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MADALGO seminars by Moshe Lewenstein, Bar-Ilan University

Fast, precise and dynamic distance queries

Abstract:

We present an approximate distance oracle for a point set S with n points and doubling dimension λ .

For every $\varepsilon > 0$, the oracle supports $(1 + \varepsilon)$ -approximate distance queries in (universal) constant time, occupies space $[\varepsilon^{-O(\lambda)} + 2^{O(\lambda \log \lambda)}]n$, and can be constructed in $[2^{O(\lambda)} \log^3 n + \varepsilon^{-O(\lambda)} + 2^{O(\lambda \log \lambda)}]n$ expected time. This improves upon the best previously known constructions, presented by Har-Peled and Mendel. Furthermore, the oracle can be made fully dynamic with expected $O(1)$ query time and only $2^{O(\lambda)} \log n + \varepsilon^{-O(\lambda)} + 2^{O(\lambda \log \lambda)}$ update time. This is the first fully dynamic $(1+\varepsilon)$ -distance oracle.

Joint work with Yair Bartal, Lee-Ad Gottlieb, Tsvi Kopelowitz, Liam Roditty