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Title: Sensor Scheduling for Remote State Estimation with Unknown Communication Channel Statistics: A Learning-Based Approach

Abstract: We consider sensor scheduling with unknown communication channel statistics. We formulate two types of scheduling problems with the communication rate being a soft or hard constraint, respectively. We first present some structural results on the optimal scheduling policy using dynamic programming and assuming the channel statistics is known. We prove that the Q-factor is monotonic and submodular, which leads to the threshold-like structures in both types of problems. Then we develop a stochastic approximation and parameter learning frameworks to deal with the two scheduling problems with unknown channel statistics. We utilize their structures to design specialized learning algorithms. We prove the convergence of these algorithms. Performance improvement compared with the standard Q-learning algorithm is shown through numerical examples.

Biography: Ling Shi received the B.S. degree in electrical and electronic engineering from Hong Kong University of Science and Technology, Kowloon, Hong Kong, in 2002 and the Ph.D. degree in Control and Dynamical Systems from California Institute of Technology, Pasadena, CA, USA, in 2008. He is currently an associate professor at the Department of Electronic and Computer Engineering, Hong Kong University of Science and Technology. His research interests include cyber-physical systems security, networked control systems, sensor scheduling, event-based state estimation, and exoskeleton robots. He is a senior member of IEEE. He served as an editorial board member for The European Control Conference 2013-2016. He was a subject editor for International Journal of Robust and Nonlinear Control (2015-2017). He has been serving as an associate editor for IEEE Transactions on Control of Network Systems from July 2016, and an associate editor for IEEE Control Systems Letters from Feb 2017. He also served as an associate editor for a special issue on Secure Control of Cyber Physical Systems in the IEEE Transactions on Control of Network Systems in 2015-2017. He served as the General Chair of the 23rd International Symposium on Mathematical Theory of Networks and Systems (MTNS 2018).