



21st
International
Conference on
Operational
Research

September 23-25, 2026,
Brela Croatia

PLENARY LECTURE

Advances in group consensus-seeking procedures – from disaggregation analysis to agentic AI

KEYNOTE SPEAKER

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PLENARY LECTURE ABSTRACT

Consensus-seeking and negotiation processes are an important topic in the theory and practice of multi-criteria decision-making. Many approaches have been developed over the past decades. Recently, autonomous AI agents have become increasingly relevant in decision systems and collaborative processes. They rely on machine learning and LLMs (Large Language Models) to facilitate human decision-makers. However, the aggregation-disaggregation analysis was established before the rise of agentic AI as an approach that follows the paradigm of constructive learning to advance classical machine learning. As a regression-based technique, it derives preferential parameters from holistic decisions, provides thorough insight into the multi-criteria model, and enables decision-makers to refine their judgments and knowledge across consecutive iterations.

We present the evolution of group consensus-seeking approaches from the aggregation-disaggregation paradigm to contemporary cooperative multi-agent systems. We focus on several approaches we developed to address different preference structures, including outranking, value functions, and hybrid Delphi procedures. Furthermore, we address the necessity of robustness and proximity measures to achieve convergence. Based on the complementary capabilities of both paradigms, we incorporate agents into multi-criteria consensus-seeking processes to automate decision-making, reduce cognitive load, and enhance the elicitation and modelling of preferential information.

At the center of such processes, an autonomous multi-agent consensus-seeking protocol applies integrative negotiation, agent collaboration patterns, agent coalition building, dynamic constraints, proximity measures, and aggregation-disaggregation analysis. Agents participate in this protocol to represent decision-makers at multiple organizational levels across all phases of the decision process.

We also discuss possible applications of consensus-seeking procedures, with a special focus on the energy sector and group multi-criteria decision-making methods for cybersecurity. We present a multi-agent protocol that advances a collaborative Delphi methodology for cyberattack mitigation, facilitating proactive and reactive cybersecurity strategies. In the intelligence and design phases, agents leverage LLMs to reason about attack techniques and help develop mitigation strategies. A key aspect of the choice phase is modelling, aggregation, and disaggregation of preferences to achieve convergence of opinions on the most cost-effective strategies.

Finally, many issues arise related to automated systems making decisions or judgments based on AI and LLMs, including bias, ethical concerns, user trust, lack of expertise, loss of human oversight, transparency, and reliability. We expose and systematize these factors in the context of agentic decision processes.

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