THE UNIVERSITY OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

C O L L O Q U I U M

An inexact projected gradient method with rounding and lifting by nonlinear programming for solving rank-one semidefinite relaxation of polynomial optimization

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Abstract

We consider solving high-order semidefinite programming (SDP) relaxations of polynomial optimization problems (POPs) that often admit degenerate rank-one optimal solutions. Instead of solving the SDP alone, we propose a new algorithmic framework that blends local search using the nonconvex POP into global descent using the convex SDP. In particular, we first design a globally convergent inexact projected gradient method (iPGM) for solving the SDP that serves as the backbone of our framework. We then accelerate iPGM by taking long, but safeguarded, rank-one steps generated by fast nonlinear programming algorithms.

We prove that the new framework is still globally convergent for solving the SDP. To solve the iPGM subproblem of projecting a given point onto the feasible set of the SDP, we design a two-phase algorithm with phase one using a symmetric Gauss-Seidel based accelerated proximal gradient method to generate a good initial point, and phase two using a modified limited-memory BFGS method to obtain an accurate solution.

We conduct numerical experiments for solving second-order SDP relaxations arising from a diverse set of POPs. Our framework demonstrates state-of-the-art efficiency, scalability, and robustness in solving degenerate rank-one SDPs to high accuracy, even in the presence of millions of equality constraints.

Date:	March 18, 2022 (Friday)
Time:	10:00 – 11:00am (Hong Kong Time)
Venue:	ZOOM: https://hku.zoom.us/j/ Meeting ID: 940 0962 9889 Password: 286660

All are welcome