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Large-Scale Convex Minimization with a Low-Rank Constraint

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We address the problem of minimizing a convex function over the space of large matrices with low rank. While this optimization problem is hard in general, we propose an efficient greedy algorithm and derive its formal approximation guarantees. Each iteration of the algorithm involves (approximately) finding the left and right singular vectors corresponding to the largest singular value of a certain matrix, which can be calculated in linear time. This leads to an algorithm which can scale to large matrices arising in several applications such as matrix completion for collaborative filtering and robust low rank matrix approximation.

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