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A linear optimization oracle for zonotope computation. (English) Zbl 07445250


Summary: A class of counting problems asks for the number of regions of a central hyperplane arrangement. By duality, this is the same as counting the vertices of a zonotope. Efficient algorithms are known that solve this problem by computing the vertices of a zonotope from its set of generators. Here, we give an efficient algorithm, based on a linear optimization oracle, that performs the inverse task and recovers the generators of a zonotope from its set of vertices. We also provide a variation of that algorithm that allows to decide whether a polytope, given as its vertex set, is a zonotope and when it is not a zonotope, to compute its greatest zonotopal summand.

MSC:
52C35 Arrangements of points, flats, hyperplanes (aspects of discrete geometry)
90C05 Linear programming

Keywords:
enumeration algorithms; hyperplane arrangements; Minkowski sums; optimization algorithms

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References:

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