n-VDD: Location Privacy Framework Based on Voronoi-Delaunay Duality

Abstract—To date, location privacy protection is a critical issue in Location-Based Services (LBS). In this work, we propose a novel geometric framework based on the classical discrete structure, the Voronoi-Delaunay duality (VDD). We make use of the fact that if only given an irregular n-side Voronoi cell around the user location, the user location cannot be recovered and the anonymity zone is the intersection of all the parallel strips perpendicular to and bounded by n Voronoi edges. The irregular Voronoi cell and its variations can be used as the concealing space to hide the user's location or the region of interest and submitted to the LBS server. Within this framework, we propose two types of anonymizing models by setting the initial Delaunay polygon to be regular with further adaption and irregular, respectively. The proposed method is efficient by taking advantage of the VDD principle where main computations are linear line-line intersections. Experiments with various parameters demonstrate the efficiency and efficacy of the proposed n-VDD framework.
Index Terms—Location-based service, location privacy, Voronoi diagram, Delaunay triangulation.