SASO 2014: Selected, Revised, and Extended Best Papers

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The international conference IEEE SASO (Self-Adapting and Self-Organizing Systems) is the main forum for studying and discussing the foundations of a principled approach to engineering systems, networks, and services based on self-adaptation and self-organization. Over the past decade, it has consolidated as the primary scientific conference for sharing ideas on algorithms, technologies, tools, and applications across a wide range of scientific fields. In 2014, the conference was hosted by Imperial College in London, United Kingdom; its scientific program comprised full papers, short papers, poster presentations, demo sessions, workshops, and tutorials. This special issue of *ACM TAAS* champions some of the most solid research results of SASO 2014, presenting selected, revised, and extended best articles.

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1. INTRODUCTION

The international conference IEEE SASO (Self-Adapting and Self-Organizing Systems) is the main forum for studying and discussing the foundations of a principled approach to engineering systems, networks, and services based on self-adaptation and self-organization. The complexity of current and emerging networks, software, and services, especially in dealing with dynamics in the environment and problem domains, has led the software engineering, distributed systems, and management communities to look for inspiration in diverse fields (e.g., complex systems, control theory, artificial intelligence, sociology, and biology) to find new ways of designing and managing such computing systems. In this endeavor, self-organization and self-adaptation have emerged as two promising interrelated approaches: on the one hand, self-adaptation is often used to identify how to change specific behavior to achieve the desired improvement to a system; on the other hand, self-organization challenges the prediction and control of global system behavior out of local computation and interaction mechanisms.

In 2014, the conference was hosted by Imperial College in London, United Kingdom. It embraced the interdisciplinarity and the scientific, empirical, and application dimensions of self-* systems, and attracted participants with different backgrounds,

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to foster cross-pollination among research fields, and to expose and discuss innovative theories, design principles, frameworks, methodologies, tools, and applications. The call for papers included the following main topics:

- Self-* systems theory*: Theoretical frameworks and models; biologically and socially inspired paradigms; interoperation of self-* mechanisms;
- Self-* systems engineering*: Reusable mechanisms, design patterns, architectures, methodologies; software and middleware; development frameworks and methods, platforms, and toolkits; hardware; self-* materials;
- Self-* system properties*: Robustness, resilience and stability; emergence; computational awareness and self-awareness; reflection;
- Self-* cyber-physical and sociotechnical systems*: Human factors and visualization; self-* social computers; crowd-sourcing and collective awareness;
- Applications and experiences of self-* systems*: Cyber-security, transportation, computational sustainability, big data, creative commons and power systems.

This special issue of *ACM TAAS* presents selected, revised, and extended best articles, championing some of the most solid research results discussed at the conference. With the help of a Program Committee formed by 60 international experts, SASO 2014 accepted 16 full papers (corresponding to an acceptance rate of about 26%), and 3 short papers. Out of these papers, 5 were selected based on a combination of the review evaluation reports and the quality of the presentations, and invited for submission to *TAAS*. They underwent a very thorough review process conducted by the *TAAS* editors and invited reviewers, at the end of which 2 papers were selected for publication, as briefly presented here.

The article “Artificial Immunology for Collective Adaptive Systems Design and Implementation,” by Nicola Capodieci, Emma Hart, and Giacomo Cabri, follows a classic methodology for advancing self-adapting and self-organizing systems: it draws inspiration from a natural phenomenon and accordingly designs a self-* technique useful for a broad set of applications. More specifically, concepts (such as antibody and lymph nodes) and mechanisms (such as idiotypic network regulation, antibody generation and composition) from Artificial Immune Systems are exploited to provide a methodology for designing autonomous systems that exhibit self-expression, namely, the ability of a system to dynamically change its architecture and coordination pattern in response to unexpected contingencies. The idea is applied to several case studies including swarm robotics, virtual creature evolution, and morphogenetic engineering.

The article “Controlling Negative Emergent Behavior by Graph Analysis at Runtime,” by Jan Kantert, Sven Tomforde, Melanie Kauder, Richard Scharrer, Sarah Edenhofer, Jörd Hähner, and Christian Müller-Scholer, takes a different stance: it aims at finding a generally applicable result for controlling the behavior of emergent phenomena in self-organized systems. Assuming a system of heterogeneous autonomous entities, possibly including subgroups of malicious agents, it detects negative emergent phenomena and is able to isolate such subgroups, resulting in a stable system in which negative effects are hence avoided. This is achieved by a feedback loop centered around construction and analysis of graph representations of trust and work units.

We would like to conclude this special issue introduction by expressing our considerable gratitude to everyone who contributed to the SASO 2014 scientific program, and to this Special Issue as one key result. We are, of course, indebted to the entire Technical Program Committee for their commitment and enthusiasm in all phases of the reviewing process, and for the quality and insight of their reviews. We also thank the Steering Committee, the Advisory Committee, and the chairs of previous SASO editions for their feedback on past experiences and general advice along the way, which was extremely helpful. Finally, many thanks to the *TAAS* Editors-in-Chief Manish Parashar and Franco Zambonelli for the opportunity to produce this special issue.