

Editorial

Special Issue: Agents and Robots for Reliable Engineered Autonomy

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The study of autonomous agents is a well-established area that has been researched for decades, both from a design and implementation viewpoint. Nonetheless, the application of agents in real-world scenarios is largely adopted when logical distribution is needed, but it is still limited when physical distribution is necessary. In parallel, robots are no longer used only in industrial applications but are instead applied in an increasing number of domains, ranging from robotic assistants to search and rescue. Robots in these applications often benefit from (or require) some level of (semi or full) autonomy. Thus, multi-agent solutions can be exploited in robotic scenarios, considering their strong similarity both in terms of logical distribution and interaction among autonomous entities.

The autonomous behavior responsible for decision making should (ideally) be verifiable since these systems are expensive to produce and are often deployed in safety-critical situations. Thus, verification and validation are important and necessary steps toward providing assurances about the reliability of autonomy in these systems. Likewise, software engineering techniques are an integral part of development in order to make sure that the systems meet requirements.

This Special Issue brings together researchers from the autonomous agents, software engineering and robotics communities, as combining knowledge from these three research areas may lead to innovative approaches that solve complex problems related with the verification and validation of autonomous robotic systems. We (the Special Issue editors) have written a perspective paper (peer-reviewed by members of the editorial board of the journal) that is included in our Special Issue [1]; in the perspective, we give an overview of recent research trends for researchers that aim at working in the intersection of these research areas.

This Special Issue was created based on the topics discussed at the First Workshop on Agents and Robots for reliable Engineered Autonomy (<https://area2020.github.io/> accessed on 30 June 2021) (AREA 2020). One of the accepted papers in the workshop was invited to extend their work and underwent additional peer-review evaluation before being accepted for publication [2]. Paper [2] contains details about an architecture for linking robots with autonomous agents applied to a case study of campus mail delivery.

The other three remaining papers, refs. [3–5], were all new submissions. Paper [3] introduces a novel formal verification approach by combining the use of two well-known model checkers to verify the decision making in self-driving vehicles; it evaluates the resulting hybrid technique on a robotic simulator with a rational agent performing the decision making. Paper [4] is also applied to the autonomous automotive domain using agent-based control, but it is focused on the traffic rules that govern road junctions; it



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applies two different model checkers to assess the behavior of the agent at two different levels (design and development). Paper [5] provides an interpretation of the multi-agent systems as part of the aggregate programming paradigm to support the programming of collective autonomous behavior. Table 1 shows an overview of the main areas discussed in each paper of the Special Issue.

Table 1. Distribution of the papers across the main areas of the Special Issue.

	Autonomous Agents	Robotics	Verification and Validation	Software Engineering
Paper [1]	✓	✓	✓	✓
Paper [2]	✓	✓		
Paper [3]	✓	✓	✓	
Paper [4]	✓		✓	
Paper [5]	✓			✓

We hope that the different research communities that are represented in our Special Issue will improve their collaboration efforts in the future so that the best proposals from these different areas can be combined to create new and exciting solutions and tools to be exploited both in academia and in industry.

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