

Control Methods for Distributed Optimization Control

Homework assignment

Ruggero Carli, Ivano Notarnicola

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Consider a consensus optimization problem for a multi-agent system of $N = 20$ agents

$$\min_x \sum_{i=1}^N f_i(x)$$

The agents communicate with their neighbors according to a randomly generated undirected connected aperiodic graph. Build a doubly stochastic matrix W according to the Metropolis-Hastings rule.

Each agent i , $i = 1, \dots, N$, has a local strongly convex cost function f_i having Lipschitz continuous gradient.¹

Implement in your preferred programming language (e.g., Python, MATLAB) the following algorithms for solving the consensus optimization problem.

1. Distributed Gradient Descent (DGD)
2. Gradient Tracking (GT)
3. Integral-Action-Based Distributed Gradient Algorithm
4. Accelerated Distributed Gradient Descent (**optional**)

Compare the implemented algorithms and present plots that highlight the convergence performance, e.g., the optimality error, the consensus error, sector bound inequality.

¹The local cost functions must be properly generated.