Abstract

We describe a $(1+\varepsilon)$-approximation algorithm for finding the minimum distortion embedding of an n-point metric space X into the shortest path metric space of a weighted graph G with m vertices. The running time of our algorithm is

$$m^{O(1)} \cdot n^{O(\omega)} \cdot (\delta_{opt}\Delta)^{\omega\cdot(1/\varepsilon)^{\lambda+2}\cdot\lambda\cdot(O(\delta_{opt}))^{2\lambda}}$$

parametrized by the values of the minimum distortion, δ_{opt}, the spread, Δ, of the points of X, the treewidth, ω, of G, and the doubling dimension, λ, of G. In particular, our result implies a PTAS provided an X with polynomial spread, and the doubling dimension of G, the treewidth of G, and δ_{opt}, are all constant. For example, if X has a polynomial spread and δ_{opt} is a constant, we obtain PTAS's for embedding X into the following spaces: the line, a cycle, a tree of bounded doubling dimension, and a k-outer planar graph of bounded doubling dimension (for a constant k).