Introduction to the RE'13 special issue

RE@21: Keeping Requirements on Track

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It is a long-standing tradition to invite the authors of the best research papers from the IEEE International Requirements Engineering (RE) Conference to submit extended versions of their papers to a special issue of the Requirements Engineering Journal (REJ). This year is no exception and, as the Program Chair of RE'13, I am pleased to showcase four of the best research papers from RE'13 here.

The year 2013 was a celebratory year for the RE conference. Not only did it mark the 21st year of the conference series, RE was held in South America for the very first time, a reflection of how pervasive requirements engineering research and practice have now become around the world. RE'13 took place in the "Marvelous City" of Rio de Janeiro, Brazil, from 15th to 19th July 2013. On behalf of all those who attended RE'13, I extend congratulations to the entire local team for hosting such a memorable event.

RE'13 attracted 149 paper submissions in total, and the four papers published here are extended versions of the best from the 114 research submissions. All originally submitted research papers underwent a rigorous, two-stage blind review process, which resulted in 21 full research papers being selected for presentation at the conference. Those then invited to the special issue underwent a further independent blind review process prior to acceptance by the REJ.

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Don't wait until the end: verify your incomplete models

The first paper accepted to this special issue brings together two topics that often feature independently in RE publications: formal verification techniques and iterative/incremental software development processes. "On Requirement Verification for Evolving Statechart Specifications", by Carlo Ghezzi, Claudio Menghi, Amir Molzam Sharifloo, and Paola Spoletini, presents an approach for model checking a partial and evolving specification. The approach is supported by a verification environment, called AGAVE, which is currently implemented for hierarchical Statecharts and Next-free Path-CTL temporal logic. It permits developers to use model checking iteratively and incrementally as they refine models and progressively build a system. At the heart of the environment is a verification algorithm that is described and then exemplified through a metro advertisement system case study in the paper. The potential of this research lies in its more general applicability to any formalism supporting the concept of model refinement and, as the authors state: "is a step toward integrating formal verification into an incremental and iterative development style".

Find out how visual requirements analytics helps create an efficient path from data to decision

The second paper seeks to leverage visual analytics within requirements engineering, to keep requirements on track by establishing "an effective and efficient path from data to decision". "Visual Requirements Analytics: A Framework and Case Study", by Sandeep Reddivari, Shirin Rad, Tanmay Bhowmik, Nisreen Cain, and Nan Niu, proposes a framework through which to characterize the key components and relationships of *visual requirements*
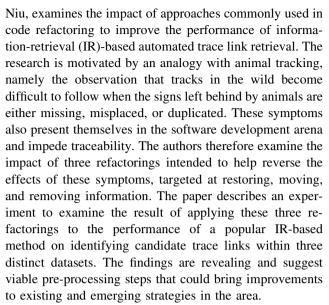
analytics, a way to visually represent requirements data so that humans can directly interact with and manipulate information to extract insight to support their requirements engineering tasks. The framework is used to evaluate a number of existing requirements-centric visualization techniques comparatively. The use of a starplot to codify the 24 conceptual dimensions of the framework provides for a visually appealing way to examine the strengths and weaknesses of the various techniques and to highlight complementary approaches. The authors also use the framework to guide the enhancement of an existing requirements visualization tool (ReCVisu), building in interactivity and analytic capability systematically (ReC-Visu+). The development process and evaluation of its results are described in the context of an industrial case study. This research highlights the promise that visual analytics can bring to our field.

In a complex application ecosystem with multiple privacy policies and stakeholders, we enable identification of conflicting data privacy requirements

The third paper tackles an important problem confronting many of today's organizations that work collaboratively to provide services—that of protecting the privacy requirements associated with data as they are transferred between systems. "Eddy, A Formal Language for Specifying and Analyzing Data Flow Specifications for Conflicting Privacy Requirements", by Travis Breaux, Hanan Hibshi, and Ashwini Rao, presents a tool-supported approach for detecting conflicting privacy requirements within and between disparate privacy policies. An analyst first identifies a subset of privacy-relevant requirements from within policy documents. These natural language requirements are then translated into a privacy requirements specification language, called Eddy. Expressed using Description Logic, this formal language supports reasoning and the automatic detection of conflicts, and permits the tracing of data flows. The approach was derived from and illustrated in the context of the privacy policies of three companies (Facebook, Zynga, and AOL Advertising). As privacy violations are the subject of regulatory enforcement, there is a pressing need for formalisms and tools, such as those presented here, to help developers ensure that practices align with policies across all tiers of a complex system.

Back to nature: restoring lost traceability tracks through refactoring

The final paper in this special issue describes an interesting advance in the line of research on automated traceability. "Supporting Requirements to Code Traceability through Refactoring", by Anas Mahmoud and Nan Niu, examines the impact of approaches commonly used in code refactoring to improve the performance of information-retrieval (IR)-based automated trace link retrieval. The research is motivated by an analogy with animal tracking, namely the observation that tracks in the wild become difficult to follow when the signs left behind by animals are either missing, misplaced, or duplicated. These symptoms also present themselves in the software development arena and impede traceability. The authors therefore examine the impact of three refactorings intended to help reverse the effects of these symptoms, targeted at restoring, moving, and removing information. The paper describes an experiment to examine the result of applying these three refactorings to the performance of a popular IR-based method on identifying candidate trace links within three distinct datasets. The findings are revealing and suggest viable pre-processing steps that could bring improvements to existing and emerging strategies in the area.

I trust that these four papers provide REJ readers with a taster of the research to expect at an RE conference, and I am delighted that two of them further reflect the theme of the 2013 conference (*RE@21: Keeping Requirements on Track*). However, the research papers are but one component of a full RE conference program, which places emphasis on research *and* practice. RE is designed for researchers, practitioners, educators, and students, and the RE'13 program also comprised: three keynote presentations, thirteen industry papers, seven workshops, six tutorials, three mini tutorials, eight posters, three panels, three new format interactive sessions, three unique sessions covering RE's Most Influential Papers and the RE@21 theme, a doctoral symposium, and a co-located event focusing on requirements engineering in Brazil. I thank the whole organizing team for designing such a vibrant program to address multiple stakeholder needs, along with the various session organizers and participants for its successful delivery. I especially thank our excellent keynote speakers for anchoring the main days of the conference, Neil Maiden and Fiona Cousins, and our keynote panelists for bringing the conference to a close with perspectives from Brazilian industry: Karin Breitman, Roberto Leite, and Jaime Sábat.

This special issue is the result of a long process supported by many people. Springer's REJ continues to be the ideal place to disseminate the RE conference's distinguished research, and I particularly thank the editorial team for fostering such a productive relationship and for assisting with every step of this special issue process. I would also like to acknowledge two important constituencies. First, I thank the members of the Program Board and Program Committee of RE'13. These are the people who work behind the scenes to ensure that high-quality research

is both encouraged and brought to the forefront at an RE conference. They represent every area of the requirements engineering field and comprise researchers at all stages in their career. I am especially grateful to those who took on the additional task of reviewing for this special issue, long after their conference task was complete. Second, I thank all the authors who took the time to write research

submissions for the RE'13 conference. It is through the research they conduct, coupled with an enthusiasm to report it at RE, that the conference has remained on track as the premier forum for requirements engineering over its 21 years. The community next meets for RE'14 in Sweden, then for RE'15 in Canada, so please consider joining us to secure a long-standing tradition.[1]

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[1] For more information on past and upcoming RE conferences, please visit: http://requirements-engineering.org/.