Proceedings of the 7th International Conference of Control, Dynamic Systems, and Robotics (CDSR'20)
Niagara Falls, Canada – June, 2020
DOI: TBA

Decentralized stochastic control of LQG systems

Aditya Mahajan
McGill University
Canada

In a seminar paper, Witsenhausen (1968) showed that in a decentralized stochastic control systems with linear dynamics, quadratic cost, and Gaussian disturbance (the LQG setup), non-linear control laws may outperform the best linear control laws. This is in contrast to the centralized LQG setup where optimal control laws are affine. It was subsequently shown by Ho and Chu (1972) that in decentralized LQG models where information flows as fast as the dynamics (the so called partially nested information structure), optimal control laws are affine. However, the Ho and Chu result does not provide a state space representation of the optimal control laws.

Since then, several papers have developed state space representation of optimal control laws for various specific instances of partially nested information structures. However, many of these results are developed on a case-by-case basis and exploit specific features of the information structure.

In this talk, we present a unified framework to analyze decentralized LQG systems. This framework is based on common information, conditional independence, and completion of squares. We show that this framework allows us to easily rederive the existing results and obtain new ones.