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Structured Sparsity via Alternating Directions Methods

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We consider a class of sparse learning problems in high dimensional feature space regularized by a structured sparsity-inducing norm which incorporates prior knowledge of the group structure of the features. Such problems often pose a considerable challenge to optimization algorithms due to the non-smoothness and non-separability of the regularization term. In this paper, we focus on two commonly adopted sparsity-inducing regularization terms, the overlapping Group Lasso penalty l_1/l_2-norm and the l_1/l_∞-norm. We propose a unified framework based on the augmented Lagrangian method, under which problems with both types of regularization and their variants can be efficiently solved. As the core building-block of this framework, we develop new algorithms using an alternating partial-linearization/splitting technique, and we prove that the accelerated versions of these algorithms require $O(\frac{1}{\sqrt{\epsilon}})$ iterations to obtain an ϵ-optimal solution. To demonstrate the efficiency and relevance of our algorithms, we test them on a collection of data sets and apply them to two real-world problems to compare the relative merits of the two norms.

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