Funnel Technique for Finding Shortest Paths from a Fixed Source Point to all Destination Points on a Convex Polyhedral Surface

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Abstract: In this talk, we present an $O(n^2)$ algorithm for finding the exact shortest paths from a fixed source point to all other points on a triangulated polyhedral surface of a convex polytope in three-dimensional space using the concept of funnels on the surface. Each funnel has a cusp which is the source point and has two borders which are locally shortest paths to vertices of the surface. Our algorithm determines a funnel tree which allows one to compute a shortest path from the source point to any query point t of the surface. The funnel tree is built by recursively splitting funnels. Because of special shape of these funnels (their left boundaries are straightest geodesics), funnels are determined explicitly and do not rely on unfolding technique. Therefore, comparing with Chen and Han's algorithm [J. Chen and Y. Han, Shortest Paths on a Polyhedron, *Int. J. Comput. Geom. Appl.*], the proposed algorithm theoretically outperforms in the step of planar unfolding. Some examples are presented in order to compare with a Kaneva and O'Rourke's implementation [B. Kaneva and J. O'Rourke, An implementation of Chen & Han's shortest paths algorithm, *CCCG 2000*] for Chen and Han's algorithm with respect to the running time.

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