THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

DEPARTMENT OF APPLIED MATHEMATICS
應 用 數 學 系

Seminar

Dr Geovani Nunes Grapiglia

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Topic

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

Date| Time

26th March 2024 (Tuesday) | 10:00 am – 11:00 am (HK Time)

Venue

Y301, Main Campus

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 $\mathcal{O}(n^{1/2} \epsilon^{-3/2})$ function and gradient evaluations for our new Hessian-free method, and a bound of $\mathcal{O}(n^{3/2} \epsilon^{-3/2})$ 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.

Biography

Geovani Grapiglia obtained his doctoral degree in Mathematics in 2014 at Universidade Federal do Paraná (Brazil). Between 2015 and 2021 he worked as Assistant and Associate Professor at the Department of Mathematics of UFPR. Since 2021 he is an Assistant Professor at the Department of Applied Mathematics of UCLouvain (Belgium). His research covers the development, analysis and application of optimization methods. Recent works range from derivative-free methods for nonconvex optimization to accelerated high-order methods for convex optimization.