

Open Invited Track IFAC WC 2023

Control for Socio-Technical Network Systems

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Abstract: The confluence of methods from control, game theory, and network science is increasingly driven by applications to large-scale complex socio-technical systems. Socio-technical systems are defined by the co-presence and interdependence of technological and human/social elements. Socio-technical systems appear in diverse domains of society and technology. Chief examples are *transportation systems*, in which the physics of traffic interplays with the collective choices of the users (drivers, pedestrians, commuters), as well as *social media*, in which users interact through online platforms (such as Facebook or YouTube) that act as information gate-keepers. Overall, these systems require specific tools to capture their salient features, including their intrinsic heterogeneity, the large size of the users' pool, the increasing role of Artificial Intelligence in their operation, the role of human decision making and the variety of spatial and temporal scales that are involved in their dynamics.

This session aims to establish a forum to discuss both general methodologies and domain-oriented contributions, including collaborations with domain experts (social scientists, psychologists, transportation experts, and so on).

Detailed description:

Socio-technical systems, characterized by the interplay between technology and humans, are becoming more and more prominent in our society. From a control perspective, these systems introduce a number of new challenges related to their large dimension, their network dependence, and the presence of humans making autonomous and selfish decisions. In the last few years, researchers have started tackling these challenges by relying on methods that integrate control techniques and graph-theoretical methods with economics concepts (e.g., game theory, mechanisms design) as well as machine learning, data-driven techniques and artificial intelligence.

For example, in the area of transportation systems game theoretical tools have been successfully used to model the outcome of selfish routing decisions as well as design effective intervention policies (such as tolls or personalized routing recommendations). Still a number of open questions remain in particular related to the systemic effects of new technologies such as routing apps, on-demand services and autonomous mobility.

The interplay between humans and technology is also apparent in the analysis and effects of online social media. Researchers in this area have focused on the effect of online social interactions on opinion formation and on the spread of new technologies/epidemics. Yet a number of open questions remain related to the role of social media platforms as aggregators and their effect in inducing extreme behaviors (eco-chambers, fake views), as well as planning of regulations aimed at counteracting these negative effects.

The objective of this Open Invited Track is to assemble new advances in the analysis and control of these socio-technical systems, with specific focus on interdisciplinary approaches advancing the state of the art.

A non-exhaustive list of topics includes but is not limited to:

- Resilience and optimization of transportation networks;
- System-level impact of increasing connectivity and automation in transportation systems;
- Multi-modal transportation networks;
- Opinion dynamics in social networks;
- Information cascades and rumors spreading in social networks;
- Game-theoretical methods (congestion games, mechanism design);
- Mean-field methods (mean-field games, graphons);
- Design of interventions in socio and economic networks;
- Information design.