

Invited Talk Abstract

ICOML 2026 | July 27–29, 2026

Data-Driven Analysis of First-Order Methods via Distributionally Robust Optimization**Bartolomeo Stellato***Department of Operations Research and Financial Engineering, Princeton University*

Date	July 27, 2026
Time	11:00–11:30
Session	Session 1
Venue	Department of Mathematics, National Taiwan Normal University, Taipei, Taiwan

Abstract

We consider the problem of analyzing the probabilistic performance of first-order methods when solving convex optimization problems drawn from an unknown distribution only accessible through samples. By combining performance estimation (PEP) and Wasserstein distributionally robust optimization (DRO), we formulate the analysis as a tractable semidefinite program. Our approach unifies worst-case and average-case analyses by incorporating data-driven information from the observed convergence of first-order methods on a limited number of problem instances. This yields probabilistic, data-driven performance guarantees in terms of the expectation or conditional value-at-risk of the selected performance metric. Experiments on smooth convex minimization, logistics regression, and Lasso show that our method significantly reduces the conservatism of classical worst-case bounds and narrows the gap between theoretical and empirical performance.