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THE HONG KONG UNIVERSITY OF SCIENCE & TECHNOLOGY

Department of Mathematics

PHD STUDENT SEMINAR

Improved Guarantees of Riemannian Optimization for Low-Rank Matrix Recovery

By

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Abstract

We study the problem of reconstructing an unknown rank-r $d\times d$ matrix from m random linear measurements. While convex methods achieve the information-theoretically optimal sample complexity of $m = \Omega(dr)$, they suffer from high computational costs. Conversely, existing non-convex approaches are computationally efficient but require a suboptimal number of measurements, typically $m = \Omega(dr^2)$. We prove that Riemannian gradient descent (RGD) matches the optimal sample complexity while maintaining computational efficiency. Specifically, RGD guarantees exact recovery with $m = \Omega(dr \log^{\alpha} d)$ samples, where $\alpha = 1$ for Gaussian measurements and $\alpha = 6$ for Pauli measurements. This matches the information-theoretic lower bound up to a logarithmic factor. Moreover, RGD converges linearly to the global minimum with an arbitrarily small convergence rate.

Date : 8 May 2025, Thursday

Time : 5:00pm

Venue : Room 5506 (Lifts 25-26)

All are Welcome!