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A rank-constrained matrix representation for hypergraph-based subspace clustering. (English) Zbl 1394.68313

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Summary: This paper presents a novel, rank-constrained matrix representation combined with hypergraph spectral analysis to enable the recovery of the original subspace structures of corrupted data. Real-world data are frequently corrupted with both sparse error and noise. Our matrix decomposition model separates the low-rank, sparse error, and noise components from the data in order to enhance robustness to the corruption. In order to obtain the desired rank representation of the data within a dictionary, our model directly utilizes rank constraints by restricting the upper bound of the rank range. An alternative projection algorithm is proposed to estimate the low-rank representation and separate the sparse error from the data matrix. To further capture the complex relationship between data distributed in multiple subspaces, we use hypergraph to represent the data by encapsulating multiple related samples into one hyperedge. The final clustering result is obtained by spectral decomposition of the hypergraph Laplacian matrix. Validation experiments on the Extended Yale Face Database B, AR, and Hopkins 155 datasets show that the proposed method is a promising tool for subspace clustering.

MSC:

68T05 Learning and adaptive systems in artificial intelligence
05C50 Graphs and linear algebra (matrices, eigenvalues, etc.)
05C65 Hypergraphs
62H30 Classification and discrimination; cluster analysis (statistical aspects)

Software:

AR face

Full Text: DOI

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