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Time-Dependent Approximate Distance Oracles

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Abstract. We present the first approximate distance oracle for sparse directed graphs with *time-dependent* arc-travel-times, which assures polynomial time-complexity and subquadratic space-complexity of the preprocessing phase, while the query-phase has sublinear time-complexity. The arc-travel-times are determined by continuous, piecewise linear, positive functions. Our oracle is based on two fundamental assumptions which are quite natural for realistic large-scale instances, such as urban-traffic in metropolitan-size road networks. The first assumption, called *Bounded Travel-Time Slopes*, asserts that the partial derivatives of the fastest-travel-time functions between any pair of origin-destination vertices are bounded in a given fixed interval $(-1, \Lambda_{\max}]$ for a given *constant* $\Lambda_{\max} \geq 0$. The second assumption, called *Bounded Opposite Trips*, asserts that, for any given departure time, the fastest-travel-time from one point to another point is not more than a *constant* $\zeta \geq 1$ times the fastest-travel-time in the other direction. These two assumptions allow the *gradual divergence* from undirectedness and time-independence.

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The full version of this technical report will appear shortly.