Master's Thesis

A second-order sequential optimality condition for nonlinear second-order cone programming problems

Guidance

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February 2023

Abstract

The nonlinear second-order cone programming problems (SOCPs) include a wide class of optimization problems and have a lot of applications in finance, control theory, and so forth. In SOCP and other conic optimization problems, it is well known that local optimal points satisfy the Karush-Kuhn-Tucker conditions under some constraint qualification. However, in the last decade, the so-called sequential optimality conditions, which do not require constraint qualifications, had been considered in the literature. In particular, Fukuda et al. (2022) analyzed the sequential optimality conditions that use second-order information, which allow improvement on the convergence assumptions of algorithms. However, such optimality conditions were not defined explicitly.

In this paper, we propose an explicit definition of approximate-Karush-Kuhn-Tucker 2 (AKKT 2) conditions for SOCPs extending the well-known second-order sequential optimality conditions of nonlinear programming problems. We prove that the proposed AKKT 2 conditions are satisfied at local optimal points of the SOCP without any constraint qualification. We also present two algorithms that are based on augmented Lagrangian and sequential quadratic programming methods, and show their global convergence to points satisfying the proposed optimality conditions.