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Sparse fixed-rank representation for robust visual analysis

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Abstract

Robust visual analysis plays an important role in a great variety of computer vision tasks, such as motion segmentation, pose and face analysis. One of the promising real-world applications is to recover the clear data representation from the corrupted data points for subspace segmentation. Recently, low-rank based methods have gained considerable popularity in solving this problem, such as Low-Rank Representation (LRR) and Fixed-Rank Representation (FRR). They both learn a low-rank data matrix and a sparse error matrix. Each new data representation is learnt using the whole dictionary covering all data points. However, they neglect a common fact that each point can be represented by a linear combination of only a few other points w.r.t. to a given dictionary, which has been shown in sparse learning. Motivated by this, we explicitly impose the sparsity constraint on the learnt low-rank representation. To be more efficient, we adopt a fixed-rank scheme by minimizing the Frobenius norm of the new representation. Hence, in this paper we propose a novel Sparse Fixed-Rank Representation (SFRR) approach for robust visual analysis. Specifically, we model the corruptions by enforcing a sparse regularizer. This way, we can obtain a new data representation with both low-rankness and sparseness robustly. Furthermore, we present a generalized alternating direction method (ADM) to optimize the objective function. Extensive experiments on both synthetic and real-world data bases have suggested the effectiveness and the robustness of the proposed method.

Keywords: fixed-rank representation, sparse learning, robust recovery, subspace segmentation, outlier detection.

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