

Sparse Sums of Positive Semidefinite Matrices

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Recently there has been much interest in "sparsifying" sums of rank one matrices: modifying the coefficients such that only a few are nonzero, while approximately preserving the matrix that results from the sum. Results of this sort have found applications in many different areas, including sparsifying graphs. In this paper we consider the more general problem of sparsifying sums of positive semidefinite matrices that have arbitrary rank.

We give several algorithms for solving this problem. The first algorithm is based on the method of Batson, Spielman and Srivastava (2009). The second algorithm is based on the matrix multiplicative weights update method of Arora and Kale (2007). We also highlight an interesting connection between these two algorithms.

Our algorithms have numerous applications. We show how they can be used to construct graph sparsifiers with auxiliary constraints, sparsifiers of hypergraphs, and sparse solutions to semidefinite programs.

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