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Convergent prediction-correction-based ADMM for multi-block separable convex programming *

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Abstract

The direct extension of the classic alternating direction method with multipliers (ADMMe) to the multi-block separable convex optimization problem is not necessarily convergent, though it often performs very well in practice. In order to preserve the numerical advantages of ADMMe and obtain convergence, many modified ADMM were proposed by correcting the output of ADMMe or employing proximal terms to solve inexactly the subproblems in ADMMe. In this paper, we present an efficient Prediction-Correction-based ADMM (PCB-ADMM) to solve the multi-block separable convex minimization model. The prediction step takes a special block coordinate descent (BCD) cycle to update the variable blocks, then the correction step corrects the output slightly by computing a convex combination of two points from the prediction step and previous iteration. The convergence property is obtained by using the variational inequality. The numerical experiments illustrate effectiveness of the proposed PCB-ADMM to solve the quadratic semidefinite programming and image decomposition.

Key words. alternating direction method of multipliers, prediction-correction, variational inequality, convergence analysis, quadratic semidefinite programming, image decomposition.

1 Introduction.

The convex minimization problem with linear constraints and a separable objective function has numerous applications in several areas, such as the dual of the (quadratic) semidefinite programming (SDP) with or without nonnegative constraints [1, 2, 3], the robust principal component analysis model with noisy and incomplete data [4, 5], image decomposition [6, 7, 8], and so on. In this paper, we consider the following separable convex minimization model with n block variables and

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