Mathematics > Optimization and Control

Convergence of a Multi-Agent Projected Stochastic Gradient Algorithm

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We introduce a new framework for the convergence analysis of a class of distributed constrained non-convex optimization algorithms in multi-agent systems. The aim is to search for local minimizers of a non-convex objective function which is supposed to be a sum of local utility functions of the agents. The algorithm under study consists of two steps: a local stochastic gradient descent at each agent and a gossip step that drives the network of agents to a consensus. Under the assumption of decreasing stepsize, it is proved that consensus is asymptotically achieved in the network and that the algorithm converges to the set of Karush-Kuhn-Tucker points. As an important feature, the algorithm does not require the double-stochasticity of the gossip matrices. It is in particular suitable for use in a natural broadcast scenario for which no feedback messages between agents are required. It is proved that our result also holds if the number of communications in the network per unit of time vanishes at moderate speed as time increases, allowing for potential savings of the network's energy. Applications to power allocation in wireless ad-hoc networks are discussed. Finally, we provide numerical results which sustain our claims.

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