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Abstracts

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Solution of a Tropical Optimization Problem Using Matrix Sparsification

Nikolai Krivulin

Saint Petersburg State University

A multidimensional optimization problem, which arises in various applications in the form of minimization of span seminorm is considered in the framework of tropical (idempotent) mathematics. The problem is formulated to minimize a nonlinear function, which is defined on vectors over an idempotent semifield, given by a matrix, and calculated using multiplicative conjugate transposition. To solve the problem, we apply and develop methods of tropical optimization proposed and investigated in [1-3]. First, we find the minimum value of the objective function, and give a partial solution as a subset of vectors represented in an explicit form. We characterize all solutions to the problem by a system of simultaneous vector equation and inequality, and use this characterization to investigate properties of the solution set, which, in particular, turns out to be closed under vector addition and scalar multiplication. Furthermore, a matrix sparsification technique is developed to drop, without affecting the solution of the problem, those entries in the matrix which are below prescribed threshold values. By combining this technique with the above characterization, the previous partial solution is extended to a wider solution subset, and then to a complete solution described as a family of subsets. Finally, we offer a backtracking procedure that generates all members of the family, and derive an explicit representation for the complete solution in a compact vector form.

References

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- [2] Krivulin, N. A multidimensional tropical optimization problem with nonlinear objective function and linear constraints. *Optimization*, vol. 64, no. 5, pp. 1107–1129, 2015.
- [3] Krivulin, N. Extremal properties of tropical eigenvalues and solutions to tropical optimization problems. *Linear Algebra Appl.*, vol. 468, pp. 211–232, 2015.