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An infeasible-start framework for convex quadratic optimization, with application to constraint-reduced interior-point and other methods. (English) Zbl 07606019


Summary: A framework is proposed for solving general convex quadratic programs (CQPs) from an infeasible starting point by invoking an existing feasible-start algorithm tailored for inequality-constrained CQPs. The central tool is an exact penalty function scheme equipped with a penalty-parameter updating rule. The feasible-start algorithm merely has to satisfy certain general requirements, and so is the updating rule. Under mild assumptions, the framework is proved to converge on CQPs with both inequality and equality constraints and, at a negligible additional cost per iteration, produces an infeasibility certificate, together with a feasible point for an (approximately) $\ell_1$-least relaxed feasible problem, when the given problem does not have a feasible solution. The framework is applied to a feasible-start constraint-reduced interior-point algorithm previously proved to be highly performant on problems with many more inequality constraints than variables (“imbalanced”). Numerical comparison with popular codes (OSQP, qpOASES, MOSEK) is reported on both randomly generated problems and support-vector machine classifier training problems. The results show that the former typically outperforms the latter on imbalanced problems. Finally, application of the proposed infeasible-start framework to other feasible-start algorithms is briefly considered, and is tested on a simplex iteration.

MSC:

65K05 Numerical mathematical programming methods
90C05 Linear programming
90C06 Large-scale problems in mathematical programming
90C20 Quadratic programming
90C51 Interior-point methods

Keywords: convex quadratic programming; convex linear programming; infeasible start; infeasibility certificate; constraint reduction; interior point; simplex algorithm

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References:


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