

Approximate Nearest Neighbor for Polygonal Curves under Frechet Distance

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Siu-Wing Cheng and Haoqiang Huang

Abstract: We propose κ -approximate nearest neighbor (ANN) data structures for n polygonal curves with at most m vertices each under the Fréchet distance in \mathbb{R}^d , where $\kappa \in \{1 + \epsilon, 3 + \epsilon\}$ and $d \geq 2$. We assume that every query curve has at most k vertices, $k \ll m$, and k is given for preprocessing. The query times are $\tilde{O}(k(mn)^{0.5+\epsilon/\epsilon^{O(d)}} + k(d/\epsilon)^{O(dk)})$ for $(1 + \epsilon)$ -ANN and $\tilde{O}(k(mn)^{0.5+\epsilon/\epsilon^{O(d)}})$ for $(3 + \epsilon)$ -ANN. The space and expected preprocessing time are $\tilde{O}(k(mnd^d/\epsilon^d)^{O(k+1/\epsilon^2)})$ in both cases. In two and three dimensions, we improve the query times to $\tilde{O}(k/\epsilon^{O(k)})$ for $(1 + \epsilon)$ -ANN and $\tilde{O}(k)$ for $(3 + \epsilon)$ -ANN. The space and expected preprocessing time improve to $\tilde{O}(k(mn/\epsilon)^{O(k)})$ in both cases. For ease of presentation, we suppress factors in our bounds that depend purely on d . The hidden polylog factors in the big- \tilde{O} notation have powers dependent on d .

Presenter: HUANG, Haoqiang

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