

2020 IEEE/ACM 42nd International Conference on Software Engineering (ICSE 2020)

**Seoul, South Korea
27 June - 19 July 2020**

Pages 1-529



**IEEE Catalog Number: CFP20018-POD
ISBN: 978-1-7281-6519-6**

**Copyright © 2020, 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:	CFP20018-POD
ISBN (Print-On-Demand):	978-1-7281-6519-6
ISBN (Online):	978-1-4503-7121-6
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

CURRAN ASSOCIATES INC.
proceedings
.com

2020 IEEE/ACM 42nd International Conference on Software Engineering (ICSE) **ICSE 2020**

Table of Contents

Message from the ICSE 2020 General Co-Chairs	xxiv
Message from the Program Chairs of ICSE 2020	xxvii
Message from the Journal-First Chairs of ICSE 2020	xxix
Organizing Committee of ICSE 2020	xxx
Program Board of ICSE 2020	xxxii
Program Committee of ICSE 2020	xxxiii
Journal First Program Committee of ICSE 2020	xxxv
External Reviewers of ICSE 2020	xxxvi
Sponsors and Supporters of ICSE 2020	xxxvii

Continuous Integration

Learning-to-Rank vs Ranking-to-Learn: Strategies for Regression Testing in Continuous Integration	1
<i>Antonia Bertolino (ISTI - CNR, Italy), Antonio Guerriero (Università di Napoli Federico II, Italy), Breno Miranda (Federal University of Pernambuco, Brazil), Roberto Pietrantuono (Università di Napoli Federico II, Italy), and Stefano Russo (Università di Napoli Federico II, Italy)</i>	
A Cost-Efficient Approach to Building in Continuous Integration	13
<i>Xianhao Jin (Virginia Tech) and Francisco Servant (Virginia Tech)</i>	
Practical Fault Detection in Puppet Programs	26
<i>Thodoris Sotiropoulos (Athens University of Economics and Business, Greece), Dimitris Mitropoulos (Athens University of Economics and Business, Greece), and Diomidis Spinellis (Athens University of Economics and Business, Greece)</i>	
Learning from, Understanding, and Supporting DevOps Artifacts for Docker	38
<i>Jordan Henkel (University of Wisconsin--Madison, USA), Christian Bird (Microsoft Research, USA), Shuvendu K. Lahiri (Microsoft Research, USA), and Thomas Reps (University of Wisconsin--Madison, USA)</i>	

Cyber-Physical Systems

- Adapting Requirements Models to Varying Environments .50.....
Dalal Alrajeh (Imperial College London), Antoine Cailliau (Université catholique de Louvain), and Axel van Lamsweerde (Université catholique de Louvain)
- Comparing Formal Tools for System Design: A Judgment Study .62.....
Alessio Ferrari (ISTI-CNR, Pisa, Italy), Franco Mazzanti (ISTI-CNR, Pisa, Italy), Davide Basile (ISTI-CNR, Pisa, Italy), Maurice Henry ter Beek (ISTI-CNR), and Alessandro Fantechi (University of Florence, Florence, Italy)

Debugging 1

- Debugging Inputs .75.....
Lukas Kirschner (CISPA – Helmholtz Center for Information Security, Saarbrücken, Germany), Ezekiel Soremekun (CISPA – Helmholtz Center for Information Security, Saarbrücken, Germany), and Andreas Zeller (CISPA – Helmholtz Center for Information Security, Saarbrücken, Germany)
- Causal Testing: Understanding Defects' Root Causes .87.....
Brittany Johnson (University of Massachusetts Amherst), Yuriy Brun (University of Massachusetts Amherst), and Alexandra Meliou (University of Massachusetts Amherst)

Ecosystems and Evolution

- Impact Analysis of Cross-Project Bugs on Software Ecosystems .100.....
Wanwangying Ma (Nanjing University, China), Lin Chen (Nanjing University, China), Xiangyu Zhang (Purdue University, USA), Yang Feng (Nanjing University, China), Zhaogui Xu (Nanjing University, China), Zhifei Chen (Nanjing University, China), Yuming Zhou (Nanjing University, China), and Baowen Xu (Nanjing University, China)
- Taming Behavioral Backward Incompatibilities via Cross-Project Testing and Analysis .112.....
Lingchao Chen (The University of Texas at Dallas), Foyzul Hassan (The University of Texas at San Antonio), Xiaoyin Wang (The University of Texas at San Antonio), and Lingming Zhang (The University of Texas at Dallas)
- Watchman: Monitoring Dependency Conflicts for Python Library Ecosystem .125.....
Ying Wang (Northeastern University, China), Ming Wen (Huazhong University of Science and Technology, China), Yepang Liu (Southern University of Science and Technology, China), Yibo Wang (Northeastern University, China), Zhenming Li (Northeastern University, China), Chao Wang (Northeastern University, China), Hai Yu (Northeastern University, China), Shing-Chi Cheung (The Hong Kong University of Science and Technology, China), Chang Xu (Nanjing University, China), and Zhiliang Zhu (Northeastern University, China)

Empirical Studies for Security

- One Size Does Not Fit All: A Grounded Theory and Online Survey Study of Developer Preferences for Security Warning Types .136.....
Anastasia Danilova (University of Bonn, Germany), Alena Naiakshina (University of Bonn, Germany), and Matthew Smith (University of Bonn, Germany & Fraunhofer FKIE, Germany)
- Schrödinger's Security: Opening the Box on App Developers' Security Rationale .149.....
Dirk van der Linden (University of Bristol), Pauline Anthonysamy (Google), Bashar Nuseibeh (The Open University; Lero, University of Limerick), Thein Than Tun (The Open University), Marian Petre (The Open University), Mark Levine (Lancaster University), John Towse (Lancaster University), and Awais Rashid (University of Bristol)

Human Practice

- How Software Practitioners Use Informal Local Meetups to Share Software Engineering Knowledge .161.....
Claire Ingram (University of York) and Anders Drachen (University of York)
- Predicting Developers' Negative Feelings about Code Review .174.....
Carolyn D. Egelman (Google, United States), Emerson Murphy-Hill (Google, United States), Elizabeth Kammer (Google, United States), Margaret Marrow Hodges (Google), Collin Green (Google), Ciera Jaspán (Google), and James Lin (Google)

Web Testing

- Near-Duplicate Detection in Web App Model Inference .186.....
Rahulkrishna Yandrapally (University of British Columbia), Andrea Stocco (Università della Svizzera Italiana), and Ali Mesbah (University of British Columbia)
- Extracting Taint Specifications for JavaScript Libraries .198.....
Cristian-Alexandru Staicu (TU Darmstadt), Martin Toldam Torp (Aarhus University), Max Schäfer (GitHub), Anders Møller (Aarhus University), and Michael Pradel (University of Stuttgart)
- SLACC: Simion-Based Language Agnostic Code Clones .210.....
George Mathew (North Carolina State University), Chris Parnin (North Carolina State University), and Kathryn T Stolee (North Carolina State University)
- Finding Client-Side Business Flow Tampering Vulnerabilities .222.....
I Luk Kim (Purdue University), Yunhui Zheng (IBM T. J. Watson Research Center), Hogun Park (Purdue University), Weihang Wang (University at Buffalo, SUNY), Wei You (Renmin University of China), Yousra Aafer (Purdue University), and Xiangyu Zhang (Purdue University)

Analysis for Security

- Securing UnSafe Rust Programs with X Rust .234.....
*Peiming Liu (Texas A&M University), Gang Zhao (Texas A&M University),
and Jeff Huang (Texas A&M University)*
- Is Rust Used Safely by Software Developers? .246.....
*Ana Nora Evans (University of Virginia), Bradford Campbell (University
of Virginia), and Mary Lou Soffa (University of Virginia)*
- Burn after Reading: A Shadow Stack with Microsecond-Level Runtime Rerandomization for
Protecting Return Addresses .258.....
*Changwei Zou (University of New South Wales, Australia) and Jingling
Xue (University of New South Wales, Australia)*
- SAVER: Scalable, Precise, and Safe Memory-Error Repair .271.....
*Seongjoon Hong (Korea University), Junhee Lee (Korea University),
Jeongsoo Lee (Korea University), and Hakjoo Oh (Korea University)*

Android and Web Application Testing

- Revealing Injection Vulnerabilities by Leveraging Existing Tests .284.....
*Katherine Hough (George Mason University), Gebrehivet Welearegai
(University of Potsdam), Christian Hammer (University of Potsdam), and
Jonathan Bell (George Mason University)*
- RoScript: A Visual Script Driven Truly Non-intrusive Robotic Testing System for Touch
Screen Applications .297.....
*Ju Qian (Nanjing University of Aeronautics and Astronautics, China),
Zhengyu Shang (Nanjing University of Aeronautics and Astronautics,
China), Shuoyan Yan (Nanjing University of Aeronautics and
Astronautics, China), Yan Wang (Nanjing University of Aeronautics and
Astronautics, China), and Lin Chen (Nanjing University)*
- Translating Video Recordings of Mobile App Usages into Replayable Scenarios .309.....
*Carlos Bernal-Cárdenas (William & Mary, USA), Nathan Cooper (William &
Mary, USA), Kevin Moran (William & Mary, USA), Oscar Chaparro (William
& Mary, USA), Andrian Marcus (The University of Texas at Dallas, USA),
and Denys Poshyvanyk (William & Mary)*
- Unblind Your Apps: Predicting Natural-Language Labels for Mobile GUI Components by Deep
Learning .322.....
*Jieshan Chen (Australian National University, Australia), Chunyang
Chen (Monash University, Australia), Zhenchang Xing (Australian
National University; Data61, CSIRO, Australia), Xiwei Xu (Data61,
CSIRO, Australia), Liming Zhu (Australian National University; Data61,
CSIRO; University of New South Wales, Australia), Guoqiang Li
(Shanghai Jiao Tong University, China), and Jinshui Wang (Fujian
University of Technology, China)*

Autonomous Driven System

- SLEMI: Equivalence Modulo Input (EMI) Based Mutation of CPS Models for Finding Compiler Bugs in Simulink .335.....
Shafiul Azam Chowdhury (University of Texas at Arlington), Sohil Lal Shrestha (University of Texas at Arlington), Taylor T. Johnson (Vanderbilt University), and Christoph Csallner (University of Texas at Arlington)
- DeepBillboard: Systematic Physical-World Testing of Autonomous Driving Systems .347.....
Husheng Zhou (The University of Texas at Dallas), Wei Li (Southern University of Science and Technology), Zelun Kong (The University of Texas at Dallas Dallas), Junfeng Guo (The University of Texas at Dallas Dallas), Yuqun Zhang (Southern University of Science and Technology), Bei Yu (The Chinese University of Hong Kong Hong Kong,), Lingming Zhang (The University of Texas at Dallas Dallas), and Cong Liu (The University of Texas at Dallas Dallas)
- Misbehaviour Prediction for Autonomous Driving Systems .359.....
Andrea Stocco (Università della Svizzera italiana), Michael Weiss (Università della Svizzera italiana), Marco Calzana (Università della Svizzera italiana), and Paolo Tonella (Università della Svizzera italiana)
- Approximation-Refinement Testing of Compute-Intensive Cyber-Physical Models: An Approach Based on System Identification .372.....
Claudio Menghi (University of Luxembourg), Shiva Nejati (University of Ottawa and University of Luxembourg), Lionel Briand (University of Ottawa and University of Luxembourg), and Yago Isasi Parache (Luxspace Sàrl)
- A Comprehensive Study of Autonomous Vehicle Bugs .385.....
Joshua Garcia (University of California, Irvine), Yang Feng (Nanjing University), Junjie Shen (University of California, Irvine), Sumaya Almanee (University of California, Irvine), Yuan Xia (University of California, Irvine), and Qi Alfred Chen (University of California, Irvine)

Debugging 2

- Studying the Use of Java Logging Utilities in the Wild .397.....
Boyuan Chen (York University) and Zhen Ming (Jack) Jiang (York University)

Human Aspects of Software Engineering 1

- A Study on the Prevalence of Human Values in Software Engineering Publications, 2015 - 2018 .409.....
Harsha Perera (Monash University, Australia), Waqar Hussain (Monash University, Australia), Jon Whittle (Monash University, Australia), Arif Nurwidiantoro (Monash University, Australia), Davoud Mougouei (Monash University, Australia), Rifat Ara Shams (Monash University, Australia), and Gillian Oliver (Monash University, Australia)

- Explaining Pair Programming Session Dynamics from Knowledge Gaps .421.....
Franz Zieris (Freie Universität Berlin, Germany) and Lutz Prechelt (Freie Universität Berlin, Germany)
- Engineering Gender-Inclusivity into Software: Ten Teams' Tales from the Trenches .433.....
Claudia Hilderbrand (Oregon State University, USA; Pacific Northwest National Laboratory, USA), Christopher Perdriau (Oregon State University, USA), Lara Letaw (Oregon State University, USA), Jillian Emard (Oregon State University, USA), Zoe Steine-Hanson (Oregon State University, USA), Margaret Burnett (Oregon State University, USA), and Anita Sarma (Oregon State University, USA)

Version Control and Programming Practice

- How Has Forking Changed in the Last 20 Years? A Study of Hard Forks on GitHub .445.....
Shurui Zhou (Carnegie Mellon University), Bogdan Vasilescu (Carnegie Mellon University), and Christian Kästner (Carnegie Mellon University)

Android Application Testing

- Multiple-Entry Testing of Android Applications by Constructing Activity Launching Contexts.457.
Jiwei Yan (Institute of Software, Chinese Academy of Sciences, China), Hao Liu (Beijing University of Technique, China), Linjie Pan (Institute of Software, Chinese Academy of Sciences, China), Jun Yan (Institute of Software, Chinese Academy of Sciences, China), Jian Zhang (Institute of Software, Chinese Academy of Sciences, China), and Bin Liang (Renmin University of China, China)
- ComboDroid: Generating High-Quality Test Inputs for Android Apps via Use Case Combinations 469
Jue Wang (Nanjing University, China), Yanyan Jiang (Nanjing University, China), Chang Xu (Nanjing University, China), Chun Cao (Nanjing University, China), Xiaoxing Ma (Nanjing University, China), and Jian Lu (Nanjing University, China)
- Time-Travel Testing of Android Apps .481.....
Zhen Dong (National University of Singapore, Singapore), Marcel Böhme (Monash University, Australia), Lucia Cojocaru (Politehnica University of Bucharest, Romania), and Abhik Roychoudhury (National University of Singapore)

Clones and Changes

- HeteroRefactor: Refactoring for Heterogeneous Computing with FPGA .493.....
Jason Lau (University of California, Los Angeles), Aishwarya Sivaraman (University of California, Los Angeles), Qian Zhang (University of California, Los Angeles), Muhammad Ali Gulzar (University of California, Los Angeles), Jason Cong (University of California, Los Angeles), and Miryung Kim (University of California, Los Angeles)

HARP: Holistic Analysis for Refactoring Python-Based Analytics Programs .506.....
Weijie Zhou (North Carolina State University, USA), Yue Zhao (Facebook, USA), Guoqiang Zhang (North Carolina State University, USA), and Xipeng Shen (North Carolina State University, USA)

CC2Vec: Distributed Representations of Code Changes .518.....
Thong Hoang (Singapore Management University), Hong Jin Kang (Singapore Management University), David Lo (Singapore Management University), and Julia Lawall (Sorbonne University/Inria/LIP6)

Contracts

Empirical Review of Automated Analysis Tools on 47,587 Ethereum Smart Contracts .530.....
Thomas Durieux (INESC-ID, University of Lisbon), João F. Ferreira (INESC-ID and IST, University of Lisbon), Rui Abreu (INESC-ID and IST, University of Lisbon), and Pedro Cruz (INESC-ID and IST, University of Lisbon)

Gap between Theory and Practice : An Empirical Study of Security Patches in Solidity .542.....
Sungjae Hwang (KAIST, South Korea) and Sukyoung Ryu (KAIST, South Korea)

Defect Prediction

An Investigation of Cross-Project Learning in Online Just-In-Time Software Defect Prediction .554.....
Sadia Tabassum (University of Birmingham, UK), Leandro L. Minku (University of Birmingham, UK), Danyi Feng (Xiliu Tech, China), George G. Cabral (Federal Rural University of Pernambuco, Brazil), and Liyan Song (University of Birmingham, UK)

Understanding the Automated Parameter Optimization on Transfer Learning for Cross-Project Defect Prediction: An Empirical Study .566.....
Ke Li (University of Exeter), Zilin Xiang (UESTC), Tao Chen (Loughborough University), Shuo Wang (University of Birmingham), and Kay Chen Tan (City University of Hong Kong)

Software Visualization and Deep Transfer Learning for Effective Software Defect Prediction.578...
Jinyin Chen (Zhejiang University of Technology, China), Keke Hu (Zhejiang University of Technology, China), Yue Yu (University of Defense Technology, China), Zhuangzhi Chen (Zhejiang University of Technology, China), Qi Xuan (Zhejiang University of Technology, China), Yi Liu (Zhejiang University of Technology, China), and Vladimir Filkov (University of California, USA)

Human Aspects of Software Engineering 2

Software Documentation: The Practitioners' Perspective .590.....
Emad Aghajani (Software Institute, USI Università della Svizzera italiana, Switzerland), Csaba Nagy (Software Institute, USI Università della Svizzera italiana, Switzerland), Mario Linares-Vasquez (Universidad de los Andes, Colombia), Laura Moreno (Colorado State University, USA), Gabriele Bavota (Software Institute, USI Università della Svizzera italiana, Switzerland), Michele Lanza (Software Institute, USI Università della Svizzera italiana, Switzerland), and David C. Shepherd (Virginia Commonwealth University, USA)

Program Repair

DLFix: Context-Based Code Transformation Learning for Automated Program Repair .602.....
Yi Li (New Jersey Institute of Technology, USA), Shaohua Wang (New Jersey Institute of Technology, USA), and Tien N. Nguyen (The University of Texas at Dallas, USA)

On the Efficiency of Test Suite Based Program Repair: A Systematic Assessment of 16 Automated Repair Systems for Java Programs .615.....
Kui Liu (Nanjing University of Aeronautics and Astronautics), Shangwen Wang (National University of Defense Technology), Anil Koyuncu (University of Luxembourg), Kisub Kim (University of Luxembourg), Tegawendé F. Bissyandé (University of Luxembourg), Dongsun Kim (Furiosa.ai), Peng Wu (National University of Defense Technology), Jacques Klein (University of Luxembourg), Xiaoguang Mao (National University of Defense Technology), and Yves Le Traon (University of Luxembourg)

Requirement Discovery

Caspar: Extracting and Synthesizing User Stories of Problems from App Reviews .628.....
Hui Guo (North Carolina State University) and Munindar P. Singh (North Carolina State University)

Detection of Hidden Feature Requests from Massive Chat Messages via Deep Siamese Network .641
Lin Shi (Institute of Software Chinese Academy of Sciences), Mingzhe Xing (Institute of Software Chinese Academy of Sciences), Mingyang Li (Institute of Software Chinese Academy of Sciences), Yawen Wang (Institute of Software Chinese Academy of Sciences), Shoubin Li (Institute of Software Chinese Academy of Sciences), and Qing Wang (Institute of Software Chinese Academy of Sciences)

Cognition

A Tale from the Trenches: Cognitive Biases and Software Development .654.....
Souti Chattopadhyay (Oregon State University), Nicholas Nelson (Oregon State University), Audrey Au (Oregon State University), Natalia Morales (Oregon State University), Christopher Sanchez (Oregon State University), Rahul Pandita (Phase Change Software), and Anita Sarma (Oregon State University)

Recognizing Developers' Emotions while Programming .666.....	<i>Daniela Girardi (University of Bari, Italy), Nicole Novielli (University of Bari, Italy), Davide Fucci (Blekinge Institute of Technology, Sweden and University of Hamburg, Germany), and Filippo Lanubile (University of Bari, Italy)</i>
Neurological Divide: An fMRI Study of Prose and Code Writing .678.....	<i>Krueger Ryan (University of Michigan, USA), Huang Yu (University of Michigan, USA), Liu Xinyu (Georgia Institute of Technology, USA), Santander Tyler (University of California, Santa Barbara, USA), Weimer Westley (University of Michigan, USA), and Leach Kevin (University of Michigan, USA)</i>
Here We Go Again: Why Is It Difficult for Developers to Learn Another Programming Language? .691.....	<i>Nischal Shrestha (North Carolina State University, USA), Colton Botta (North Carolina State University, USA), Titus Barik (Microsoft, USA), and Chris Parnin (North Carolina State University, USA)</i>

Deep Learning Testing and Debugging 1

Importance-Driven Deep Learning System Testing .702.....	<i>Simos Gerasimou (University of York, UK), Hasan Ferit Eniser (Max Planck Institute for Software Systems), Alper Sen (Bogazici University, Turkey), and Alper Cakan (Bogazici University, Turkey)</i>
ReluDiff: Differential Verification of Deep Neural Networks .714.....	<i>Brandon Paulsen (University of Southern California, USA), Jingbo Wang (University of Southern California, USA), and Chao Wang (University of Southern California, USA)</i>
DISSECTOR: Input Validation for Deep Learning Applications by Crossing-Layer Dissection .727..	<i>Huiyan Wang (Nanjing University), Jingwei Xu (Nanjing University), Chang Xu (Nanjing University), Xiaoxing Ma (Nanjing University), and Jian Lu (Nanjing University)</i>
Towards Characterizing Adversarial Defects of Deep Learning Software from the Lens of Uncertainty .739.....	<i>Xiyue Zhang (Peking University, China), Xiaofei Xie (Nanyang Technological University, Singapore), Lei Ma (Kyushu University, Japan), Xiaoning Du (Nanyang Technological University, Singapore), Qiang Hu (Kyushu University, Japan), Yang Liu (Nanyang Technological University, Singapore), Jianjun Zhao (Kyushu University, Japan), and Meng Sun (Peking University, China)</i>

Fuzzing 1

Gang of Eight: A Defect Taxonomy for Infrastructure as Code Scripts .752.....	<i>Akond Rahman (Tennessee Tech University), Effat Farhana (North Carolina State University), Chris Parnin (North Carolina State University), and Laurie Williams (North Carolina State University)</i>
---	---

MemLock: Memory Usage Guided Fuzzing .765.....	
	<i>Cheng Wen (Shenzhen University, China), Haijun Wang (Ant Financial Services Group, China), Yuekang Li (Nanyang Technological University, Singapore), Shengchao Qin (Teesside University, UK), Yang Liu (Nanyang Technological University, Singapore), Zhiwu Xu (Shenzhen University, China), Hongxu Chen (Nanyang Technological University, Singapore), Xiaofei Xie (Nanyang Technological University, Singapore), Geguang Pu (East China Normal University, China), and Ting Liu (Xi'an Jiaotong University, China)</i>
sFuzz: An Efficient Adaptive Fuzzer for Solidity Smart Contracts .778.....	
	<i>Tai Duy Nguyen (Singapore Management University), Long Hong Pham (Singapore Management University), Jun Sun (Singapore Management University), Yun Lin (National University of Singapore), and Quang Tran Minh (Ho Chi Minh City University of Technology)</i>
Targeted Greybox Fuzzing with Static Lookahead Analysis .789.....	
	<i>Valentin Wüstholtz (ConsenSys Diligence/MythX, Germany) and Maria Christakis (MPI-SWS, Germany)</i>
Planning for Untangling: Predicting the Difficulty of Merge Conflicts .801.....	
	<i>Caius Brindescu (Oregon State University), Iftekhar Ahmed (University of California, Irvine), Rafael Leano (Oregon State University), and Anita Sarma (Oregon State University)</i>

Static Analysis 1

Conquering the Extensional Scalability Problem for Value-Flow Analysis Frameworks .812.....	
	<i>Qingkai Shi (The Hong Kong University of Science and Technology, China), Rongxin Wu (Xiamen University, China), Gang Fan (The Hong Kong University of Science and Technology, China), and Charles Zhang (The Hong Kong University of Science and Technology, China)</i>
Tailoring Programs for Static Analysis via Program Transformation .824.....	
	<i>Rijnard van Tonder (Carnegie Mellon University) and Claire Le Goues (Carnegie Mellon University)</i>
Pipelining Bottom-Up Data Flow Analysis .835.....	
	<i>Qingkai Shi (The Hong Kong University of Science and Technology, China) and Charles Zhang (The Hong Kong University of Science and Technology)</i>

Traceability

A Novel Approach to Tracing Safety Requirements and State-Based Design Models .848.....	
	<i>Mounifah Alenazi (University of Cincinnati, USA), Nan Niu (University of Cincinnati, USA), and Juha Savolainen (Danfoss Drives A/S, Denmark)</i>
Establishing Multilevel Test-to-Code Traceability Links .861.....	
	<i>Robert White (University College London, UK), Jens Krinke (University College London, UK), and Raymond Tan (University College London, UK)</i>

Improving the Effectiveness of Traceability Link Recovery using Hierarchical Bayesian Networks .873.....
Kevin Moran (William & Mary), David Nader Palacio (William & Mary), Carlos Bernal-Cárdenas (William & Mary), Daniel McCrystal (William & Mary), Denys Poshyvanyk (William & Mary), Chris Shenefiel (Cisco Systems), and Jeff Johnson (Cisco Systems)

API

How Android Developers Handle Evolution-Induced API Compatibility Issues: A Large-Scale Study .886.....
Hao Xia (Fudan University, China), Yuan Zhang (Fudan University, China), Yingtian Zhou (Fudan University, China), Xiaoting Chen (Fudan University, China), Yang Wang (Fudan University, China), Xiangyu Zhang (Purdue University, USA), Shuaishuai Cui (Fudan University, China), Geng Hong (Fudan University, China), Xiaohan Zhang (Fudan University, China), Min Yang (Fudan University, China), and Zhemin Yang (Fudan University, China)

An Empirical Study on API Parameter Rules .899.....
Hao Zhong (Shanghai Jiao Tong University, China), Na Meng (Virginia Polytechnic Institute and State University, USA), Zexuan Li (Shanghai Jiao Tong University, China), and Li Jia (Shanghai Jiao Tong University, China)

When APIs are Intentionally Bypassed: An Exploratory Study of API Workarounds .912.....
Maxime Lamothe (Concordia University, Canada) and Weiyi Shang (Concordia University, Canada)

Demystify Official API Usage Directives with Crowdsourced API Misuse Scenarios, Erroneous Code Examples and Patches .925.....
Xiaoxue Ren (Zhejiang University, Ningbo Research Institute, PengCheng Laboratory), Jiamou Sun (Australian National University), Zhenchang Xing (Australian National University, Data61), Xin Xia (Monash University), and Jianling Sun (Zhejiang University)

Bug Analysis

Simulee: Detecting CUDA Synchronization Bugs via Memory-Access Modeling .937.....
Mingyuan Wu (Southern University of Science and Technology, China), Yicheng Ouyang (Southern University of Science and Technology, China), Husheng Zhou (University of Texas at Dallas, USA), Lingming Zhang (University of Texas at Dallas, USA), Cong Liu (University of Texas at Dallas, USA), and Yuqun Zhang (Southern University of Science and Technology, China)

Deep Learning Testing and Debugging 2

- White-box Fairness Testing through Adversarial Sampling .949.....
Peixin Zhang (Zhejiang University, China), Jingyi Wang (National University of Singapore, Singapore), Jun Sun (Singapore Management University, Singapore), Guoliang Dong (Zhejiang University, China), Xinyu Wang (Zhejiang University, China), Xingen Wang (Zhejiang University, China), Jin Song Dong (National University of Singapore, Singapore), and Ting Dai (Huawei International Pte. Ltd., China)
- Structure-Invariant Testing for Machine Translation .961.....
Pinjia He (ETH Zurich), Clara Meister (ETH Zurich), and Zhendong Su (ETH Zurich)
- Automatic Testing and Improvement of Machine Translation .974.....
Zeyu Sun (Key Laboratory of HCST, Peking University, MoE, China), Jie M. Zhang (University College London), Mark Harman (Facebook London and University College London), Mike Papadakis (University of Luxembourg), and Lu Zhang (Key Laboratory of HCST, Peking University, MoE, China)
- TRADER: Trace Divergence Analysis and Embedding Regulation for Debugging Recurrent Neural Networks .986.....
Guanhong Tao (Purdue University, USA), Shiqing Ma (Rutgers University, USA), Yingqi Liu (Purdue University, USA), Qiuling Xu (Purdue University, USA), and Xiangyu Zhang (Purdue University, USA)

Fuzzing 2

- Typestate-Guided Fuzzer for Discovering Use-After-Free Vulnerabilities .999.....
Haijun Wang (Ant Financial Services Group, China & Shenzhen University, China), Xiaofei Xie (Nanyang Technological University), Yi Li (Nanyang Technological University), Cheng Wen (Shenzhen University), Yuekang Li (Nanyang Technological University), Yang Liu (Nanyang Technological University & Zhejiang Sci-Tech University), Shengchao Qin (Teesside University), Hongxu Chen (Nanyang Technological University), and Yulei Sui (University of Technology Sydney)
- JVM Fuzzing for JIT-Induced Side-Channel Detection .1011.....
Tegan Brennan (University of California, Santa Barbara), Seemanta Saha (University of California, Santa Barbara), and Tefvik Bultan (University of California, Santa Barbara)
- Ankou: Guiding Grey-Box Fuzzing towards Combinatorial Difference .1024.....
Valentin J.M. Manès (CSRC, KAIST), Soomin Kim (KAIST), and Sang Kil Cha (KAIST)

Static Analysis 2

- BCFA: Bespoke Control Flow Analysis for CFA at Scale .1037.....
Ramanathan Ramu (Microsoft, Redmond, Washington), Ganesha B Upadhyaya (Harmony, Mountain View, California), Hoan A Nguyen (Amazon, Seattle, Washington), and Hridayesh Rajan (Iowa State University)

On the Recall of Static Call Graph Construction in Practice .1049.....	
	<i>Li Sui (Massey University, New Zealand), Jens Dietrich (Victoria University of Wellington, New Zealand), Amjed Tahir (Massey University, New Zealand), and George Fourtounis (University of Athens, Greece)</i>
Heaps'n Leaks: How Heap Snapshots Improve Android Taint Analysis .1061.....	
	<i>Manuel Benz (Paderborn University), Erik Krogh Kristensen (Aarhus University), Linghui Luo (Paderborn University), Nataniel P. Borges Jr. (CISPA Helmholtz Center for Information Security), Eric Bodden (Paderborn University & Fraunhofer IEM), and Andreas Zeller (CISPA Helmholtz Center for Information Security)</i>

Big Data

Big Code != Big Vocabulary: Open-Vocabulary Models for Source Code .1073.....	
	<i>Rafael - Michael Karampatsis (The University of Edinburgh, United Kingdom), Hlib Babii (Free University of Bozen-Bolzano, Italy), Romain Robbes (Free University of Bozen-Bolzano, Italy), Charles Sifton (Google Research, United States), and Andrea Janes (Free University of Bozen-Bolzano, Italy)</i>
Improving Data Scientist Efficiency with Provenance .1086.....	
	<i>Jingmei Hu (Harvard University), Jiwon Joung (University of Michigan), Maia Jacobs (Harvard University), Krzysztof Z. Gajos (Harvard University), and Margo I. Seltzer (University of British Columbia)</i>
Managing Data Constraints in Database-Backed Web Applications .1098.....	
	<i>Junwen Yang (University of Chicago), Utsav Sethi (University of Chicago), Cong Yan (University of Washington), Alvin Cheung (University of California, Berkeley), and Shan Lu (University of Chicago)</i>

Deep Learning Testing and Debugging 3

Taxonomy of Real Faults in Deep Learning Systems .1110.....	
	<i>Nargiz Humbatova (Università della Svizzera italiana), Gunel Jahangirova (Università della Svizzera italiana), Gabriele Bavota (Università della Svizzera italiana), Vincenzo Riccio (Università della Svizzera italiana), Andrea Stocco (Università della Svizzera italiana), and Paolo Tonella (Università della Svizzera italiana)</i>
Testing DNN Image Classifiers for Confusion & Bias Errors .1122.....	
	<i>Yuchi Tian (Columbia University, USA), Ziyuan Zhong (Columbia University, USA), Vicente Ordonez (University of Virginia, USA), Gail Kaiser (Columbia University, USA), and Baishakhi Ray (Columbia University, USA)</i>
Repairing Deep Neural Networks: Fix Patterns and Challenges .1135.....	
	<i>Md Johirul Islam (Iowa State University, USA), Rangeet Pan (Iowa State University, USA), Giang Nguyen (Iowa State University, USA), and Hridayesh Rajan (Iowa State University, USA)</i>

- Fuzz Testing Based Data Augmentation to Improve Robustness of Deep Neural Networks .1147...
Xiang Gao (National University of Singapore, Singapore), Ripon K. Saha (Fujitsu Laboratories of America, Inc, USA), Mukul R. Prasad (Fujitsu Laboratories of America, Inc, USA), and Abhik Roychoudhury (National University of Singapore, Singapore)
- An Empirical Study on Program Failures of Deep Learning Jobs .1159.....
Ru Zhang (Microsoft Research), Wencong Xiao (Alibaba Group), Hongyu Zhang (The University of Newcastle), Yu Liu (Microsoft Research), Haoxiang Lin (Microsoft Research), and Mao Yang (Microsoft Research)

Natural Language Artifacts in Software

- Primers or Reminders? The Effects of Existing Review Comments on Code Review .1171.....
Davide Spadini (Delft University of Technology / Software Improvement Group, The Netherlands), Gül Çalikli (Chalmers & University of Gothenburg, Sweden), and Alberto Bacchelli (University of Zurich, Switzerland)
- Mitigating Turnover with Code Review Recommendation: Balancing Expertise, Workload, and Knowledge Distribution .1183.....
Ehsan Mirsaeedi (Concordia University) and Peter C. Rigby (Concordia University)

Open Source Software

- How Do Companies Collaborate in Open Source Ecosystems? An Empirical Study of OpenStack .1196
Yuxia Zhang (Peking University, China), Minghui Zhou (Peking University, China), Klaas-Jan Stol (University College Cork, Ireland), Jianyu Wu (Peking University, China), and Zhi Jin (Peking University, China)
- How to Not Get Rich: An Empirical Study of Donations in Open Source .1209.....
Cassandra Overney (Olin College, USA), Jens Meinicke (Carnegie Mellon University, USA), Christian Kästner (Carnegie Mellon University, USA), and Bogdan Vasilescu (Carnegie Mellon University, USA)
- Scaling Open Source Communities: An Empirical Study of the Linux Kernel .1222.....
Xin Tan (Peking University, China), Minghui Zhou (Peking University, China), and Brian Fitzgerald (University of Limerick, Ireland)

Symbolic Execution

- SpecuSym: Speculative Symbolic Execution for Cache Timing Leak Detection .1235.....
Shengjian Guo (Baidu Security), Yueqi Chen (Penn State University), Peng Li (Baidu Security), Yueqiang Cheng (Baidu Security), Huibo Wang (Baidu Security), Meng Wu (Ant Financial Services Group), and Zhiqiang Zuo (State Key Lab. for Novel Software Technology, Nanjing University)

- Symbolic Verification of Message Passing Interface Programs .1248.....
Hengbiao Yu (National University of Defense Technology, Changsha, China), Zhenbang Chen (National University of Defense Technology, Changsha, China), Xianjin Fu (National University of Defense Technology, Changsha, China ; National University of Defense Technology, Changsha, China), Ji Wang (National University of Defense Technology, Changsha, China ; National University of Defense Technology, Changsha, China), Zhendong Su (Department of Computer Science, ETH Zurich, Switzerland), Jun Sun (Singapore Management University, Singapore), Chun Huang (National University of Defense Technology, Changsha, China), and Wei Dong (National University of Defense Technology, Changsha, China)
- Efficient Generation of Error-Inducing Floating-Point Inputs via Symbolic Execution .1261.....
Hui Guo (University of California, Davis) and Cindy Rubio-González (University of California, Davis)
- HyDiff: Hybrid Differential Software Analysis .1273.....
Yannic Noller (Humboldt-Universität zu Berlin), Corina S. Păsăreanu (Carnegie Mellon University Silicon Valley, NASA Ames Research Center), Marcel Böhme (Monash University), Youcheng Sun (Queen's University Belfast), Hoang Lam Nguyen (Humboldt-Universität zu Berlin), and Lars Grunske (Humboldt-Universität zu Berlin)

Testing 1

- Seenomaly: Vision-Based Linting of GUI Animation Effects against Design-Don't Guidelines .1286
Dehai Zhao (Australian National University), Zhenchang Xing (Australian National University, Data61, CSIRO), Chunyang Chen (Monash University), Xiwei Xu (Data61, CSIRO), Liming Zhu (Data61, CSIRO, University of New South Wales), Guoqiang Li (Shanghai Jiao Tong University), and Jinshui Wang (Australian National University)
- Low-Overhead Deadlock Prediction .1298.....
Yan Cai (State Key Laboratory of Computer Science, Institute of Software, Chinese Academy of Sciences, Beijing, China), Ruijie Meng (State Key Laboratory of Computer Science, Institute of Software, Chinese Academy of Sciences, and University of Chinese Academy of Sciences, Beijing, China), and Jens Palsberg (University of California, Los Angeles, USA)

Android

- An Empirical Assessment of Security Risks of Global Android Banking Apps .1310.....
Sen Chen (Nanyang Technological University, Singapore), Lingling Fan (Nanyang Technological University, Singapore), Guozhu Meng (SKLOIS, Institute of Information Engineering, Chinese Academy of Sciences, China and School of Cyber Security, University of Chinese Academy of Sciences, China), Ting Su (ETH Zurich, Switzerland), Minhui Xue (The University of Adelaide, Australia), Yinxing Xue (University of Science and Technology of China, China), Yang Liu (Nanyang Technological University, Singapore and Zhejiang Sci-Tech University, China), and Lihua Xu (New York University Shanghai, China)

- Accessibility Issues in Android Apps: State of Affairs, Sentiments, and Ways Forward .1323.....
Abdulaziz Alshayban (University of California, Irvine, USA), Iftekhar Ahmed (University of California, Irvine, USA), and Sam Malek (University of California, Irvine, USA)
- Collaborative Bug Finding for Android Apps .1335.....
Shin Hwei Tan (Southern University of Science and Technology, China) and Ziqiang Li (Southern University of Science and Technology, China)

Code Summarization and Analysis

- POSIT: Simultaneously Tagging Natural and Programming Languages .1348.....
Profir-Petru Pârțachi (University College London, London, United Kingdom), Santanu Kumar Dash (University of Surrey, Guildford, Surrey, United Kingdom), Christoph Treude (University of Adelaide, Adelaide, South Australia, Australia), and Earl T. Barr (University College London, London, United Kingdom)
- CPC: Automatically Classifying and Propagating Natural Language Comments via Program Analysis .1359.....
Juan Zhai (Purdue University and Rutgers University), Xiangzhe Xu (Nanjing University), Yu Shi (Purdue University), Guanhong Tao (Purdue University), Minxue Pan (Nanjing University), Shiqing Ma (Rutgers University), Lei Xu (Nanjing University), Weifeng Zhang (Nanjing University of Posts and Telecommunications), Lin Tan (Purdue University), and Xiangyu Zhang (Purdue University)
- Suggesting Natural Method Names to Check Name Consistencies .1372.....
Son Nguyen (The University of Texas at Dallas, USA), Hung Phan (Iowa State University, USA), Trinh Le (University of Engineering and Technology, Vietnam), and Tien N. Nguyen (The University of Texas at Dallas, USA)
- Retrieval-Based Neural Source Code Summarization .1385.....
Jian Zhang (Beihang University, China; Beijing Advanced Innovation Center for Big Data and Brain Computing, China), Xu Wang (Beihang University, China; Beijing Advanced Innovation Center for Big Data and Brain Computing, China), Hongyu Zhang (The University of Newcastle, Australia), Hailong Sun (Beihang University, China; Beijing Advanced Innovation Center for Big Data and Brain Computing, China), and Xudong Liu (Beihang University, China; Beijing Advanced Innovation Center for Big Data and Brain Computing, China)

Machine Learning and Models

- On Learning Meaningful Assert Statements for Unit Test Cases .1398.....
Cody Watson (Washington and Lee University), Michele Tufano (Microsoft), Kevin Moran (The College of William & Mary), Gabriele Bavota (Università della Svizzera italiana (USI)), and Denys Poshyvanyk (The College of William & Mary)

Quickly Generating Diverse Valid Test Inputs with Reinforcement Learning .1410.....
Sameer Reddy (University of California, Berkeley, USA), Caroline Lemieux (University of California, Berkeley, USA), Rohan Padhye (University of California, Berkeley, USA), and Koushik Sen (University of California, Berkeley, USA)

Meta Studies

An Evidence-Based Inquiry into the Use of Grey Literature in Software Engineering .1422.....
He Zhang (Nanjing University), Xin Zhou (Nanjing University), Xin Huang (Nanjing University), Huang Huang (Nanjing University), and Muhammad Ali Babar (University of Adelaide)

Performance

Towards the Use of the Readily Available Tests from the Release Pipeline as Performance Tests. Are We There Yet? .1435.....
Zishuo Ding (Concordia University, Canada), Jinfu Chen (Concordia University), and Weiyi Shang (Concordia University)

Software Verification

Verifying Object Construction .1447.....
Martin Kellogg (University of Washington), Manli Ran (University of California, Riverside), Manu Sridharan (University of California, Riverside), Martin Schäfer (Amazon Web Services), and Michael D. Ernst (University of Washington)

Automatically Testing String Solvers .1459.....
Alexandra Bugariu (ETH Zurich, Switzerland) and Peter Müller (ETH Zurich, Switzerland)

Testing 2

A Study on the Lifecycle of Flaky Tests .1471.....
Wing Lam (University of Illinois at Urbana-Champaign), Kıvanç Muşlu (Microsoft), Hitesh Sajnani (Microsoft), and Suresh Thummalapenta (Microsoft)

Testing File System Implementations on Layered Models .1483.....
Dongjie Chen (Nanjing University, Nanjing, China), Yanyan Jiang (Nanjing University, Nanjing, China), Chang Xu (Nanjing University, Nanjing, China), Xiaoxing Ma (Nanjing University, Nanjing, China), and Jian Lu (Nanjing University, Nanjing, China)

Code Generation

- Co-Evolving Code with Evolving Metamodels .1496.....
Djamel Eddine khelladi (CNRS, France), Benoit Combemale (Université Toulouse & Inria, France), Mathieu Acher (Univ. Rennes, France), Olivier Barais (Univ. Rennes, France), and Jean-Marc Jézéquel (Univ. Rennes, France)

Dependencies and Configuration

- Lazy Product Discovery in Huge Configuration Spaces .1509.....
Lienhardt Michael (ONERA (France)), Damiani Ferruccio (University of Turin (Italy)), Johnsen Einar Broch (University of Oslo (Norway)), and Mauro Jacopo (University of Southern Denmark (Denmark))
- Reducing Run-Time Adaptation Space via Analysis of Possible Utility Bounds .1522.....
Clay Stevens (University of Nebraska-Lincoln, USA) and Hamid Bagheri (University of Nebraska-Lincoln, USA)

Recommendations

- Context-Aware In-Process Crowdsworker Recommendation .1535.....
Junjie Wang (Institute of Software Chinese Academy of Sciences), Ye Yang (Stevens Institute of Technology), Song Wang (York University), Yuanzhe Hu (Institute of Software Chinese Academy of Sciences), Dandan Wang (Institute of Software Chinese Academy of Sciences), and Qing Wang (Institute of Software Chinese Academy of Sciences)

Security

- A Large-Scale Empirical Study on Vulnerability Distribution within Projects and the Lessons Learned .1547.....
Bingchang Liu (Institute of Information Engineering, Chinese Academy of Sciences, China; University of Chinese Academy of Sciences, China), Guozhu Meng (Institute of Information Engineering, Chinese Academy of Sciences, China; University of Chinese Academy of Sciences, China), Wei Zou (Institute of Information Engineering, Chinese Academy of Sciences, China; University of Chinese Academy of Sciences, China), Qi Gong (Institute of Information Engineering, Chinese Academy of Sciences, China), Feng Li (Institute of Information Engineering, Chinese Academy of Sciences, China; University of Chinese Academy of Sciences, China), Min Lin (Tsinghua University, China), Dandan Sun (Institute of Information Engineering, Chinese Academy of Sciences, China), Wei Huo (Institute of Information Engineering, Chinese Academy of Sciences, China; University of Chinese Academy of Sciences, China), and Chao Zhang (Tsinghua University, China; Beijing National Research Center for Information Science and Technology, China)
- Unsuccessful Story about Few Shot Malware Family Classification and Siamese Network to the Rescue .1560.....
Yude Bai (Tianjin University, China), Zhenchang Xing (Australian National University, Australia), Xiaohong Li (Tianjin University), Zhiyong Feng (Tianjin University), and Duoyuan Ma (Tianjin University)

How Does Misconfiguration of Analytic Services Compromise Mobile Privacy? 1572
Xueling Zhang (University of Texas at San Antonio), Xiaoyin Wang (University of Texas at San Antonio), Rocky Slavin (University of Texas at San Antonio), Travis Breaux (Carnegie Mellon University), and Jianwei Niu (University of Texas at San Antonio)

Stack Overflow

Interpreting Cloud Computer Vision Pain-Points: A Mining Study of Stack Overflow 1584
Alex Cummaudo (Deakin University, Australia), Rajesh Vasa (Deakin University, Australia), Scott Barnett (Deakin University, Australia), John Grundy (Monash University, Australia), and Mohamed Abdelrazek (Deakin University, Australia)

Author Index