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$l_{2,p}$ Matrix Norm and Its Application in Feature Selection

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Recently, $l_{2,1}$ matrix norm has been widely applied to many areas such as computer vision, pattern recognition, biological study and etc. As an extension of l_1 vector norm, the mixed $l_{2,1}$ matrix norm is often used to find jointly sparse solutions. Moreover, an efficient iterative algorithm has been designed to solve $l_{2,1}$-norm involved minimizations. Actually, computational studies have showed that l_p-regularization ($0<p<1$) is sparser than l_1-regularization, but the extension to matrix norm has been seldom considered. This paper presents a definition of mixed $l_{2,p}$ $(p\in (0, 1])$ matrix pseudo norm which is thought as both generalizations of l_p vector norm to matrix and $l_{2,1}$-norm to nonconvex cases $(0<p<1)$. Fortunately, an efficient unified algorithm is proposed to solve the induced $l_{2,p}$-norm $(p\in (0, 1])$ optimization problems. The convergence can also be uniformly demonstrated for all $p\in (0, 1]$. Typical $p\in (0,1]$ are applied to select features in computational biology and the experimental results show that some choices of $0<p<1$ do improve the sparse pattern of using $p=1$.

Subjects: **Learning (cs.LG)**; Computer Vision and Pattern Recognition (cs.CV); Machine Learning (stat.ML)

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