A simple method for robust matrix completion with theoretical recovery guarantees

Eilon Vaknin Laufer, Pini Zilber and Boaz Nadler

Weizmann Institute of Science, Rehovot, Israel

Abstract

Recovering a low rank matrix from a subset of its entries, is known as the matrix completion (MC) problem. When some of the observed entries are corrupted, this problem is known as robust matrix completion (RMC). Existing methods have several limitations: they require a relatively large number of observed entries; they may fail under overparameterization, when their assumed rank is higher than the correct one; and many of them fail to recover even mildly ill-conditioned matrices. In this talk, I'll describe simple iterative methods for both the MC and the RMC problems, that empirically overcome these limitations. Our approach to both the MC and RMC problems is a factorization-based iterative algorithm, based on a Gauss–Newton linearization, and in the latter case combined with removal of entries suspected to be outliers. We present theoretical guarantees for both methods, which are amongst the best known for factorization-based approaches.

Keywords

matrix completion, outliers, low rank structure, Gauss-Newton.

References

[1] Zilber, P., and Nadler, B. (2022). GNMR: A provable one-line algorithm for low rank matrix recovery. *SIAM Journal on Mathematics of Data Science, 4(2)*, 909-934.

[2] Vaknin Laufer, E., and Nadler, B. (2026). RGNMR: A Gauss-Newton method for robust matrix completion with theoretical guarantees. *Advances in Neural Information Processing Systems 38*, 60146-60188.