Solving Norm Constrained Portfolio Optimizations via Coordinate-Wise Descent Algorithms

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In this paper we demonstrate that coordinate-wise descent algorithms can be used to solve portfolio selection problems in which asset weights are constrained by l_q norms for $1 \leq q \leq 2$. A special case of the such problems is when $q = 1$. The l_1 norm constraint promotes zero values for the weight vector, leading to an automatic asset selection for the portfolio. We first consider the case of minimum (global) variance portfolio (mvp) in which the asset weights are constrained by weighted l_1 and squared l_2 norms. We use two benchmark data sets to examine performances of the norm constrained portfolio. When the sample size is not large in comparison with the number of assets, the norm constrained portfolio tends to have a lower out-of-sample portfolio variance, lower turnover rate, less numbers of active assets and short-sale positions, but higher Sharpe ratio than the one without such norm constraints. We then show some extensions; particularly we derive an efficient algorithm for solving an mvp problem in which assets are allowed to be chosen grouply. All of the program codes for the algorithms are written by *R*.