

COLLEGE OF ENGINEERING

Control Seminar



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New Approaches to Distributed Hypothesis Testing and State Estimation in Large-Scale Networks



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March 5, 2021 @ 3:30 pm - 4:30 pm
Event will take place via Zoom

ABSTRACT: Applications in environmental monitoring, surveillance, and industrial control require a network of (mobile) agents to cooperatively understand the state of the world based on their local measurements and the information that they obtain from their neighbors. However, these networks of mobile agents also introduce various challenges for distributed state estimation and hypothesis testing, including intermittent or partially informative observations of the system state, loss of communication links due to mobility and packet drops, and the potential for misbehavior by some of the agents. In this work, we describe new ways to solve distributed hypothesis testing and state estimation problems that account for these various challenges. We first tackle the problem of distributed hypothesis testing, and propose a novel technique to allow each node in the network to rapidly identify the true state of the world. We then propose a simple method to design distributed observers for dynamical systems for the most general class of systems and networks possible, and show how such observers can be extended to handle a broad class of time-varying networks. We further describe how our approaches can be extended to be resilient to adversarial nodes that inject misinformation into the network.

BIO: Shreyas Sundaram is an Associate Professor in the School of Electrical and Computer Engineering at Purdue University, and a Co-Director of the Center for Innovation in Control, Optimization, and Networks (ICON). He received his PhD 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 an Air Force Research Lab Summer Faculty Fellowship. At Purdue, he received the Outstanding Mentor of Engineering Graduate Students Award, the Hesselberth Award for Teaching Excellence, and the Ruth and Joel Spira Outstanding Teacher Award. At Waterloo, he received the Department of Electrical and Computer Engineering Research Award, the University of Waterloo Outstanding Performance Award, and the Faculty of Engineering Distinguished Performance Award. He was a finalist for the Best Student Paper Award at the 2007 and 2008 *American Control Conferences*.



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