Chapter 1 : Concrete And Abstract Voronoi Diagrams

Abstract. The Voronoi diagram of a set of sites is a partition of the plane into regions, one to each site, such that the region of each site contains all points of the plane that are closer to this site than to the other ones.

This paper presents control and coordination algorithms for groups of vehicles. The focus is on autonomous vehicle networks performing distributed sensing tasks where each vehicle plays the role of a mobile tunable sensor. The paper proposes gradient descent algorithms for a class of utility functio The paper proposes gradient descent algorithms for a class of utility functions which encode optimal coverage and sensing policies. The resulting closed-loop behavior is adaptive, distributed, asynchronous, and verifiably correct. A centroidal Voronoi tessellation is a Voronoi tessellation whose generating points are the centroids centers of mass of the corresponding Voronoi regions. We give some applications of such tessellations to problems in image compression, quadrature, finite difference methods, distribution of res We give some applications of such tessellations to problems in image compression, quadrature, finite difference methods, distribution of resources, cellular biology, statistics, and the territorial behavior of animals. We discuss methods for computing these tessellations, provide some analyses concerning both the tessellations and the methods for their determination, and, finally, present the results of some numerical experiments. Show Context Citation Context Note that if one instead considers 1. The theme of this paper is a rather simple method that has proved very potent in the analysis of the expected performance of various randomized algorithms and data structures in computational geometry. The method can be described as "analyze a randomized algorithm as if it were running backward The approach has proved useful in such diverse area It was also very soon realized that the O n log n bound was asymptotically worst case opti Discrete Algorithms , " The Voronoi diagram of a point set is a fundamental geometric structure that partitions the space into elementary regions of influence defining a discrete proximity graph and dually a well-shaped Delaunay triangulation. In this paper, we investigate a framework for defining and building the Voronoi In this paper, we investigate a framework for defining and building the Voronoi diagrams for a broad class of distortion measures called Bregman divergences, that includes not only the traditional squared Euclidean distance, but also various divergence measures based on entropic functions. As a by-product, Bregman Voronoi diagrams allow one to define information-theoretic Voronoi diagrams in statistical parametric spaces based on the relative entropy of distributions. We show that for a given Bregman divergence, one can define several types of Voronoi diagrams related to each other Show Context Citation Context In artificial intelligence, machine learning techniques also rely on geom

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Abstract Voronoi diagrams can be computed efficiently and there exists a worst-case efficient algorithm of divide-and-conquer type that applies to all abstract Voronoi diagrams satisfying a certain constraint.

Show Context Citation Context In artificial intelligence, machine learning techniques also rely on geometric concepts for building classifiers in supervised problems e. This paper presents a dynamic algorithm for the construction of the Euclidean Voronoi diagram of a set of convex objects in the plane. We consider first the Voronoi diagram of smooth convex objects forming pseudo-circles set. A pseudo-circles set is a set of bounded objects such that the boundarie A pseudo-circles set is a set of bounded objects such that the boundaries of any two objects intersect at most twice. Our algorithm is a randomized dynamic algorithm. It does not use a conflict graph or any sophisticated data structure to perform conflict detection. This feature allows us to handle deletions in a relatively easy way. In the case where objects do not intersect, the randomized complexity of an insertion or deletion can be shown to be respectively and. Our algorithm can easily be adapted to the case of pseudocircles sets formed by piecewise smooth convex objects. The rising need for handling curved objects triggered further works for the planar cases. They provided a randomized incremental algorithm to construct diagrams of this class. We present a general framework for computing two-dimensional Voronoi diagrams of different site classes under various distance functions. The computation of the diagrams employs the Cgal software for constructing envelopes of surfaces in 3-space, which implements a divide-and-conquer algorithm. A straightforward application of the divide-andconquer approach for Voronoi diagrams yields highly inefficient algorithms. We show that through randomization, the expected running time is near-optimal in a worst-case sense. We believe this result, which also holds for general envelopes, to be of independent interest. We describe the interface between the construction of the diagrams and the underlying construction of the envelopes, together with methods we have applied to speed up the exact computation. We then present results, where a variety of diagrams are constructed with our implementation, including power diagrams, Apollonius diagrams, diagrams of line segments, Voronoi diagrams on a sphere, and more. In all cases the implementation is exact and can handle degenerate input. Various Voronoi diagrams computed with our program; for the parameters of sites in each diagram, see Table 1: Transportation networks model facilities for fast movement on the plane. A transportation network, together with its underlying distance, induces a new distance. Previously, only the Euclidean and the L1 distances have been considered as such underlying distances. However, this paper first considers However, this paper first considers distances induced by general distances and transportation networks, and present a unifying approach to compute Voronoi diagrams under such a general setting. With this approach, we show that an algorithm for convex distances can be easily obtained. We consider the Voronoi diagram of a set of n points in three dimensions under a convex distance function induced by an arbitrary, fixed polytope. The combinatorial complexity, i. Unlike previous work, we do not need probabilistic arguments or recurrence techniques, but we exploit properties of the involved geometric structures. Key observations are that the lower envelope of n polygonal chains in the plane with a total of O n line segments and with only a fixed number of slopes is linear in n, and that the number of slopes of Voronoi edges is bounded by a constant that only depends on the complexity of the polytope. A further generalization of distances is proposed in [14]; here, every site is associated its own, different distance function. This paper is organized as follows. The Voronoi diagram of planar convex objects by Menelaos I. A pseudo-circles set is a set of bounded objects such that the b In the case where objects do not intersect, the randomized complexity of an insertion or deletion can be shown to be respectively O log 2 n and O log 3 n. Our algorithm can easily be adapted to the case of pseudo-circles sets formed by piecewise smooth convex objects. Given two sets A and B of m non-intersecting line segments in the plane, we show how to compute in O m log m time a data structure that uses O m space and allows to answer the following query in O log m time: This structure can be used This structure can be used to build a data structure that stores a simple polygon and allows ray-shooting queries along parabolic trajectories with vertical main axis. This matches the best known bound for circular ray shooting in simple polygons.

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Concrete and abstract Voronoi diagrams. [Rolf Klein] -- "The Voronoi diagram of a set of sites is a partition of the plane into regions, one to each site, such that the region of each site contains all points of the plane that are closer to this site than.

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The Abstract Voronoi diagrams are a general framework covering many types of concrete diagrams for different types of sites or distance measures. Generalizing a famous result by Aggarwal et al. [1.

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