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Halving Lines and Measure Concentration in the Plane

Given a set $P$ of $n$ points in the plane and a collection of $k$ halving lines of $P l_1, \ldots, l_k$, indexed according to the increasing order of their slopes, we denote by $d(l_j, l_j + 1)$ the number of points in $P$ that lie above $l_j + 1$ and below $l_j$. We prove an upper bound of $O(nk^{1/3})$ for the sum $\sum_{j = 1}^{k-1} d(l_j, l_j + 1)$. We show how this problem is related to the halving lines problem and provide several consequences about measure concentration in $\mathbb{R}^2$. 