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Some reformulations and applications of the alternating direction method of multipliers.
(English) Zbl 0816.90109

Summary: We consider the alternating direction method of multipliers decomposition algorithm for convex programming, as recently generalized by the first author and D. P. Bertsekas [Math. Program. 55A, No. 3, 293-318 (1992; Zbl 0765.90073)]. We give some reformulations of the algorithm, and discuss several alternative means for deriving time. We then apply these reformulations to a number of optimization problems, such as the minimum convex-cost transportation and multicommodity flow. The convex transportation version is closely related to a linear-cost transportation algorithm proposed earlier by D. P. Bertsekas and J. N. Tsitsiklis ['Parallel and distributed computation: numerical methods' (1989; Zbl 0743.65107)]. Finally, we construct a simple data-parallel implementation of the convex-cost transportation algorithm for the CM-5 family of parallel computers, and give computational results. The method appears to converge quite quickly on sparse quadratic-cost transportation problems, even if they are very large; for example, we solve problems with over a million arcs in roughly 100 iterations, which equates to about 30 seconds of run time on a system with 256 processing nodes. Substantially better timings can probably be achieved with a more careful implementation.

For the entire collection see [Zbl 0795.00025].

MSC:
90C25 Convex programming
90B10 Deterministic network models in operations research
65Y05 Parallel numerical computation
90C08 Special problems of linear programming (transportation, multi-index, data envelopment analysis, etc.)
90C06 Large-scale problems in mathematical programming

Keywords:
alternating direction method; multipliers decomposition algorithm; minimum convex-cost transportation; multicommodity flow; data-parallel implementation; sparse quadratic-cost transportation

Software:
NETGEN