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Large Stochastic Exchangeable Teams, Their Mean-Field Limits, and Optimality of Symmetric Policies

Stochastic teams entail a collection of decision-makers acting together to optimize a common cost function but not necessarily sharing all the available information. We discuss a class of decentralized stochastic exchangeable teams with a finite number of decision-makers as well as their mean-field limits with infinite numbers of decision-makers.

We first consider convex teams. For this class of problems, we establish the existence of a globally optimal solution and show that it is symmetric (identical) for both the finite decision-maker regime and the infinite one. As the number of decision makers drives to infinity (that is for the mean-field limits), we establish the existence of a privately randomized globally optimal solution and show that it is symmetric among decision makers. For the class of non-convex exchangeable teams, we establish the existence of a globally optimal solution and show that it is exchangeable (the joint distribution is permutation invariant) and not necessarily symmetric for the finite decision-maker regime. For the infinite population regime, however, we show the existence of a globally optimal solution and establish that it is privately randomized and symmetric. Finally, we establish that a symmetric globally optimal solution for the mean-field problem is approximately optimal for the corresponding finite-population team with a large number of decision-makers.