IEEE ICUS 2021

Invited Session Summary

Title of Session

Distributed and Scalable Schemes for Multi-agent Decision Making over Networks

Name, Salutation, Affiliation and Email of Organizers

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Details of Session(including aim and scope)

Multi-agent decision making over networks has recently attracted an exponentially growing number of researchers from the systems and control community in the past few years. The area has gained huge momentum in various fields including engineering, social sciences, economics, urban science, and artificial intelligence, as it serves as a prevalent framework for studying large and complex systems, and has been widely applied in tackling many problems arising in these fields, such as smart grid management, traffic control, wireless and communication networks, cybersecurity, as well as multi-agent autonomous systems. Due to the proliferation of advanced technologies and services in modern network applications, solving the decision-making problems in multi-agent networks calls for novel models and approaches.

In the cooperative network settings, the agents want to collectively optimize the objective being the sum of local cost functions, while in the noncooperative settings, each agent has an individual objective depending on its rival agents' decision variables. As such, the cooperative and noncooperative decision-making problems in multi-agent systems can be respectively modelled as distributed optimization over graphs and games played on networks.

However, in a large-scale multi-agent networked scenario, agents are inherently limited to being observable by or communicating with a few other neighbors. The main challenge lies in how to design the distributed and scalable algorithms for finding the optima or Nash equilibria, where the computation is distributed among the agents and is based on local communication with some neighbouring agents over a network typically modelled as a graph.

Our purposes for organizing this session are as follows. Firstly, promote discussions among some active researchers working on optimization and game-theoretic problems that arise from networks. The second is to provide some recent advances in this field from a variety of perspectives, such as new methods, innovative analytic tools, and some recent applications.

The final goal is to attract more researchers to participate in the exploration of this promising research area.