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*Nabil Mustafa and Saurabh Ray*

PTAS for Geometric Hitting Set Problems via Local Search

We consider the problem of computing minimum-sized geometric hitting sets in which, given a set of geometric objects and a set of points, the goal is to compute the smallest subset of points which hit all geometric objects. The problem is known to be strongly NP-hard even for simple geometric objects like unit disks in the plane. Therefore, unless  $P = NP$ , it is not possible to get Fully Polynomial Time Approximation Algorithms (FPTAS) for such problems. We give the first PTAS for this problem when the geometric objects are halfspaces in  $\mathbb{R}^3$  and when they are  $r$ -admissible regions in the plane (this includes pseudodisks since they are 2-admissible). When there are  $m$  objects and  $n$  points, the algorithm computes a  $(1 + \epsilon)$ -approximation to the minimum hitting set in time  $O(mn^{O(\epsilon-2)})$ . Quite surprisingly, our algorithm is a very simple local search algorithm which iterates over local improvements.