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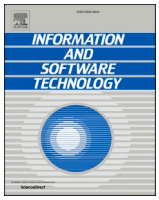

Editorial

Requirements engineering: Foundation for software quality (REFSQ2020)

Guest editors

Requirements Engineering (RE) is an important activity in the development of high-quality software, systems and services. RE methods, tools and processes support the engineering of systems of different types, scale, and complexity, and are used in a variety of application domains involving stakeholders of different types. The International Working Conference on Requirements Engineering: Foundation for Software Quality (REFSQ) is a long-established international forum for publishing and discussing current and state-of-the-art Requirements Engineering (RE) theory and practices. The 26th edition of the REFSQ conference (REFSQ 2020) was one of the first virtual software engineering conferences during the pandemic. To acknowledge the technical contributions of the research papers published at the REFSQ conference series, we decided to organize a special section of the Information and Software Technology journal associated with the REFSQ 2020 edition.

For REFSQ 2020, we sought insightful contributions describing novel ideas and techniques that (1) enhance the quality of RE artefacts, products and processes, (2) reflect on current research and industrial RE practices, and (3) provide new views on RE. We invited submissions on any aspect of RE and encouraged researchers and practitioners from the RE, software engineering, and related fields to present original work. In particular, we encouraged contributions from complementary fields, such as systems engineering, economics, management, and social sciences, providing new insights into RE.

We also solicited submissions on the special theme of the conference "*RE & Cyber-Physical Systems*", which aims to explore the role that RE can play in the design of Cyber-Physical Systems. These systems should achieve the required smartness while dealing with the complexity arising from the scale, connectivity, and uncertainty inherent in their operating environment, and we encouraged studies on RE methods to support the development and evolution of these next generation systems.

We invited the authors of the best REFSQ 2020 papers to submit substantially extended manuscripts for consideration in this Special Section. The five submissions underwent peer-review, which included two of the REFSQ 2020 PC members who reviewed the conference version of the paper along with a third reviewer chosen from the remaining members of the REFSQ20 PC and researchers active in the Requirements Engineering community. After the review process, and subsequent revisions, we accepted all 5 submissions. These manuscripts concern a variety of topics within the field of Requirements Engineering, as summarized below.

The first article, "Improving Requirements Specification Use by Transferring Attention with Eye Tracking" by Ahrens and Schneider, aims to ease the reading of requirements specifications. The core aspect of their approach is to create visualisations from eye-tracking data generated by previous readers of the given specifications. These visualisations are subsequently made available to new readers familiarising with those specifications to help them to find relevant information more efficiently. The authors report on an experiment they conducted to investigate the influence of different "attention visualization" features on the specification-reading process of agents such as software architects, UI-designers and testers.

The second article, "On Deriving Conceptual Models from User Requirements: An Empirical Study" by Dalpiaz et al., describes two empirical studies that assess the adequacy of the common requirements notations of textual use cases and user stories to support manual derivation of a structural conceptual model that represents the system domain. In a first time-constrained classroom experiment, user stories outperform use cases, leading to significantly better conceptual models when compared to a gold standard. However, in a second quasi-experiment conducted over multiple weeks, the authors observe that the quality of the conceptual models is not affected by the notation used, but rather by the complexity of the considered case, and by the approach used by the participants to derive the models. When participants follow a more systematic process, the completeness of the conceptual models with respect to the gold standard is significantly increased.

The third article, "Automated Formalization of Structured Natural Language Requirements" by Giannakopoulou et al., describes a framework for automatically translating the requirements of cyber-physical systems into temporal logic formulas, and guaranteeing that the translation is correct with respect to the intended meaning of the requirements. . Requirements are written using the Fretish structured natural language, whose semantics can be expressed through Real-Time Graphical Interval Logic (RTGIL). The presented framework first translates the requirements into temporal logic formulas, and then checks that the translation conforms to the expected RTGIL semantics through testing and equivalence checking. This is performed with the support of the nuXmv model checker. The overall approach is implemented in a tool called FRET, which is made publicly available by the authors.

The fourth article, "Analyzing Privacy Policies through Syntax-Driven Semantic Analysis of Information Types" by Hosseini et al., contributes to addressing the problem of avoiding ambiguous terminology in privacy policy statements, when these use abstract information types (e.g., "we collect your device information"). In particular, the paper describes a syntax-based NLP technique to identify phrases that refer to information types, and infer semantic relationships (hypernymy, meronymy, and synonymy) between information types. The approach achieves a precision between 0.76 and 0.99, when compared with

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different ground truths produced by experts and non-experts. The authors suggest that the method can be exploited to facilitate the construction of ontologies that represent semantic relations between information types. These ontologies can be used by authors of privacy policies to support the selection of unambiguous terms when referring to information types.

The fifth article, "Alignment and Granularity of Requirements and Architecture in Agile Development: A Functional Perspective" by Spijkman et al., addresses some of the issues related to maintaining alignment between requirements and software architecture. The paper describes a model that assists practitioners in analyzing the alignment and the granularity of functional requirements and architectural components. The proposed approach is applied to two case studies. The results show that the proposed model and associated evaluation metrics help practitioners pinpoint problems with the relationship between functional requirements and architecture.

Managing this special issue was an insightful experience for us and would not have been possible without the hard work of all the reviewers, who provided important feedback to the authors of the submitted articles. We are also very grateful for the gracious support of IST Journal's Special Content Editor Jeffrey Carver, whose help was vital for the preparation of this special issue. We also wish to extend our sincere gratitude to the authors, reviewers, and chairs of the REFSQ working conference series. The research presented in this special section builds upon the pioneering foundations laid by those contributors.

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