

# **2019 IEEE 27th International Requirements Engineering Conference (RE 2019)**

**Jeju Island, South Korea  
23 – 27 September 2019**



**IEEE Catalog Number: CFP19022-POD  
ISBN: 978-1-7281-3913-5**

**Copyright © 2019 by the Institute of Electrical and Electronics Engineers, Inc.  
All Rights Reserved**

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

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

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

IEEE Catalog Number:	CFP19022-POD
ISBN (Print-On-Demand):	978-1-7281-3913-5
ISBN (Online):	978-1-7281-3912-8
ISSN:	1090-705X

**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](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

# 2019 IEEE 27th International Requirements Engineering Conference (RE) **RE 2019**

## Table of Contents

<b>Welcome Message from the RE'19 Chairs</b> .....	<b>xii</b>
<i>Daniela Damian (University of Victoria), Anna Perini (Fondazione Bruno Kessler), and Seok-Won Lee (Ajou University)</i>	
<b>Organizing Committee</b> .....	<b>xv</b>
<b>Program Committee</b> .....	<b>xvii</b>
<b>RE'19 Donors and Sponsors</b> .....	<b>xxi</b>

## Keynotes

Requirements We Live By .....	1
<i>Bashar Nuseibeh (The Open University &amp; Lero)</i>	
Uncertain Requirements, Assurance and Machine Learning .....	2
<i>Marsha Chechik (University of Toronto)</i>	
Human Values in Software: A New Paradigm for Requirements Engineering? .....	4
<i>Jon Whittle (Monash University)</i>	
The Next Step in Requirements Management: Artificial Intelligence .....	5
<i>Hazel Woodcock (IBM Watson IoT)</i>	

## Research Track

Do we Really Know What we are Building? Raising Awareness of Potential Sustainability Effects of Software Systems in Requirements Engineering .....	6
<i>Leticia Duboc (La Salle University Ramon Llull), Stefanie Betz (Hochschule Furtwangen University), Birgit Penzenstadler (Chalmers University of Technology), Sedef Akinli Kocak (Vector Institute for Artificial Intelligence), Ruzanna Chitchyan (University of Bristol), Ola Leifler (Linkopings Universitet), Jari Porras (Lappeenranta University of Technology), Norbert Seyff (University of Applied Sciences and Arts Northwestern Switzerland), and Colin C. Venters (University of Huddersfield)</i>	
Can a Conversation Paint a Picture? Mining Requirements In Software Forums .....	17
<i>James Tizard (University of Auckland), Hechen Wang (University of Auckland), Lydia Yohannes (University of Auckland), and Kelly Blincoe (University of Auckland)</i>	

Learning Requirements Elicitation Interviews with Role-Playing, Self-Assessment and Peer-Review .....	28
<i>Alessio Ferrari (CNR-ISTI), Paola Spoletini (Kennesaw State University), Muneera Bano (Swinburne University of Technology), and Didar Zowghi (University of Technology Sydney)</i>	
Optimizing for Recall in Automatic Requirements Classification: An Empirical Study .....	40
<i>Jonas Paul Winkler (TU Berlin), Jannis Grönberg (TU Berlin), and Andreas Vogelsang (TU Berlin)</i>	
A Machine Learning-Based Approach for Demarcating Requirements in Textual Specifications .....	51
<i>Sallam Abualhaija (University of Luxembourg), Chetan Arora (University of Luxembourg), Mehrdad Sabetzadeh (University of Luxembourg), Lionel C. Briand (University of Luxembourg; University of Ottawa), and Eduardo Vaz (QRA Corp.)</i>	
Analysis of Requirements-Related Arguments in User Forums .....	63
<i>Javed Ali Khan (Tsinghua University), Yuchen Xie (Tsinghua University), Lin Liu (Tsinghua University), and Lijie Wen (Tsinghua University)</i>	
The Role of Environment Assertions in Requirements-Based Testing .....	75
<i>Tanmay Bhowmik (Mississippi State University), Surendra Raju Chekuri (Mississippi State University), Anh Quoc Do (Mississippi State University), Wentao Wang (University of Cincinnati), and Nan Niu (University of Cincinnati)</i>	
An Approach for Reviewing Security-Related Aspects in Agile Requirements Specifications of Web Applications .....	86
<i>Hugo Villamizar (Pontifical Catholic University of Rio de Janeiro), Amadeu Anderlin Neto (Pontifical Catholic University of Rio de Janeiro), Marcos Kalinowski (Pontifical Catholic University of Rio de Janeiro), Alessandro Garcia (Pontifical Catholic University of Rio de Janeiro), and Daniel Méndez (Blekinge Institute of Technology)</i>	
Detecting Bad Smells in Use Case Descriptions .....	98
<i>Yotaro Seki (Tokyo Institute of Technology), Shinpei Hayashi (Tokyo Institute of Technology), and Motoshi Saeki (Tokyo Institute of Technology)</i>	
Visualization Requirements for Business Intelligence Analytics: A Goal-Based, Iterative Framework .....	109
<i>Ana Lavallo (University of Alicante), Alejandro Maté (University of Alicante), Juan Trujillo (University of Alicante), and Stefano Rizzi (University of Bologna)</i>	
Predicting How to Test Requirements: An Automated Approach .....	120
<i>Jonas Paul Winkler (Technische Universität Berlin), Jannis Grönberg (Technische Universität Berlin), and Andreas Vogelsang (Technische Universität Berlin)</i>	
Extracting and Analyzing Context Information in User-Support Conversations on Twitter .....	131
<i>Daniel Martens (University of Hamburg) and Walid Maalej (University of Hamburg)</i>	
Requirements Classification with Interpretable Machine Learning and Dependency Parsing .....	142
<i>Fabiano Dalpiaz (Utrecht University), Davide Dell'Anna (Utrecht University), Fatma Basak Aydemir (Bogaziçi University), and Sercan Çevikol (Bogaziçi University)</i>	

How do Practitioners Capture and Utilize User Feedback During Continuous Software Engineering? .....	153
<i>Jan Ole Johanssen (Technical University of Munich), Anja Kleebaum (Heidelberg University), Bernd Bruegge (Technical University of Munich), and Barbara Paech (Heidelberg University)</i>	
Analysing Gender Differences in Building Social Goal Models: A Quasi-Experiment .....	165
<i>Catarina Gralha (Universidade NOVA de Lisboa), Miguel Goulão (Universidade NOVA de Lisboa), and João Araújo (Universidade NOVA de Lisboa)</i>	
Requirements Reference Models Revisited: Accommodating Hierarchy in System Design .....	177
<i>Anitha Murugesan (Honeywell Aerospace), Sanjai Rayadurgam (University of Minnesota), and Mats Heimdahl (University of Minnesota)</i>	
Automated Recommendation of Software Refactorings Based on Feature Requests .....	187
<i>Ally S. Nyamawe (Beijing Institute of Technology), Hui Liu (Beijing Institute of Technology), Nan Niu (University of Cincinnati), Qasim Umer (Beijing Institute of Technology), and Zhendong Niu (Beijing Institute of Technology)</i>	
A Metamodeling Approach to Support the Engineering of Modeling Method Requirements .....	199
<i>Dimitris Karagiannis (University of Vienna), Patrik Burzynski (University of Vienna), Wilfrid Utz (University of Vienna), and Robert Andrei Buchmann (University Babeş-Bolyai)</i>	
Extraction of System States from Natural Language Requirements .....	211
<i>Florian Pudlitz (Technische Universität Berlin), Florian Brokhausen (Technische Universität Berlin), and Andreas Vogelsang (Technische Universität Berlin)</i>	
Do End-Users Want Explanations? Analyzing the Role of Explainability as an Emerging Aspect of Non-Functional Requirements .....	223
<i>Larissa Chazette (Leibniz Universität Hannover), Oliver Karras (Leibniz Universität Hannover), and Kurt Schneider (Leibniz Universität Hannover)</i>	
Scalable Analysis of Real-Time Requirements .....	234
<i>Vincent Langenfeld (University of Freiburg), Daniel Dietsch (University of Freiburg), Bernd Westphal (University of Freiburg), Jochen Hoenicke (University of Freiburg), and Amalinda Post (Robert Bosch GmbH)</i>	
Arithmetic Semantics of Feature and Goal Models for Adaptive Cyber-Physical Systems .....	245
<i>Amal Ahmed Anda (University of Ottawa) and Daniel Amyot (University of Ottawa)</i>	

## **Industrial Innovation**

Clustering for Traceability Managing in System Specifications .....	257
<i>Manel Mezghani (Semios for requirements, One Light studio), Juyeon Kang (Fortia Financial Solutions), Eun-Bee Kang (Semios for requirements, One Light Studio), and Florence Sedes (IRIT, University of Toulouse, CNRS)</i>	
The General Data Protection Regulation: Requirements, Architectures, and Constraints .....	265
<i>Kalle Hjerpe (Geniem Oy), Jukka Ruohonen (University of Turku), and Ville Leppänen (University of Turku)</i>	

Requirements Engineering Method for Infrastructure Automation and Cloud Projects .....	276
<i>Andreas Banz (Netcloud AG)</i>	
On the Requirements for Serious Games Geared Towards Software Developers in the Industry .....	286
<i>Tiago Espinha Gasiba (Siemens AG), Kristian Beckers (Siemens AG), Santiago Suppan (Siemens AG), and Filip Rezabek (Siemens AG)</i>	
Motivational Modelling in Software for Homelessness: Lessons from an Industrial Study .....	297
<i>Rachel Burrows (PsyLab Ltd), Antonio Lopez-Lorca (Semantic Web Company), Leon Sterling (Swinburne University of Technology), Tim Miller (University of Melbourne), Antonette Mendoza (University of Melbourne), and Sonja Pedell (Swinburne University of Technology)</i>	
Automating Consistency Verification of Safety Requirements for Railway Interlocking Systems .....	308
<i>Xiaohong Chen (Shanghai Key Laboratory of Trustworthy Computing, East China Normal University), Zhiwei Zhong (Shanghai Key Laboratory of Trustworthy Computing, East China Normal University), Zhi Jin (Peking University), Min Zhang (Shanghai Key Laboratory of Trustworthy Computing, East China Normal University), Tong Li (Beijing University of Technology), Xiang Chen (CASCO Signal Ltd.), and Tingliang Zhou (CASCO Signal Ltd.)</i>	
A Query System for Extracting Requirements-Related Information from Legal Texts .....	319
<i>Amin Sleimi (University of Luxembourg), Marcello Ceci (University of Luxembourg), Nicolas Sannier (University of Luxembourg), Mehrdad Sabetzadeh (University of Luxembourg), Lionel Briand (University of Luxembourg, University of Ottawa), and John Dann (Central Legislative Service, Ministry of State, Luxembourg)</i>	
Big Data Analytics on Cyber Attack Graphs for Prioritizing Agile Security Requirements .....	330
<i>Ethan Hadar (Accenture) and Amin Hassanzadeh (Accenture)</i>	
Requirements Elicitation with a Service Canvas for Packaged Enterprise Systems .....	340
<i>Blagovesta Pirelli (EPFL), Lucien Etzlinger (EPFL), David Derrier (Nexell), Gil Regev (EPFL), and Alain Wegmann (EPFL)</i>	
<b>RE@Next!</b>	
Design Thinking in a Nutshell for Eliciting Requirements of a Business Process: A Case Study of a Design Thinking Workshop .....	351
<i>Meira Levy (Shenkar College of Engineering, Design and Art) and Chen Huli (Shenkar College of Engineering, Design and Art)</i>	
LadderBot: A Requirements Self-Elicitation System .....	357
<i>Tim Rietz (Karlsruhe Institute of Technology) and Alexander Maedche (Karlsruhe Institute of Technology)</i>	
Explainability as a Non-Functional Requirement .....	363
<i>Maximilian A. Köhl (Saarland University), Kevin Baum (Saarland University), Markus Langer (Saarland University), Daniel Oster (Saarland University), Timo Speith (Saarland University), and Dimitri Bohlender (RWTH Aachen University)</i>	
BakeRE: A Serious Educational Game on the Specification and Analysis of User Stories .....	369
<i>Merle Delen (Utrecht University), Fabiano Dalpiaz (Utrecht University), and Kendra Cooper (Independent Scholar)</i>	

Don't Worry, Be Happy – Exploring Users' Emotions During App Usage for Requirements Engineering .....	375
<i>Melanie Stade (University of Applied Sciences and Arts Northwestern Switzerland), Simon André Scherr (Fraunhofer Institute for Experimental Software Engineering IESE), Patrick Mennig (Fraunhofer Institute for Experimental Software Engineering IESE), Frank Elberzhager (Fraunhofer Institute for Experimental Software Engineering IESE), and Norbert Seyff (University of Applied Sciences and Arts Northwestern Switzerland)</i>	
Gender and User Feedback: An Exploratory Study .....	381
<i>Emitza Guzman (Vrije Universiteit Amsterdam) and Andres Paredes Rojas (Universidad Nacional de General Sarmiento)</i>	
Non-Functional Requirements for Machine Learning: Challenges and New Directions .....	386
<i>Jennifer Horkoff (Chalmers University of Technology and University of Gothenburg)</i>	
Towards Effective Assessment for Social Engineering Attacks .....	392
<i>Tong Li (Beijing University of Technology), Kaiyuan Wang (Beijing University of Technology), and Jennifer Horkoff (Chalmers University of Technology and University of Gothenburg)</i>	
New RE Dimensions for Digital Ecosystems - Initial Results from an Expert Interview Study .....	398
<i>Matthias Koch (Fraunhofer IESE)</i>	
Towards Integrating Human Values into Software: Mapping Principles and Rights of GDPR to Values .....	404
<i>Harsha Perera (Monash University), Waqar Hussain (Monash University), Davoud Mougouei (Monash University), Rifat Ara Shams (Monash University), Arif Nurwidyantoro (Monash University), and Jon Whittle (Monash University)</i>	
Environment-Centric Safety Requirements for Autonomous Unmanned Systems .....	410
<i>Yixing Luo (Peking University), Yijun Yu (The Open University), Zhi Jin (Peking University), and Haiyan Zhao (Peking University)</i>	
Data-Driven Elicitation and Optimization of Dependencies between Requirements .....	416
<i>Gouri Deshpande (University of Calgary), Chahal Arora (University of Calgary), and Guenther Ruhe (University of Calgary)</i>	
Consent Verification Under Evolving Privacy Policies .....	422
<i>Marco Robol (University of Trento), Travis D. Breaux (Carnegie Mellon University), Elda Paja (IT University of Copenhagen), and Paolo Giorgini (University of Trento)</i>	

## Doctoral Symposium

Requirement Mining in Software Product Forums .....	428
<i>James Tizard (University of Auckland)</i>	
Behaviour-Driven Requirements Engineering for Agile Product Line Engineering .....	434
<i>Heba Elshandidy (Cairo University)</i>	
Mining Requirements Arguments from user Forums .....	440
<i>Javed Ali Khan (Tsinghua University)</i>	
Towards Human Values Traceability in Software: A Goal Modeling Approach .....	446
<i>Harsha Perera (Monash University)</i>	

Designing a Conversational Requirements Elicitation System for End-Users .....	452
<i>Tim Rietz (Karlsruhe Institute of Technology)</i>	
An Approach to Design Trust-Aware Goal Model and Provenance Model for Intelligent Adaptive Systems .....	458
<i>Lee Hyo-Cheol (Ajou University)</i>	
An Agile Method of Representing, Organizing, and (Re) Prioritizing Requirements in a Large Enterprise .....	464
<i>Woogon Shim (Ajou University)</i>	
Mitigating Challenges in the Elicitation and Analysis of Transparency Requirements .....	470
<i>Larissa Chazette (Leibniz Universität Hannover)</i>	
Handling Socio-Technical Barriers Involved in Crowd-Based Requirements Elicitation .....	476
<i>Talat Ambreen (International Islamic University Islamabad)</i>	

## Posters and Demos

Requirements Intelligence with OpenReq Analytics .....	482
<i>Christoph Stanik (University of Hamburg) and Walid Maalej (University of Hamburg)</i>	
RM2PT: Requirements Validation through Automatic Prototyping .....	484
<i>Yilong Yang (University of Macau), Wei Ke (Macao Polytechnic Institute), and Xiaoshan Li (University of Macau)</i>	
CARGo: A Prototype for Contextual Annotation and Reconciliation of Goal Models .....	486
<i>Novarun Deb (Ca' Foscari University), Manjarini Mallik (University of Calcutta), Anwasha Roychowdhury (University of Calcutta), and Nabendu Chaki (University of Calcutta)</i>	
T-Star: A Text-Based iStar Modeling Tool .....	490
<i>Yiwen Chen (Beijing University of Technology), Yuanpeng Wang (Beijing University of Technology), Yixuan Hou (Beijing University of Technology), and Yunduo Wang (Beijing University of Technology)</i>	
OpenReq Issue Link Map: A Tool to Visualize Issue Links in Jira .....	492
<i>Clara Marie Lüders (The Qt Company), Mikko Raatikainen (University of Helsinki), Joaquim Motger (Universitat Politècnica de Catalunya), and Walid Maalej (University of Hamburg)</i>	

## Tutorials

Software Reuse and Reusability Based on Requirements: Feature Modelling vs. Case-Based Reasoning .....	494
<i>Hermann Kaindl (TU Wien) and Mike Mannion (Glasgow Caledonian University)</i>	
RE4CPS: Requirements Engineering for Cyber-Physical Systems .....	496
<i>Zhi Jin (Peking University), Xiaohong Chen (East China Normal University), Zhi Li (Guangxi Normal University), and Yijun Yu (The Open University)</i>	



Using Metamodeling for Requirements Engineering: A Best-Practice with ADOxx .....	498
<i>Dimitris Karagiannis (University of Vienna), Moonkun Lee (Chonbuk National University), and Robert Andrei Buchmann (University Babes-Bolyai)</i>	
Security Requirements Engineering: From TARA to PenTest .....	500
<i>Christof Ebert (Vector Consulting)</i>	
Usable and Secure Requirements Engineering with CAIRIS .....	502
<i>Shamal Faily (Bournemouth University) and Duncan Ki-Aries (Bournemouth University)</i>	
Requirements Engineering Challenges in the First 1000 Days of a Venture Capital-Backed US Startup .....	504
<i>Ivan Jureta (Fonds de la Recherche Scientifique - FNRS, University of Namur)</i>	
Strategies for Data and Computation Movements in Fog Computing .....	506
<i>Pierluigi Plebani (Politecnico di Milano), Mattia Salnitri (Politecnico di Milano), and Monica Vitali (Politecnico di Milano)</i>	
Specifying Requirements through Interaction Design .....	508
<i>Hermann Kaindl (TU Wien)</i>	

## **Additional Paper**

Towards an Ontology of Requirements Engineering approaches .....	510
<i>A. Mavin (Independent Requirements Specialist), S. Mavin (Laing O'Rourke), B. Penzenstadler, and C. C. (University of Huddersfield)</i>	
<b>Author Index</b> .....	<b>513</b>