



Séminaire Systèmes Complexes

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Vadim Malvone
Télécom Paris, IP Paris

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Vidéo recording :



Formal Verification for Multi-Agent Systems: Theory and Practice

Abstract Game theory in AI provides a powerful mathematical framework that has been widely applied over the past three decades for strategic reasoning in multi-agent systems. Early work in this area began with turn-based, two-player games (under both perfect and imperfect information). Since then, significant efforts have extended these approaches to multi-agent settings, particularly for efficiently analyzing solution concepts like Nash Equilibria. A key application of game theory in AI is formal system verification, where it serves as an invaluable tool for verifying reactive and embedded systems. Major breakthroughs include the development of strategic reasoning logics, such as Alternating-time Temporal Logic and Strategy Logic, along with their extensions. These advances provide the theoretical foundation for reasoning about complex interactions in multi-agent systems, but applying them in practice remains challenging. In fact, verifying multi-agent systems in realistic scenarios remains difficult: existing tools are often limited, hard-coded, and lack compositionality, making them hard to use. To bridge this gap between theory and practice, we present VITAMIN, a modular and extensible methodology for the formal verification of multi-agent systems, along with an initial prototype implementation. Unlike existing frameworks, VITAMIN is designed to be easily adaptable to different logics (used to specify properties) and models (used to define the systems under verification), making it a flexible and user-friendly alternative in the field. In this talk, we will present the main elements of this research area, highlight some of our contributions, and demonstrate how VITAMIN can support the formal verification of multi-agent systems in a practical and extensible way.

Speaker Bio Dr. Vadim Malvone is an expert in multi-agent system verification with over ten years of research experience. He earned his Ph.D. in 2018 from the University of Naples, Federico II, with a focus on strategic reasoning in game theory. After completing a postdoctoral position at the University of Evry (2018–2020), he became an associate professor at Télécom Paris in 2020. In 2024, he obtained the HDR (Habilitation à Diriger des Recherches) in Computer Science, Data Science, and Artificial Intelligence. Dr. Malvone has co-authored over 80 publications in formal verification and game theory. He actively mentors postdoctoral, doctoral, and master's students, leading projects on formal verification, strategic reasoning, and cybersecurity.



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