

A Globally Convergent Inexact Augmented Lagrangian Method for Zero-One Composite Optimization

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The zero-one composite optimization problem (0/1-COP) aims to minimize the sum of a smooth function and a composition of a zero-one loss function with a linear operator. It has wide applications, including the support vector machine (SVM), calcium dynamics fitting (CDF), 1-bit compressive sensing (1-bit CS) and so on. However, it remains challenging to design a globally convergent algorithm for the original model of 0/1-COP, due to the nonconvex and discontinuous zero-one loss function. We aim to develop an inexact augmented Lagrangian method (IALM) in which the generated whole sequence converges to a local minimizer of 0/1-COP under reasonable assumptions. In the iteration process, IALM performs minimization on a Lyapunov function with an adaptively adjusted multiplier. The involved Lyapunov penalty subproblem is shown to admit the exact penalty theorem for 0/1-COP, provided that the multiplier is optimal in the sense of the proximal type stationarity. An efficient zero-one Bregman alternating linearized minimization (0/1-BALM) algorithm is also designed to achieve an approximate solution of the underlying subproblem in finite steps. Numerical experiments for handling SVM, CDF and 1-bit CS demonstrate the satisfactory performance of the proposed method in terms of solution accuracy and time efficiency. This is a joint work with Penghe Zhang and Naihua Xiu.

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