SIGEST

The SIGEST article in this issue, "First-Order Methods for Nonconvex Quadratic Minimization," by Yair Carmon and John C. Duchi, looks at the minimization of quadratic functions that are (a) potentially indefinite and (b) have been regularized either via a trust-region constraint or a cubic penalty term. This task forms an important component in many nonlinear optimization algorithms.

The SIGEST award is based on the 2019 *SIAM Journal on Optimization* (SIOPT) article [6]. In adapting the article for the SIGEST section, the authors have included subsequent work that appeared in the 2018 Neural Information Processing Systems (NeurIPS) conference [5]. Both papers considered the same underlying optimization problem, but studied different large-scale solution techniques: gradient descent and Krylov subspace methods. The overall aim is to establish global convergence and computational complexity results.

By combining the analyses of both algorithms into one paper, the authors present SIREV readers with a broad perspective, highlighting the similarities and differences between the approaches and placing them within the wider context of large-scale optimization. They also include a new result: Section 6 studies the randomized Krylov subspace method from the NeurIPS paper combined with the majorization scheme from the SIOPT paper. The resulting analysis recovers the strongest known convergence guarantees for second-order stationary points with considerably more ease than prior work, and with a method bearing strong resemblance to practical implementations of Newton-type methods.

In addition, this article features an expanded Introduction section describing concurrent and subsequent work and a rewritten discussion section providing further perspective into the conceptual differences between the analysis of gradient descent and Krylov subspace techniques. The material here gives SIREV readers a window into the current state of the art in large-scale optimization.

The Editors