Coordinate-Descent Adaptation over Hamiltonian Multi-Agent Networks

ABSTRACT

The incremental least-mean-square (ILMS) algorithm is a useful method to perform distributed adaptation and learning in Hamiltonian networks. To implement the ILMS algorithm, each node needs to receive the local estimate of the previous node on the cycle path to update its own local estimate. However, in some practical situations, perfect data exchange may not be possible among the nodes. In this paper, we develop a new version of ILMS algorithm, wherein in its adaptation step, only a random subset of the coordinates of update vector is available. We draw a comparison between the proposed coordinate-descent incremental LMS (CD-ILMS) algorithm and the ILMS algorithm in terms of convergence rate and computational complexity. Employing the energy conservation relation approach, we derive closed-form expressions to describe the learning curves in terms of excess mean-square-error (EMSE) and mean-square deviation (MSD). We show that, the CD-ILMS algorithm has the same steady-state error performance compared with the ILMS algorithm. However, the CD-ILMS algorithm has a faster convergence rate. Numerical examples are given to verify the efficiency of the CD-ILMS algorithm and the accuracy of theoretical analysis.