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Sparse Unmixing of Hyperspectral Data by Exploiting Joint-Sparsity and Rank-Deficiency

Authors : Fanqiang Kong, Chending Bian

Abstract : In this work, we exploit two assumed properties of the abundances of the observed signatures (endmembers) in order to reconstruct the abundances from hyperspectral data. Joint-sparsity is the first property of the abundances, which assumes the adjacent pixels can be expressed as different linear combinations of same materials. The second property is rank-deficiency where the number of endmembers participating in hyperspectral data is very small compared with the dimensionality of spectral library, which means that the abundances matrix of the endmembers is a low-rank matrix. These assumptions lead to an optimization problem for the sparse unmixing model that requires minimizing a combined l_{2,p}-norm and nuclear norm. We propose a variable splitting and augmented Lagrangian algorithm to solve the optimization problem. Experimental evaluation carried out on synthetic and real hyperspectral data shows that the proposed method outperforms the state-of-the-art algorithms with a better spectral unmixing accuracy.

Keywords : hyperspectral unmixing, joint-sparse, low-rank representation, abundance estimation
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