

**2015 IEEE
31st International Conference
on Software Maintenance
and Evolution
(ICSME)**

Proceedings

Rainer Koschke, Jens Krinke, and Martin Robillard

September 29 – October 1, 2015
Bremen, Germany

Sponsors: IEEE, IEEE Computer Society, TCSE

2015 IEEE
31st International Conference
on Software Maintenance
and Evolution
(ICSME)

IEEE Catalog Number: CFP15079-ART
ISBN: 978-1-4673-7532-0

Copyright and Reprint Permission:

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 Operations Center, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331.

All rights reserved.

Copyright © 2015 by the Institute of Electrical and Electronics Engineers

Production: Conference Publishing Consulting, D-94034 Passau, Germany
info@conference-publishing.com

Contents

Frontmatter

Messages from the Chairs	iii
ICSME 2015 Organization	x

Technical Research Track

Developers

Software History under the Lens: A Study on Why and How Developers Examine It Mihai Codoban, Sruti Srinivasa Ragavan, Danny Dig, and Brian Bailey — <i>Oregon State University, USA; University of Illinois at Urbana-Champaign, USA</i>	1
To Fix or to Learn? How Production Bias Affects Developers' Information Foraging during Debugging David Piorkowski, Scott D. Fleming, Christopher Scaffidi, Margaret Burnett, Irwin Kwan, Austin Z. Henley, Jamie Macbeth, Charles Hill, and Amber Horvath — <i>Oregon State University, USA; University of Memphis, USA; Clemson University, USA</i>	11
Developers' Perception of Co-change Patterns: An Empirical Study Luciana L. Silva, Marco Tulio Valente, Marcelo de A. Maia, and Nicolas Anquetil — <i>Federal University of Minas Gerais, Brazil; Federal University of Uberlândia, Brazil; INRIA, France</i>	21
When and Why Developers Adopt and Change Software Licenses Christopher Vendome, Mario Linares-Vásquez, Gabriele Bavota, Massimiliano Di Penta, Daniel M. German, and Denys Poshyvanyk — <i>College of William and Mary, USA; Free University of Bolzano, Italy; University of Sannio, Italy; University of Victoria, Canada</i>	31

Program Comprehension

Investigating Naming Convention Adherence in Java References Simon Butler, Michel Wermelinger, and Yijun Yu — <i>Open University, UK</i>	41
Developing a Model of Loop Actions by Mining Loop Characteristics from a Large Code Corpus Xiaoran Wang, Lori Pollock, and K. Vijay-Shanker — <i>University of Delaware, USA</i>	51
Delta Extraction: An Abstraction Technique to Comprehend Why Two Objects Could Be Related Naoya Nitta and Tomohiro Matsuoka — <i>Konan University, Japan</i>	61
Modeling Changeset Topics for Feature Location Christopher S. Corley, Kelly L. Kashuda, and Nicholas A. Kraft — <i>University of Alabama, USA; ABB Corporate Research, USA</i>	71

Software Quality

Four Eyes Are Better Than Two: On the Impact of Code Reviews on Software Quality Gabriele Bavota and Barbara Russo — <i>Free University of Bolzano, Italy</i>	81
A Comparative Study on the Bug-Proneness of Different Types of Code Clones Manishankar Mondal, Chanchal K. Roy, and Kevin A. Schneider — <i>University of Saskatchewan, Canada</i>	91
An Empirical Study of Bugs in Test Code Arash Vahabzadeh, Amin Milani Fard, and Ali Mesbah — <i>University of British Columbia, Canada</i>	101
Investigating Code Review Quality: Do People and Participation Matter? Oleksii Kononenko, Olga Baysal, Latifa Guerrouj, Yaxin Cao, and Michael W. Godfrey — <i>University of Waterloo, Canada; Université de Montréal, Canada; École de Technologie Supérieure, Canada</i>	111

Modularity

Inter-smell Relations in Industrial and Open Source Systems: A Replication and Comparative Analysis Aiko Yamashita, Marco Zanoni, Francesca Arcelli Fontana, and Bartosz Walter — <i>Oslo and Akershus University College of Applied Sciences, Norway; University of Milano-Bicocca, Italy; Poznan University of Technology, Poland</i>	121
--	-----

Evaluating Clone Detection Tools with BigCloneBench	
Jeffrey Svajlenko and Chanchal K. Roy — <i>University of Saskatchewan, Canada</i>	131
Uncovering Dependence Clusters and Linchpin Functions	
David Binkley, Árpád Beszédes, Syed Islam, Judit Jász, and Béla Vancsics — <i>Loyola University Maryland, USA; University of Szeged, Hungary; University of East London, UK</i>	141
Forked and Integrated Variants in an Open-Source Firmware Project	
Ștefan Stănciulescu, Sandro Schulze, and Andrzej Wąsowski — <i>IT University of Copenhagen, Denmark; TU Braunschweig, Germany</i>	151
Program Analysis	
Towards Automating Dynamic Analysis for Behavioral Design Pattern Detection	
Andrea De Lucia, Vincenzo Deufemia, Carmine Gravino, and Michele Risi — <i>University of Salerno, Italy</i>	161
Practical and Accurate Pinpointing of Configuration Errors using Static Analysis	
Zhen Dong, Artur Andrzejak, and Kun Shao — <i>University of Heidelberg, Germany; Hefei University of Technology, China</i>	171
Deterministic Dynamic Race Detection Across Program Versions	
Sri Varun Poluri and Murali Krishna Ramanathan — <i>Indian Institute of Science, India</i>	181
Program Specialization and Verification using File Format Specifications	
Raveendra Kumar Medicherla, Raghavan Komondoor, and S. Narendran — <i>Tata Consultancy Services, India; Indian Institute of Science, India</i>	191
Refactoring	
An Empirical Evaluation of Ant Build Maintenance using Formiga	
Ryan Hardt and Ethan V. Munson — <i>University of Wisconsin-Eau Claire, USA; University of Wisconsin-Milwaukee, USA</i>	201
Scripting Parametric Refactorings in Java to Retrofit Design Patterns	
Jongwook Kim, Don Batory, and Danny Dig — <i>University of Texas at Austin, USA; Oregon State University, USA</i>	211
System Specific, Source Code Transformations	
Gustavo Santos, Nicolas Anquetil, Anne Etien, Stéphane Ducasse, and Marco Tulio Valente — <i>INRIA, France; Federal University of Minas Gerais, Brazil</i>	221
A Decision Support System to Refactor Class Cycles	
Tosin Daniel Oyetoyan, Daniela Soares Cruzes, and Christian Thurmman-Nielsen — <i>NTNU, Norway; SINTEF, Norway; EVRY, Norway</i>	231
Code Mining and Recommendation	
On the Role of Developer's Scattered Changes in Bug Prediction	
Dario Di Nucci, Fabio Palomba, Sandro Siravo, Gabriele Bavota, Rocco Oliveto, and Andrea De Lucia — <i>University of Salerno, Italy; University of Molise, Italy; Free University of Bolzano, Italy</i>	241
How Do Developers React to API Evolution? The Pharo Ecosystem Case	
André Hora, Romain Robbes, Nicolas Anquetil, Anne Etien, Stéphane Ducasse, and Marco Tulio Valente — <i>Federal University of Minas Gerais, Brazil; University of Chile, Chile; INRIA, France</i>	251
Who Should Review This Change?: Putting Text and File Location Analyses Together for More Accurate Recommendations	
Xin Xia, David Lo, Xinyu Wang, and Xiaohu Yang — <i>Zhejiang University, China; Singapore Management University, Singapore</i>	261
Exploring API Method Parameter Recommendations	
Muhammad Asaduzzaman, Chanchal K. Roy, Samiul Monir, and Kevin A. Schneider — <i>University of Saskatchewan, Canada</i>	271
Mobile Applications	
How Can I Improve My App? Classifying User Reviews for Software Maintenance and Evolution	
Sebastiano Panichella, Andrea Di Sorbo, Emitza Guzman, Corrado A. Visaggio, Gerardo Canfora, and Harald C. Gall — <i>University of Zurich, Switzerland; University of Sannio, Italy; TU München, Germany</i>	281

User Reviews Matter! Tracking Crowdsourced Reviews to Support Evolution of Successful Apps Fabio Palomba, Mario Linares-Vásquez, Gabriele Bavota, Rocco Oliveto, Massimiliano Di Penta, Denys Poshyvanyk, and Andrea De Lucia — <i>University of Salerno, Italy; College of William and Mary, USA; Free University of Bolzano, Italy; University of Molise, Italy; University of Sannio, Italy</i>	291
What Are the Characteristics of High-Rated Apps? A Case Study on Free Android Applications Yuan Tian, Meiyappan Nagappan, David Lo, and Ahmed E. Hassan — <i>Singapore Management University, Singapore; Rochester Institute of Technology, USA; Queen's University, Canada</i>	301
GreenAdvisor: A Tool for Analyzing the Impact of Software Evolution on Energy Consumption Karan Aggarwal, Abram Hindle, and Eleni Stroulia — <i>University of Alberta, Canada</i>	311

Tool Demo Track

apiwave: Keeping Track of API Popularity and Migration André Hora and Marco Tulio Valente — <i>Federal University of Minas Gerais, Brazil</i>	321
UrbanIt: Visualizing Repositories Everywhere Andrea Ciani, Roberto Minelli, Andrea Mocci, and Michele Lanza — <i>University of Lugano, Switzerland</i>	324
ePadEvo: A Tool for the Detection of Behavioral Design Patterns Andrea De Lucia, Vincenzo Deufemia, Carmine Gravino, Michele Risi, and Ciro Pirolli — <i>University of Salerno, Italy</i>	327
PARC: Recommending API Methods Parameters Muhammad Asaduzzaman, Chanchal K. Roy, and Kevin A. Schneider — <i>University of Saskatchewan, Canada</i>	330
ArchFloc: Locating and Explaining Architectural Features in Running Web Applications Yan Gao and Daqing Hou — <i>Clarkson University, USA</i>	333
WSDarwin: A Web Application for the Support of REST Service Evolution Marios Fokaefs, Mihai Oprescu, and Eleni Stroulia — <i>University of Alberta, Canada</i>	336
DUM-Tool Simone Romano and Giuseppe Scanniello — <i>University of Basilicata, Italy</i>	339

Industry Track

Industry Experience

An Empirical Study on the Handling of Crash Reports in a Large Software Company: An Experience Report Abdou Maiga, Abdelwahab Hamou-Lhadj, Mathieu Nayrolles, Korosh Koochekian-Sabor, and Alf Larsson — <i>Concordia University, Canada; Ericsson, Sweden</i>	342
How Developers Detect and Fix Performance Bottlenecks in Android Apps Mario Linares-Vásquez, Christopher Vendome, Qi Luo, and Denys Poshyvanyk — <i>College of William and Mary, USA</i>	352
Challenges for Maintenance of PLC-Software and Its Related Hardware for Automated Production Systems: Selected Industrial Case Studies Birgit Vogel-Heuser, Juliane Fischer, Susanne Rösch, Stefan Feldmann, and Sebastian Ulewicz — <i>TU München, Germany</i>	362
Code Smells in Spreadsheet Formulas Revisited on an Industrial Dataset Bas Jansen and Felienne Hermans — <i>Delft University of Technology, Netherlands</i>	372

Developer Studies

Web Usage Patterns of Developers Christopher S. Corley, Federico Lois, and Sebastián Quezada — <i>ABB Corporate Research, USA; Corvalius, Argentina</i>	381
Identifying Wasted Effort in the Field via Developer Interaction Data Gergő Balogh, Gábor Antal, Árpád Beszédes, László Vidács, Tibor Gyimóthy, and Ádám Zoltán Végh — <i>University of Szeged, Hungary; AENSys Informatics, Hungary</i>	391
Is This Code Written in English? A Study of the Natural Language of Comments and Identifiers in Practice Timo Pawelka and Elmar Juergens — <i>TU München, Germany; CQSE, Germany</i>	401
Impact Assessment for Vulnerabilities in Open-Source Software Libraries Henrik Plate, Serena Elisa Ponta, and Antonino Sabetta — <i>SAP Labs, France</i>	411

Software Quality

Experiences from Performing Software Quality Evaluations via Combining Benchmark-Based Metrics Analysis, Software Visualization, and Expert Assessment Aiko Yamashita — <i>Oslo and Akershus University College of Applied Sciences, Norway</i>	421
Do Automatic Refactorings Improve Maintainability? An Industrial Case Study Gábor Szőke, Csaba Nagy, Péter Hegedűs, Rudolf Ferenc, and Tibor Gyimóthy — <i>University of Szeged, Hungary</i> . .	429
An Empirical Evaluation of the Effectiveness of Inspection Scenarios Developed from a Defect Repository Kiyotaka Kasubuchi, Shuji Morisaki, Akiko Yoshida, and Chikako Ogawa — <i>SCREEN Holdings, Japan; Nagoya University, Japan; Shizuoka University, Japan</i>	439
Efficient Regression Testing Based on Test History: An Industrial Evaluation Edward Dunn Ekelund and Emelie Engström — <i>Axis Communication, Sweden; Lund University, Sweden</i>	449

Software Reengineering

Migrating Legacy Control Software to Multi-core Hardware Michael Wahler, Raphael Eidenbenz, Carsten Franke, and Yvonne-Anne Pignolet — <i>ABB Corporate Research, Switzerland</i>	458
Query by Example in Large-Scale Code Repositories Vipin Balachandran — <i>VMware, India</i>	467
Does Software Modernization Deliver What It Aimed for? A Post Modernization Analysis of Five Software Modernization Case Studies Ravi Khadka, Prajan Shrestha, Bart Klein, Amir Saeidi, Jurriaan Hage, Slinger Jansen, Edwin van Dis, and Magiel Bruntink — <i>Utrecht University, Netherlands; University of Amsterdam, Netherlands; CGI, Netherlands</i>	477
Reverse Engineering a Visual Age Application Harry M. Sneed and Chris Verhoef — <i>SoRing, Germany; VU University Amsterdam, Netherlands</i>	487
Using Static Analysis for Knowledge Extraction from Industrial User Interfaces Bernhard Dorninger, Josef Pichler, and Albin Kern — <i>Software Competence Center Hagenberg, Austria; Engel Austria, Austria</i>	497

Early Research Achievements Track

Defects and Refactoring

Constrained Feature Selection for Localizing Faults Tien-Duy B. Le, David Lo, and Ming Li — <i>Singapore Management University, Singapore; Nanjing University, China</i>	501
Crowdsourced Bug Triaging Ali Sajedi Badashian, Abram Hindle, and Eleni Stroulia — <i>University of Alberta, Canada</i>	506
Toward Improving Graftability on Automated Program Repair Soichi Sumi, Yoshiki Higo, Keisuke Hotta, and Shinji Kusumoto — <i>Osaka University, Japan</i>	511
Mining Stack Overflow for Discovering Error Patterns in SQL Queries Csaba Nagy and Anthony Cleve — <i>University of Namur, Belgium</i>	516
Towards Purity-Guided Refactoring in Java Jiacheng Yang, Keisuke Hotta, Yoshiki Higo, and Shinji Kusumoto — <i>Osaka University, Japan</i>	521
Fitness Workout for Fat Interfaces: Be Slim, Clean, and Flexible Spyros Kranas, Apostolos V. Zarras, and Panos Vassiliadis — <i>University of Ioannina, Greece</i>	526

Social and Developers

Choosing Your Weapons: On Sentiment Analysis Tools for Software Engineering Research Robbert Jongeling, Subhajit Datta, and Alexander Serebrenik — <i>Eindhoven University of Technology, Netherlands; Singapore University of Technology and Design, Singapore</i>	531
Assessing Developer Contribution with Repository Mining-Based Metrics Jalerson Lima, Christoph Treude, Fernando Figueira Filho, and Uirá Kulesza — <i>Federal University of Rio Grande do Norte, Brazil</i>	536

What's Hot in Software Engineering Twitter Space?	541
Abhishek Sharma, Yuan Tian, and David Lo — <i>Singapore Management University, Singapore</i>	
Validating Metric Thresholds with Developers: An Early Result	546
Paloma Oliveira, Marco Tulio Valente, Alexandre Bergel, and Alexander Serebrenik — <i>Federal University of Minas Gerais, Brazil; University of Chile, Chile; Eindhoven University of Technology, Netherlands</i>	
Towards a Survival Analysis of Database Framework Usage in Java Projects	551
Mathieu Goeminne and Tom Mens — <i>University of Mons, Belgium</i>	

Maintenance and Analysis

Exploring the Use of Deep Learning for Feature Location	556
Christopher S. Corley, Kostadin Damevski, and Nicholas A. Kraft — <i>University of Alabama, USA; Virginia Commonwealth University, USA; ABB Corporate Research, USA</i>	
Using Stereotypes in the Automatic Generation of Natural Language Summaries for C++ Methods	561
Nahla J. Abid, Natalia Dragan, Michael L. Collard, and Jonathan I. Maletic — <i>Kent State University, USA; University of Akron, USA</i>	
Keele: Mining Key Architecturally Relevant Classes using Dynamic Analysis	566
Liliane do Nascimento Vale and Marcelo de A. Maia — <i>Federal University of Uberlândia, Brazil</i>	
Combining Software Interrelationship Data across Heterogeneous Software Repositories	571
Nikola Ilo, Johann Grabner, Thomas Artner, Mario Bernhart, and Thomas Grechenig — <i>Vienna University of Technology, Austria</i>	
Recovering Transitive Traceability Links among Software Artifacts	576
Kazuki Nishikawa, Hironori Washizaki, Yoshiaki Fukazawa, Keishi Oshima, and Ryota Mibe — <i>Waseda University, Japan; Hitachi, Japan</i>	
Live Object Exploration: Observing and Manipulating Behavior and State of Java Objects	581
Benjamin Biegel, Benedikt Lesch, and Stephan Diehl — <i>University of Trier, Germany</i>	

Doctoral Symposium

Post-Doctoral

Supporting Newcomers in Software Development Projects	586
Sebastiano Panichella — <i>University of Zurich, Switzerland</i>	
Advances in Software Product Quality Measurement and Its Applications in Software Evolution	590
Péter Hegedűs — <i>University of Szeged, Hungary</i>	

Pre-Doctoral

Treating Software Quality as a First-Class Entity	594
Yuriy Tymchuk — <i>University of Lugano, Switzerland</i>	
Detection Strategies of Smells in Web Software Development	598
Maurício F. Aniche — <i>University of São Paulo, Brazil</i>	
Code Smells in Highly Configurable Software	602
Wolfram Fenske — <i>University of Magdeburg, Germany</i>	
A Model-Based Approach to Software Refactoring	606
Ioana Verebi — <i>Politehnica University of Timisoara, Romania</i>	
Author Index	610