Instituto de Ingeniería Matemática y Computacional

PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE

INVARIANCE IN FIRST-ORDER OPTIMIZATION

Jelena Diakonikolas
Ph.D. in Electrical Engineering, Columbia University (2016), Postdoctoral, Foundations of Data Analysis Institute, UC Berkeley.

Abstract

First-order methods with optimal worst-case iteration complexities for various classes of convex optimization problems have been known for decades. However, their standard analysis bears little intuition, which makes their generalization to new problems arising in modern data analysis challenging. In this talk, I will present a novel general and unifying framework for the analysis of first-order methods. The framework relies on the construction of a primal-dual gap and can be likened to Lagrangian mechanics: continuous-time methods and their convergence analyses follow directly from enforcing a certain invariance. The discrete-time methods can then be obtained by using different methods of discretization. This stands in contrast with standard approaches, which can be thought of as being analogous to Newtonian mechanics, where an action (i.e., a predetermined optimization method) is applied to a system and then its behavior (convergence) analyzed.

In the remainder of the talk, I will describe several generalizations and applications of this framework. I will also discuss how this invariance-based view can be generalized to the setting of convergence to stationary points in convex and non-convex optimization through a connection between the framework and Hamiltonian systems.

SEMINARIO

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AUDITORIO SAN AGUSTÍN
CAMPUS SAN JOAQUÍN UC

@IMC_UC
+562 23541100
imt@ing.puc.cl
imc.uc.cl