

Software Engineering in Society

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MODERN SOFTWARE SYSTEMS pervade our lives. They have become more open and hyperconnected, manage large amounts of our personal data, and are used to support the lives of individuals and communities and the functions of businesses and governments. They are a part of our society and play an important role in shaping it.

Software, in addition to its traditional roles, is increasingly playing a fundamental part in addressing major societal challenges, from improving

receiving research contributions that explored the synergies of software engineering with a broad spectrum of disciplines including the following:

- health (e.g., health informatics and software technologies for the aging)
- physical sciences (e.g., computational chemistry and genomic biotechnologies)
- environmental sciences (e.g., sustainability, urban planning, ecology, and climate change)

- arts (e.g., digital art and the performing arts) and crafts (e.g., do-it-yourself electronics)
- interdisciplinary research (e.g., cognitive science and digital social innovation).

In addition, a particular, overarching focus was also on work that emerged from research partnerships with communities, nongovernmental organizations cultural institutions, and the public/private sector as well as research reflections on the long-term implications of digital technology interventions on all aspects of society.

For this special issue, we received a total of 18 article submissions, all of which underwent a thorough peer-review process. Each submission was evaluated by three conflict-free external reviewers. Relying on the reviewers' assessments, we made an acceptance or rejection decision about each manuscript. The submissions we received concerned widely varying and complementary topics—exactly as we had hoped.

One article was concerned with gender diversity, in particular, analyzing its ability to mitigate undesired communication patterns in software communities. Another article provided strategies that developers can use to maximize security in practice using online communities. Four were concerned with how to incorporate ethics and human values into software production and into computer science education. Civic tech practices and the issues that have emerged over the years were discussed in two articles, while two others focused on the growth of software for sustainability. Three articles tackled the development of mobile apps and services for the “sharing economy” as well as its citizens (e.g., to reduce the digital divide between farmers and information

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the quality of health care, manufacturing and transportation systems, to ensuring sustainable living, fighting cybercrime, protecting the rights of citizens, and reducing the digital divide. As such, software engineering has a duty to society beyond the narrow technical goals of creating systems that meet their cost, schedule, and quality goals.

Acknowledging the many important roles embraced by software engineering practitioners in society today, we decided to organize a special issue of *IEEE Software* on this topic. This theme, which entails primarily innovative and inspiring research, with a clear impact on software engineering challenges, directions, methods, and tools, focuses on the concerns beyond those of traditional software engineering research. We anticipated

- social sciences (e.g., ethics, software fairness, and regulatory compliance)
- management (e.g., sociotechnical ecosystems, technical debt, and social debt)
- economics (e.g., electronic payments and blockchain technologies)
- computing and engineering (e.g., human-computer interaction, AI, data science, and distributed computing)
- security, safety, and privacy (e.g., security-, safety-, and privacy-preserving software development)
- policing (e.g., combating and investigating crime)
- manufacturing (e.g., Industry 4.0 and smart factories)
- engineering emerging cyberphysical systems (e.g., autonomous vehicles and smart cities)

and communications technology infrastructure). Another article analyzed the social, practical, and methodological challenges of developing cyberphysical production systems in factories. Others reported on software patterns that represent human components, characterized developers by using their code searches, reflected on knowledge transfer in software engineering, and described the results of a survey to understand the role of software in the public and private sectors.

Out of 18 submissions and after a rigorous peer-review cycle, three submissions were selected for inclusion in this special issue of *IEEE Software*. The first article, “Gender Diversity and Community Smells: Insights From the Trenches,” by Catolino et al., surveys 60 software practitioners to understand the correlations between gender diversity and communication antipatterns found within software communities. One of the main findings of this article is that, although practitioners value communication skills, they seem not to perceive the phenomenon of gender diversity as an important factor that could be employed to mitigate the presence of community smells.

In “Critical Requirements Engineering in Practice,” Duboc et al. describe a collaborative action research project that demonstrates how crucial systems heuristics can be used in the context of requirements engineering to achieve a critical awareness of power and politics to support an analytical reflection on boundary judgments as well as support requirements professionals in understanding the selectivity of their choices.

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Finally, in the third article, “Taking the Middle Path: Learning About Security Through Online Social Interaction,” Lopez et al. analyze message exchanges on Stack Overflow to understand how security and secure practices were informally developed and disseminated among practitioners. Their study suggests that informal learning through social interaction is the “middle path” for security practices. Websites such as Stack Overflow are relevant resources for supporting informal learning, allowing developers to thoughtfully connect with, and tend to, security problems.

Managing this special issue was a great experience for us and would

not have been possible without the hard work of all our reviewers, who provided important feedback to the authors of the submitted articles. We are also very grateful for the gracious support of *IEEE Software*’s Editor in Chief Ipek Ozkaya, whose help was vital for the preparation of this special issue. And we also wish to extend our sincere gratitude to the many authors, reviewers, and chairs of the Software Engineering in Society track at the International Conference on Software Engineering over the past five years. The research presented in this special issue of *IEEE Software* builds on the pioneering foundations laid by those contributors. ☺