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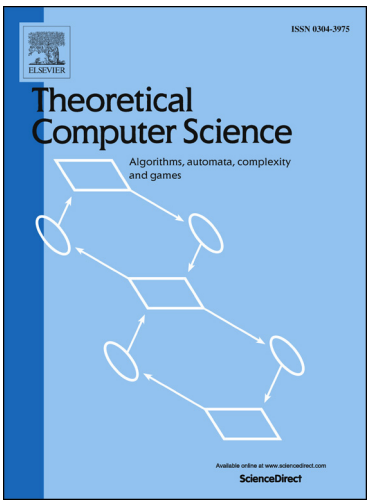

Terminal Embeddings

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Terminal Embeddings*

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Abstract

In this paper we study *terminal embeddings*, in which one is given a finite metric (X, d_X) (or a graph $G = (V, E)$) and a subset $K \subseteq X$ of its points are designated as *terminals*. The objective is to embed the metric into a normed space, while approximately preserving all distances among pairs that contain a terminal. We devise such embeddings in various settings, and conclude that even though we have to preserve $\approx |K| \cdot |X|$ pairs, the distortion depends only on $|K|$, rather than on $|X|$.

We also strengthen this notion, and consider embeddings that approximately preserve the distances between *all* pairs, but provide improved distortion for pairs containing a terminal. Surprisingly, we show that such embeddings exist in many settings, and have optimal distortion bounds both with respect to $X \times X$ and with respect to $K \times X$.

Moreover, our embeddings have implications to the areas of Approximation and Online Algorithms. In particular, [ALN08] devised an $\tilde{O}(\sqrt{\log r})$-approximation algorithm for sparsest-cut instances with r demands. Building on their framework, we provide an $\tilde{O}(\sqrt{\log |K|})$-approximation for sparsest-cut instances in which each demand is incident on one of the vertices of K (aka, terminals). Since $|K| \leq r$, our bound generalizes that of [ALN08].

Keywords— embedding, distortion, terminals

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