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Session (3)

A revisit to maximum variance unfolding from a viewpoint of phase retrieval

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Abstract

For a set of points, multidimensional scaling recovers the spacial information (covariance matrix) from their mutual distances. Facing a set of high dimensional data sampled from a low dimensional manifold, maximum variance unfolding (MVU) estimates a low rank covariance matrix, which unveil the hidden low dimensional structure (Weinberger, Saul 2006). The computation exploits convex optimization, where the trace norm of the covariance matrix is maximized subject to a set of local-distance constraints. However, the global convergence of the desired low rank matrix in fact requires a sufficient number of local-distance constraints, as other low rank recovery problems.

As the simplest case in the low rank recovery, phase retrieval recovers a rank-one positive semidefinite matrix from a set of linear measurements. To overcome the limitation of insufficient measurements as well as the expensive computational load, nonconvex optimization methods are recently proposed to overcome the limitation of insufficient constraints, e.g., Douglas-Rachfold algorithms. In addition, many spectral methods (e.g., null vector method) are proposed to generate initial guesses. In this talk, we demonstrate the application of these nonconvex methods to the maximum variance unfolding problem. In our empirical studies, MVU is applied to the lung deformation fields. If time permitted, global convergence will be discussed.