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The Geodesic Farthest-Site Voronoi Diagram in a Polygonal Domain with Holes

We investigate the farthest-site Voronoi diagram of k point sites with respect to the geodesic distance in a polygonal domain of n corners and h (≥ 0) holes. In the case of $h = 0$, Aronov et al. in 1993 proved that there are at most $O(k)$ faces in the diagram and the complexity of the diagram is at most $O(n + k)$. However, any nontrivial upper bound on the geodesic farthest-site Voronoi diagram in a polygonal domain when $h > 0$ remains unknown afterwards. In this paper, we show that the diagram in a polygonal domain consists of $\Theta(hk)$ faces and its total combinatorial complexity is $\Theta(nk)$ in the worst case for any $h \geq 1$. Interestingly, the worst-case complexity of the diagram is independent from the number h of holes if $h \geq 1$ while the maximum possible number of faces is dependent on h rather than on the complexity n of the polygonal domain. Also, we present an $O(nk \log^2 (n + k) \log k)$-time algorithm that constructs the diagram explicitly.