Reading Report (Feb)

Distributed Dual Subgradient Algorithms With Iterate-Averaging Feedback for Convex Optimization With Coupled Constraints

Considering the different required information of various optimization problems, there are three types of constraints, i.e., local constraints, compatible constraints and coupled constraints. Apparently, the last one is more complicated and more intractable to deal with.

In this paper, the authors consider distributed and possibly nonsmooth convex optimization with local set constraints and coupled equality and inequality constraints. To solve such optimization problems, this paper proposes a class of distributed dual sugradient algorithms with an iterate-averaging feedback technique. First, they design an algorithm utilizing the properties of dual problems and subgradient methods but with a center node. Compared with the original dual subgradient algorithm, this algorithm can be implemented with a larger step-size and archives the optimal convergence rate $O(1/\sqrt{T})$, where T represents the number of iterations. To remove the requirement of a center node in the network, the authors employ the consensus tracking iterates on each node to establish a fully distributed algorithm. This distributed algorithm achieves a convergence rate of $O(\ln T/\sqrt{T})$.

To prove the convergence rates, the authors propose a notion referred to as performance index $V[T]$ and demonstrate the effectiveness of the V in characterizing the convergence rate. Additionally, these two proposed algorithms share the same lover bound of $V[T]$ but the upper bound of $V[T]$ generated by the algorithm without a center node is larger. This cost is caused by the average consensus tracking scheme and can be regarded as the price of removing the center node in the network topology.

Comparing the algorithm without a center node with existing algorithms, the algorithm achieves the optimal solution by using vanishing step-size over a fixed topology. Moreover, this algorithm does not need to exchange neither the local constraints nor the dual variables with neighbors, but share the local variable z_i whose dimension is the same as the local dual variable.