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# Introduction to the special issue on NorMAS 2009

In March 2009, the fourth NorMAS (Normative Multi-agent Systems) was held at Schloss Dagstuhl Leibniz Center for Informatics. During the seminar, around 30 invited participants presented their current research, and discussed ongoing work and open problems discussed. This special issue presents a few of the papers discussing formal models (both logic and computational implementations) and normative concepts of relevance to the area.

The paper by Cranefield and Winkoff [1]<sup>1</sup> focuses on monitoring of expectations during runtime (online) and before execution (offline). In the paper a linear temporal logic of expectation, fulfillment and violation of norms is presented. Path truncation is used to solve problems connected to the lack of future information in the offline case. For both the online and offline case, algorithms and model checkers are presented as well.

In the paper by Criado, Argente and Botti, the authors continue their work on norm-aware agents, now turning their attention to the design of an institutional framework that incorporates executable norms as a key component. In fact, the authors take an existing agent platform, THOMAS, which was originally devised for agent-enabled virtual organizations, and add to it different types of norms and enforcement mechanisms. The authors discuss the representation in THOMAS of constitutive, regulative and procedural norms. Noteworthy is their decision to include agreements and contracts as particular types of regulative norm. The authors then proceed to propose an operational semantics for their framework and report on their implementation of the framework.

Dastani et al. present a programming language designed to implement normative artifacts, where the behavior of the agents is regulated by means of norms that are enforced by monitoring and sanctioning mechanisms. Moreover, a logic to specify and verify properties of programs developed of programs that implement norm-based artifacts is introduced.

Multi-agent systems are increasingly created as open systems, hence requiring more design flexibility. In order to tackle this problem, Derakhshan, Bench-Capon and McBurney introduce a method for the dynamic assignment of roles, rights and responsibilities in normative multi-agent systems at run-time. Their method is based on the representation of norms as conditional rules, where the preconditions state various runtime occurrences. The approach proposed is extremely flexible and framework-independent. This means that it can be overlaid to any multi-agent system intended to have norm enforcement.

Lam and Governatori propose a non-monotonic rule based system combined with numerical computation methods to solve the UAV (Unmanned Autonomous Vehicle) routing problem, that consists of having all UAVs travel to the destination without colliding with each other.

Okuyama, Costa and Bordini discuss an original notion of normative objects whose pragmatics is situated. Actually, the paper summarizes their main contributions on normative architectures that are situated and distributed. The gist of their contribution is the idea that there are ways of regulating agent interactions that make sense only when particular situations arise. For instance, the sign “no parking on weekdays from 8 to 20” is a normative object that applies in the context of a particular physical location and at particular time intervals. That intuition, that might seem rather innocent, is shown in this paper to deserve a thorough treatment in order to make it precise, operational and

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<sup>1</sup>This paper was published in volume 21 of *Journal of Logic and Computation*. doi: 10.1093/logcom/exq055

practical in large-scale realistic normative MAS. A treatment that happens to be comprehensive, coherent and convincing in this paper.

Cooperative Boolean games are a family of coalitional games where agents may depend on each other for the satisfaction of their personal goals, and where agents have preferences over possible coalitions. One of the solution concepts introduced for those games is the notion of core. Sauro and Villata present an approach to improve the computation of the core by means of the dependence networks associated to a cooperative Boolean game.

Following this NorMAS, two more NorMAS workshops have been organized (in 2010 and 2011 respectively) and the 7th NorMAS workshop will take place in August 2013 at the Lorentz Center in Leiden (the Netherlands).

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## Reference

- [1] S. Cranefield and M. Winikoff. Verifying social expectations by model checking truncated paths. *Journal of Logic and Computation*, **21**, 1217–1256, 2011.