

SEMINAR ANNOUNCEMENT

Friday February 28th, 2025

at 10:00 am

Room "Sala Seminari" - Abacus Building (U14)

Distributed Coordination in Decentralized Cyber-Physical Systems: Solutions, challenges, and applications to Emergency Management and Multi-Robot Systems

Speaker

prof. Marin Lujak,

University Rey Juan Carlos in Madrid

Abstract

In this talk, we focus on Decentralized Cyber-Physical Systems (CPS), where software agents in networked devices, such as robots, sensors, and autonomous vehicles, coordinate autonomously through wireless networks without shared memory. These systems are essential for scalable, sustainable designs in large, complex physical systems with multiple stakeholders. The talk will address how to efficiently coordinate these systems to balance individual interests and overall

system performance using distributed optimization and multi-agent systems (MAS). We will explore models and architectures for task allocation, vehicle routing, and emergency evacuation, with a focus on distributed and decentralized algorithms that solve coordination problems while optimizing both individual and collective objectives. The goal is to design decision-making systems in which agents act in their own best interest while adhering to system constraints and fairness criteria, ultimately ensuring globally efficient behaviour. Additionally, we will discuss how to encourage collaboration without relying on negative reinforcement. Real-time coordination, based on advances in sensory and communication technologies, will also be highlighted. Applications include distributed coordination of Emergency Medical Services and evacuation routes for buildings or cities, as well as the coordination of autonomous mobile robot fleets in an agriculture cooperative.

Short Bio

Marin Lujak is a Distinguished Researcher Lecturer at the University Rey Juan Carlos in Madrid, Spain, specializing in distributed and decentralized methodologies for coordinating large, complex multi-agent systems with limited resources. With over 80 peer-reviewed papers, his research spans smart and green transport, emergency management, and multi-robot coordination. Previously an Associate Professor at IMT Lille Douai, University of Lille, France, Marin has held leadership roles in various academic organizations, including serving as a member and treasurer of the board of the European Association for Multi-Agent Systems. He is also an Associate Editor for the IET Collaborative Intelligent Manufacturing journal and a guest editor for multiple special issues in internationally renowned peer-reviewed journals. Marin has co-chaired numerous international conferences and workshops (e.g., Poster Chair of the ACM/SIGAPP Symposium on Applied Computing SAC 2024, co-chair of the workshop ASSIA@PAAMS'22-PAAMS'25 and the Workshop on Agents in Traffic and Transportation ATT@ECAI20,22,24) and has served as a PC member for over 100 conferences and workshops. He has been an independent expert and project evaluator for agencies such as the Spanish State Research Agency AEI, the French National Research Agency ANR, and the Israel Science Foundation. Fluent in multiple languages, Marin is a co-supervisor for PhD students in co-tutelle with other international universities and has served on doctoral thesis committees internationally.