincoln), Sebastian Elbaum
(University of Nebraska - Lincoln), and Gregg Rothermel (University of
Nebraska - Lincoln)
[Journal First] MAHAKIL: Diversity Based Oversampling Approach to Alleviate the Class Imbalance
Issue in Software Defect Prediction .699.
Kwabena Ebo Bennin (City University of Hong Kong), Jacky Keung (City
University of Hong Kong), Passakorn Phannachitta (Chiang Mai
University), Akito Monden (Okayama University), and Solomon Mensah
(Chiang Mai University)
[Journal First] On the Use of Hidden Markov Model to Predict the Time to Fix Bugs .700
Mayy Habayeb (Ryerson University), Syed Shariyar Murtaza (Ryerson
University), Andriy Miranskyy (Ryerson University), and Ayse Basar
Bener (Ryerson University)
Cassian 22. Studying Caftyyana Engineers II
Session 22: Studying Software Engineers II
[Journal First] What Makes a Great Manager of Software Engineers? 701.
Eirini Kalliamvakou (University of Victoria), Christian Bird
(Microsoft), Thomas Zimmermann (Microsoft), Andrew Begel (Microsoft),
Robert DeLine (Microsoft), and Daniel German (University of Victoria)
[Journal First] Older Adults and Hackathons: A Qualitative Study .702
Wieslaw Kopec (Polish-Japanese Academy of Information Technology),
Bartlomiej Balcerzak (Polish-Japanese Academy of Information
Technology), Radoslaw Nielek (Polish-Japanese Academy of Information
Technology), Grzegorz Kowalik (Polish-Japanese Academy of Information
Technology), Adam Wierzbicki (Polish-Japanese Academy of Information
Technology), and Fabio Casati (University of Trento)
[Journal First] Does Syntax Highlighting Help Programming Novices? 704.
Christoph Hannebauer (University of Duisburg-Essen), Marc Hesenius
(University of Duisburg-Essen), and Volker Gruhn (University of
Duisburg-Essen)
Do Programmers Work at Night or During the Weekend? 705.
Maëlick Claes (University of Oulu), Mika Mäntylä (University of Oulu),
Miikka Kuutila (University of Oulu), and Bram Adams (Polytechnique
Montreal)
Session 23: Program Analysis II
Session 23. I Togram Analysis II
Multi-granular Conflict and Dependency Analysis in Software Engineering Based on Graph
Transformation 716
Leen Lambers (Hasso-Plattner-Institut Potsdam), Daniel Strüber (Universität Kohlenz Landau), Gabriele Taantzer (Universität Marbura)
(Universität Koblenz-Landau), Gabriele Taentzer (Universität Marburg), Kristopher Born (Universität Marburg), and Jevgenij Huebert
(Universität Marburg)

Self-Hiding Behavior in Android Apps: Detection and Characterization 728. Zhiyong Shan (Wichita State University), Iulian Neamtiu (New Jersey Institute of Technology), and Raina Samuel (New Jersey Institute of Technology) [Journal First] The Scent of a Smell: An Extensive Comparison Between Textual and Structural Smells .740... Fabio Palomba (University of Zurich), Annibale Panichella (Delft University of Technology), Andy Zaidman (Delft University of Technology), Rocco Oliveto (University of Molise), and Andrea De Lucia (University of Salerno) ConflictJS: Finding and Understanding Conflicts Between JavaScript Libraries .741..... Jibesh Patra (TU Darmstadt), Pooja N. Dixit (TU Darmstadt), and Michael Pradel (TU Darmstadt) **Session 24: Software Comprehension** Debugging Data Flows in Reactive Programs .752..... Herman Banken (Delft University of Technology), Erik Meijer (Delft University of Technology), and Georgios Gousios (Delft University of Technology) Do You Remember This Source Code? 764. Jacob Krüger (Harz University of Applied Sciences & Otto-von-Guericke-University), Jens Wiemann (Otto-von-Guericke-University), Wolfram Fenske (Otto-von-Guericke-University), Gunter Saake (Otto-von-Guericke-University), and Thomas Leich (Harz University of Applied Sciences & METOP GmbH) Inferring Hierarchical Motifs from Execution Traces 776. Saba Alimadadi (Northeastern University), Ali Mesbah (University of British Columbia), and Karthik Pattabiraman (University of British Columbia) [Journal First] A Comparison of Program Comprehension Strategies by Blind and Sighted Programmers .788... Ameer Armaly (University of Notre Dame), Paige Rodeghero (University of Notre Dame), and Collin McMillan (University of Notre Dame) **Session 25: Performance and Maintenance** Identifying Patch Correctness in Test-Based Program Repair 789. Yingfei Xiong (Peking University), Xinyuan Liu (Peking University), Muhan Zeng (Peking University), Lu Zhang (Peking University), and Gang Huang (Peking University) How not to Structure Your Database-Backed Web Applications: A Study of Performance Bugs in the Wild .800 Junwen Yang (University of Chicago), Cong Yan (University of Washington), Pranav Subramaniam (University of Chicago), Shan Lu (University of Chicago), and Alvin Cheung (University of Washington)

Speedoo: Prioritizing Performance Optimization Opportunities .8.11
[Journal First] Empirical Study on the Discrepancy Between Performance Testing Results from Virtual and Physical Environments 822
Session 26: Requirements and Recommender Systems
The Evolution of Requirements Practices in Software Startups .823
Traceability in the Wild: Automatically Augmenting Incomplete Trace Links .834.  Michael Rath (Technical University Ilmenau), Jacob Rendall (University of Notre Dame), Jin L.C. Guo (McGill University), Jane Cleland-Huang (University of Notre Dame), and Patrick Mäder (Technical University Ilmenau)
A Temporal Permission Analysis and Enforcement Framework for Android .846.  Alireza Sadeghi (University of California, Irvine), Reyhaneh  Jabbarvand (University of California, Irvine), Negar Ghorbani  (University of California, Irvine), Hamid Bagheri (University of  Nebraska, Lincoln), and Sam Malek (University of California, Irvine)
[Journal First] Global-Aware Recommendations for Repairing Violations in Exception Handling .858
Session 27: Testing III
RFC-Directed Differential Testing of Certificate Validation in SSL/TLS Implementations .859
Symbolic Verification of Regular Properties .871  Hengbiao Yu (National University of Defense Technology, Changsha),  Zhenbang Chen (National University of Defense Technology, Changsha),  Ji Wang (National University of Defense Technology, Changsha),  Zhendong Su (University of California, Davis), and Wei Dong (National  University of Defense Technology, Changsha)
[Journal First] Metamorphic Testing of RESTful Web APIs .882

[Journal First] Integrating Technical Debt Management and Software Quality Management Processes: A Framework and Field Tests .883
Narayan Ramasubbu (University of Pittsburgh) and Chris Kemerer (University of Pittsburgh)
Session 28: Mining Software Repositories
[Journal First] Understanding the Factors for Fast Answers in Technical Q&A Websites: An Empirical Study of Four Stack Exchange Websites .884.  Mike Papadakis (University of Luxembourg), Shaowei Wang (SAIL Queen's University), Tse-Hsun Chen (Concordia University), and Ahmed E. Hassan (SAIL Queen's University)
[Journal First] Towards Reusing Hints from Past Fixes: An Exploratory Study on Thousands of Real Samples .885
Are Code Examples on an Online Q&A Forum Reliable?: A Study of API Misuse on Stack Overflow .886  Tianyi Zhang (University of California, Los Angeles), Ganesha  Upadhyaya (Iowa State University), Anastasia Reinhardt (George Fox  University), Hridesh Rajan (Iowa State University), and Miryung Kim  (University of California, Los Angeles)
[Journal First] Inference of Development Activities from Interaction with Uninstrumented Applications .897
Session 29: Models and Modeling I
Propagating Configuration Decisions with Modal Implication Graphs .898.  Sebastian Krieter (University of Magdeburg; Harz University of Applied Sciences), Thomas Thüm (TU Braunschweig), Sandro Schulze (University of Magdeburg), Reimar Schröter (University of Magdeburg), and Gunter Saake (University of Magdeburg)
A Combinatorial Approach for Exposing Off-Nominal Behaviors .9.10
Identifying Design Problems in the Source Code: A Grounded Theory .921.  Leonardo Sousa (PUC-Rio), Anderson Oliveira (PUC-Rio), Willian Oizumi (PUC-Rio), Simone Barbosa (PUC-Rio), Alessandro Garcia (PUC-Rio), Jaejoon Lee (Lancaster University), Marcos Kalinowski (PUC-Rio), Rafael de Mello (PUC-Rio), Baldoino Fonseca (UFAL), Roberto Oliveira (PUC-Rio), Carlos Lucena (PUC-Rio), and Rodrigo Paes (UFAL)
[Journal First] Predicting Future Developer Behavior in the IDE Using Topic Models .932

## Session 30: Code Search, Synthesis, Performance

Deep Code Search 933  Xiaodong Gu (The Hong Kong University of Science and Technology),  Hongyu Zhang (The University of Newcastle), and Sunghun Kim (The Hong  Kong University of Science and Technology)
[Journal First] Augmenting and Structuring User Queries to Support Efficient Free-Form Code Search .945  Raphael Sirres (National Library of Luxembourg), Tegawendé F.  Bissyandé (SnT), Dongsun Kim (SnT), David Lo (Singapore Management University), Jacques Klein (SnT), Kisub Kim (SnT), and Yves Le Traon (SnT)
FaCoY – A Code-to-Code Search Engine 946  Kisub Kim (SnT), Dongsun Kim (SnT), Tegawendé F. Bissyandé (SnT),  Eunjong Choi (Nara Institute of Science and Technology (NAIST)), Li Li  (Faculty of Information Technology), Jacques Klein (SnT), and Yves Le  Traon (SnT)
Generalized Data Structure Synthesis .958.  Calvin Loncaric (University of Washington, Seattle), Michael D. Ernst  (University of Washington, Seattle), and Emina Torlak (University of Washington, Seattle)
Session 31: Software Tools and Environments
A Graph Solver for the Automated Generation of Consistent Domain-Specific Models .969
Automatically Finding Bugs in a Commercial Cyber-Physical System Development Tool Chain With SLforge.98  Shafiul Azam Chowdhury (The University of Texas at Arlington), Soumik  Mohian (The University of Texas at Arlington), Sidharth Mehra (The  University of Texas at Arlington), Sidhant Gawsane (The University of  Texas at Arlington), Taylor T. Johnson (The University of Texas at  Arlington), and Christoph Csallner (The University of Texas at  Arlington)
Context-Aware Conversational Developer Assistants 993.  Nick Bradley (University of British Columbia), Thomas Fritz  (University of Zurich), and Reid Holmes (University of British Columbia)
Open Source Barriers to Entry, Revisited: A Sociotechnical Perspective .1004

## Session 32: Search-Based Software Engineering I

Testing Vision-Based Control Systems Using Learnable Evolutionary Algorithms .101.6
To Preserve or Not to Preserve Invalid Solutions in Search-Based Software Engineering: A Case Study in Software Product Lines .1027
Nemo: Multi-criteria Test-Suite Minimization with Integer Nonlinear Programming 1039.  Jun-Wei Lin (University of California, Irvine), Reyhaneh Jabbarvand  (University of California, Irvine), Joshua Garcia (University of California, Irvine), and Sam Malek (University of California, Irvine)
Is "Better Data" Better Than "Better Data Miners"? 1050
Session 33: Testing IV
[Journal First] Analyzing the Effects of Test Driven Development in GitHub .1062.  Neil Borle (University of Alberta), Meysam Feghhi (University of Alberta), Eleni Stroulia (University of Alberta), Russell Grenier (University of Alberta), and Abram Hindle (University of Alberta)
[Journal First] A Comparative Study to Benchmark Cross-Project Defect Prediction Approaches .1063  Steffen Herbold (University of Goettingen), Alexander Trautsch (University of Goettingen), and Jens Grabowski (University of Göttingen)
[Journal First] MSeer – An Advanced Technique for Locating Multiple Bugs in Parallel .1064
[Journal First] Journal First Presentation of an Experience Report on Applying Software Testing Academic Results in Industry: We Need Usable Automated Test Generation .1065
Session 34: Software Evolution and Maintenance II
CCAligner: A Token Based Large-Gap Clone Detector 1066  Pengcheng Wang (University of Science and Technology of China),  Jeffrey Svajlenko (University of Saskatchewan), Yanzhao Wu (University  of Science and Technology of China), Yun Xu (University of Science and  Technology of China), and Chanchal K. Roy (University of Saskatchewan)
HireBuild: An Automatic Approach to History-Driven Repair of Build Scripts .1078.  Foyzul Hassan (The University of Texas at San Antonio) and Xiaoyin Wang (The University of Texas San Antonio)
The Road to Live Programming: Insights from the Practice .1090  Juraj Kubelka (University of Chile), Romain Robbes (Free University of Bozen-Bolzano), and Alexandre Bergel (University of Chile)

Assessing the Threat of Untracked Changes in Software Evolution .1102
Session 35: Models and Modeling II
Programming Not Only by Example 1114
Goal-Conflict Likelihood Assessment Based on Model Counting 1125.  Renzo Degiovanni (Universidad Nacional de Río Cuarto), Pablo Castro (Universidad Nacional de Río Cuarto and CONICET), Marcelo Arroyo (Universidad Nacional de Río Cuarto), Marcelo Ruiz (Universidad Nacional de Río Cuarto), Nazareno Aguirre (Universidad Nacional de Río Cuarto and CONICET), and Marcelo Frias (Instituto Tecnológico de Buenos Aires and CONICET)
[Journal First] A Posteriori Typing for Model-Driven Engineering: Concepts, Analysis, and Applications .1136
A Static Verification Framework for Message Passing in Go Using Behavioural Types .1.137
Session 36: Inference and Invariants
Inferring and Asserting Distributed System Invariants .1149  Stewart Grant (University of British Columbia), Hendrik Cech (University of Bamberg), and Ivan Beschastnikh (University of British Columbia)
DroidStar: Callback Typestates for Android Classes .1.160
Debugging with Intelligence via Probabilistic Inference .1.17.1
Reducer-Based Construction of Conditional Verifiers .1.182

## **Session 37: Surveys and Reviews**

Literature: An Exploratory Study with Novices 1194  Talita Vieira Ribeiro (Federal University of Rio de Janeiro), Jobson  Massollar (Federal University of Rio de Janeiro), and Guilherme Horta  Travassos (Federal University of Rio de Janeiro)	
Statistical Errors in Software Engineering Experiments: A Preliminary Literature Review .1.195	•••
Synthesizing Qualitative Research in Software Engineering: A Critical Review .1207	
[Journal First] Automatic Software Repair: A Survey .1219	•••
Session 38: Search-Based Software Engineering II	
Search-Based Test Data Generation for SQL Queries 1220	•••
Technology), Annibale Panichella (Delft University of Technology), and Arie van Deursen (Delft University of Technology)	
Technology), Annibale Panichella (Delft University of Technology), and	•••
Technology), Annibale Panichella (Delft University of Technology), and Arie van Deursen (Delft University of Technology)  Multi-objective Integer Programming Approaches for Solving Optimal Feature Selection Problem: A New Perspective on Multi-objective Optimization Problems in SBSE .1231	••••

**Author Index**