

Fast Projection and Optimization Over the Simplex Using Semismooth Newton, Restarted FISTA, and Manifold Optimization

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We consider strong duality results for nonlinear, nonconvex, optimization problems on the Stiefel manifold. We compare Semidefinite relaxations with trust region approaches restricted to the manifold. Applications include semidefinite relaxations of hard combinatorial problems and quadratic optimization on the simplex. We first develop a semismooth Newton method for faster projection onto the simplex, which can be seen as a special case of minimization of a smooth convex function on the simplex. We then develop a restarted FISTA specialized for faster general optimization on the simplex that uses semismooth Newton to solve its projection subproblems.

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