Distributed Learning in Network Games: a Dual Averaging Approach

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Over the past few years, networked systems analysis has been on the cutting edge of multi-disciplinary research, with applications spanning from wireless resource allocation to biological immune systems. However, most of existing works mainly focus on cooperative manners of a network of agents, while many of real-world networked systems exhibit non-cooperative behaviors because of various reasons, such as the existence of greedy agents and malicious agents as well as the competition for limited resources. Inspired by this, the authors propose a distributed non-regret learning algorithm for a networked game-theoretical model incorporating with the dual averaging approach, referred to as Team-Based dual averaging (TDA). In this work, the authors consider a non-cooperative game between two parties, both playing on a network consisting of all the agents connected via a communication graph. Compared to cooperative models, the information sharing only occurs among the agents within the same party instead of the entire agents. Moreover, the ultimate goal of agents in the proposed model is to seek a global Nash Equilibrium instead of an "optimal" solution. To distributively learn an equilibrium point, each party updates the states of its agents using a distributed dual averaging method. To derive the convergence of TDA, the authors impose assumptions of convexity and monotonicity on the objective function of each team. In the sequel, the function value at running local average eventually converges to the Nash Equilibrium point. Under more regularity condition, the convergence of iterates can also be guaranteed.