XIV BRAZILIAN WORKSHOP ON CONTINUOUS OPTIMIZATION

NOTEBOOK OF ABSTRACTS

AND

OTHER RELEVANT INFORMATION

School of Applied Mathematics of Fundação Getúlio Vargas, Rio de Janeiro, Brazil

PLENNARY TALKS

Current work in the development of augmented Lagrangian software and applications

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Abstract

Our Augmented Lagrangian method Algencan was introduced about two decades ago. Since then, its computational implementation and asymptotic convergence theory have been updated and strengthened several times, and complexity results have been presented. In 2020, a completely new implementation of Algencan was developed for the case where second derivatives are available and matrix factorizations are affordable. We are currently revising the version of Algencan that uses only first-order derivatives and does not perform factorizations. In this talk we will report on the current state of this development. Recent applications of Algencan will also be presented.

First and zeroth-order implementations of the regularized Newton method with lazy approximated Hessians

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Abstract

In this work, we develop first-order (Hessian-free) and zeroth-order (derivative-free) implementations of the Cubically regularized Newton method for solving general non-convex optimization problems. For that, we employ finite difference approximations of the derivatives. We use a special adaptive search procedure in our algorithms, which simultaneously fits both the regularization constant and the parameters of the finite difference approximations. It makes our schemes free from the need to know the actual Lipschitz constants. Additionally, we equip our algorithms with the lazy Hessian update that reuse a previously computed Hessian approximation matrix for several iterations. Specifically, we prove the global complexity bound of $O\left(n^{1/2}\varepsilon^{-3/2}\right)$ function and gradient evaluations for our new Hessian-free method, and a bound of $O\left(n^{3/2}\varepsilon^{-3/2}\right)$ function evaluations for the derivative-free method, where n is the dimension of the problem and ε is the desired accuracy for the gradient norm. These complexity bounds significantly improve the previously known ones in terms of the joint dependence on n and ε, for the first-order and zeroth-order non-convex optimization.