固定パラメータ問題に対する高速算法に基づく計算困難問題の解決

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2006 Fiscal Year Final Research Report Summary

Solving Computationally Hard Problems Based on Fast Algorithms for Fixed-Parameter Problems

Research Project

Project/Area Number

15300003

Research Category

Grant-in-Aid for Scientific Research (B)

Allocation Type

Single-year Grants

Section

一般

Research Field

Fundamental theory of informatics

Research Institution

JapanAdvanced Institute of Science and Technology

Principal Investigator

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Project Period (FY)

2003 – 2006

Keywords

algorithm / computational geometry / fixed-parameter problem / asymptotic analysis / computational complexity

Research Abstract

The purpose of this research is to establish methodology for solving fixed parameter problems in an efficient way under latest computer environment. For the purpose we mathematically evaluate some aspects of programming which has not been reflected to analysis as just simple programming techniques and then analyze computational performance from a completely different standpoint from the existing ones.
In this year we spent much time for the study of distance trisector curves. Given two points in the plane, it is easy to draw perpendicular bisector, but it is hard to draw two curves equidistant from each other. More exactly, we can approximate points on the curves at any precision, but it is impossible to compute their coordinates exactly without any error. In fact we conjecture that the curves are non-algebraic. In this research we proved that such curves exist and they are unique, mathematically in a constructive manner. We also found many interesting properties of the curves. The resu lts were presented at an international symposium STOC, one of the top conference in the world in this area and also published in a top mathematical journal, Advances in Mathematics. It is rather surprising that it is quite simple and fundamental problem while there is no study on the curves. We also applied the idea to Voronoi diagrams, which is one of the most important research topics in computational geometry. In this research we defined various Voronoi diagrams based on criteria on goodness of triangles by generalizing the traditional Voronoi diagrams.

More concretely, given a set of line segments in the plane, an angular Voronoi diagram is a partition of the plane into regions by the relation on which line segment gives the smallest visual angle. We have shown that this Voronoi diagram has properties which are quite different from those of the exisiting ones. We also gave an efficient algorithm for finding a point that maximizes the smallest visual angle. The results were presented at an international symposium on Voronoi diagrams We are now preparing journal version of those papers to submit them to international journals.▲ Less

Research Products (36 results)

All | 2007 | 2006 | Other

All | Journal Article

[Journal Article] Zone Diagram : Existence, Uniaueness and Algorithmic Challenge 2007

[Journal Article] Zone Diagram : Existence, Uniqueness and Algorithmic Challenge, 2007

[Journal Article] Inserting Points Uniformly at Every Instance 2006

[Journal Article] A Linear Time Algorithm for Binary Fingerprint Image Denoising Using Distance Transform 2006

[Journal Article] Polyline fitting of planar points under min-sum criterion 2006

[Journal Article] Site consistency in phylogenetic networks with recombination 2006

[Journal Article] Fingerprint Matching Using Minutia Foiygons 2006

[Journal Article] A Combined Radial Basis Function Model lor Fingerprint Distortion 2006

[Journal Article] Angular Voronoi Diagram with Applications 2006

[Journal Article] Aspect-ratio voronoi Diagram with Applications 2006

[Journal Article] Distorted Fingerprint Indexing Using Minutia Detail and Delaunay Triangle 2006

[Journal Article] Distance Trisector Curves in Regular Convex Distance Metrics 2006

[Journal Article] The Distance Trisector Curve 2006

[Journal Article] Template Matrices for Perfect Phylogeny Haplotyping and Site Consistency 2006

[Journal Article] Computational Geometric and Combinatorial Approaches to Digital Halftoning 2006

[Journal Article] Inserting Points Uniformly at Every Instance, 2006

[Journal Article] A Linear Time Algorithm for BinaryFingerprint Image Denoising Using Distance Transform, 2006

[Journal Article] Polyline fitting of planar points under min-sum criterion, 2006

[Journal Article] Site consistencyin phylogenetic networks with recombination 2006

[Journal Article] Fingerprint Matching Using Minutia Polygons, 2006

[Journal Article] A Combined RadialBasis Function Model for Fingerprint Distortion, 2006

[Journal Article] Angular Voronoi Diagram with Applications, 2006

[Journal Article] Aspect-ratio Voronoi Diagram with Applications, 2006

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[Journal Article] A Generalization of Magic Squares with Applications to Digital Halftoning

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