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On the Multi-Cover Problem in Geometric Settings

We consider the set multi-cover problem in geometric settings. Given a set of points P and a collection of geometric shapes (or sets) F , we wish to find a minimum cardinality subset of F such that each point $p \in P$ is covered (contained in) at least $d(p)$ sets. Here $d(p)$ is an integer requirement for p . When the demands $d(p) = 1$ for all p , this is the standard set cover problem. The set cover problem in geometric settings admits an approximation ratio that is better than the general version. In this paper, we show that similar improvements can be obtained for the multi-cover problem as well. In particular, we obtain an $O(\log \text{opt})$ approximation for set systems of bounded VC-dimension and an $O(1)$ approximation for covering points by half-spaces in three dimensions and for some other classes of shapes.