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A dual symmetric Gauss-Seidel alternating direction method of multipliers for hyperspectral sparse unmixing. (English) [Zbl 1465.65026]

Summary: Since sparse unmixing has emerged as a promising approach to hyperspectral unmixing, some spatial-contextual information in the hyperspectral images has been exploited to improve the performance of the unmixing recently. The total variation (TV) has been widely used to promote the spatial homogeneity as well as the smoothness between adjacent pixels. However, the computation task for hyperspectral sparse unmixing with a TV regularization term is heavy. Besides, the convergence of the primal alternating direction method of multipliers (ADMM) for the hyperspectral sparse unmixing with a TV regularization term has not been explained in detail. In this paper, we design an efficient and convergent dual symmetric Gauss-Seidel ADMM (sGS-ADMM) for hyperspectral sparse unmixing with a TV regularization term. We also present the global convergence and local linear convergence rate analysis for this algorithm. As demonstrated in numerical experiments, our algorithm can obviously improve the efficiency of the unmixing compared with the state-of-the-art algorithm. More importantly, we can obtain images with higher quality.

MSC:
65F10 Iterative numerical methods for linear systems
65D18 Numerical aspects of computer graphics, image analysis, and computational geometry
94A08 Image processing (compression, reconstruction, etc.) in information and communication theory

Keywords:
hyperspectral imaging; sparse unmixing; total variation; semi-proximal alternating direction method of multipliers; symmetric Gauss-Seidel

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References: