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Stochastic Dynamic Teams with Asymmetric Information

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Abstract

In any real application of stochastic distributed decision making, be it in the cooperative team framework or the non-cooperative game setting, asymmetry in the information acquired by different decision makers (synonymously agents or players) naturally arises. Presence of asymmetric information, particularly in dynamic (multi-stage) decision problems, creates challenges in the establishment of existence of optimal solutions (in teams) and non-cooperative equilibria (in games) as well as in their characterization and computation. No unified theory exists (such as dynamic programming or maximum principle) that would be applicable to such problems. In this talk, I will discuss some recent efforts toward developing such a unified theory with regard to existence of solutions, concentrating on teams. The framework will encompass problems with non-classical information, such as Witsenhausen's counterexample (and its multi-dimensional and multi-agent extensions) and the Gaussian test channel (and its multi-relay versions with real-time information processing and transmission), among others (including multi-agent systems with agent interactions and flow of information governed by two separate networks), for which the existence of team-optimal solutions will be established. Several examples will be provided to illustrate the solution technique, the underlying caveats, and the conditions involved. As time permits, a brief account of extensions to stochastic dynamic games with asymmetric information within the context of Nash equilibrium will be presented.