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Approximate Center Points with Proofs

This paper presents the first deterministic algorithm for computing an approximate center point of a set $P \in \Re^d$ with running time subexponential in d. The algorithm is a derandomization of the Iterated-Radon algorithm of Clarkson et al and is guaranteed to terminate with an $O(1 / d^2)$-center. Moreover, it returns a polynomial-time checkable proof of the approximation guarantee, despite the coNP-Completenes of testing center points in general. We also show how using iterated Tverberg points can improve the runtime of the deterministic algorithm and improve the approximation guarantee for the randomized algorithm. In particular, we show how to improve the $O(1 / d^2)$ approximation ratio of the Iterated-Radon algorithm to $O(1 / d^{r / (r - 1)})$ for a cost of $O((rd)^d)$ in time for any integer r.