Electrical & Computer Engineering

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Louisiana State University

Notions of Resilience in Large-Scale Networks, with Applications to Distributed Coordination, Optimization, and Learning

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Abstract—A key challenge in large-scale networks is to allow each agent to learn the true state of the world, based on its own measurements and information that it obtains from others in the network. For example, in autonomous swarms and sensor networks, what information should the agents (drones and sensors) exchange with each other in order for the swarm to understand its environment? Similarly, in social networks, how should individuals incorporate the opinions of their friends when updating their own beliefs about the world? The challenge of learning in such settings is made even more difficult when malicious agents in the network spread misinformation to prevent the other agents from learning the true state.

In this talk, we will provide an overview of classes of networked dynamics (or algorithms) that have been studied over the past decade for resilient coordination and learning in networks. In particular, we will describe a simple general-purpose approach to enabling resilience to adversarial nodes in several classes of distributed coordination and optimization dynamics, based on each node removing a certain number of the most extreme values in its neighborhood at each time-step. In the process, we will identify key insights about the interplay between network topology and dynamics in the context of creating more resilient networked systems.

Bio—Shreyas Sundaram is the Marie Gordon Professor in the Elmore Family School of Electrical and Computer Engineering at Purdue University, and Co-Director of the Institute for Control, Optimization and Networks (ICON). He received his Ph.D. in Electrical Engineering from the University of Illinois at Urbana-Champaign in 2009, and was a Postdoctoral Researcher at the University of Pennsylvania from 2009 to 2010. He was an Assistant Professor at the University of Waterloo from 2010 to 2014. His research interests include control of distributed and multi-agent systems, fault-tolerant and secure control, game theory, and network science. Dr. Sundaram is a recipient of the National Science Foundation CAREER award, and the Intel Outstanding Researcher Award. At Purdue, he received the Dean A. A. Potter Award for Teaching Excellence, the Dean H. T. Yang Leadership in Service Award, the HKN Outstanding Professor Award, the Outstanding Mentor of Engineering Graduate Students Award, the Hesselberth Award for Teaching Excellence, and the Ruth and Joel Spira Outstanding Teacher Award.

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