An Objective-Function-Free Trust Region Framework for Decentralized Optimization

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ABSTRACT

We consider the problem of decentralized optimization, where a network of computational agents collaboratively minimizes a global objective given as the sum of local functions, each privately held by an individual agent. While several first and second-order methods have been proposed for this setting, one of the main challenges is the choice of the stepsize. In particular, classical globalization strategies are not directly applicable in decentralized contexts, and existing methods typically rely on fixed, conservatively small stepsizes, or on specialized adaptive rules tailored to specific algorithms.
In this work, we propose a distributed Trust-Region objective-function-free method. It enables adaptive trust-region radii, which vary across both nodes and iterations. The framework includes a broad class of second-order models, such as Newton, quasi-Newton, and Gauss–Newton methods. Under suitable assumptions on the objective functions and the communication network, we establish convergence guarantees for the proposed method. Finally, we present numerical experiments that investigate the performance of the algorithm, and compare the proposed strategy with methods from the literature, in terms of both computation and communication cost.