Algorithmical Geometry: Delaunay Triangulation

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Outline

Introduction

Introduction: Previous Work and Hands-On Approach

(1) Shewchuk, "Triangle: Engineering a 2D Quality Mesh Generator and Delaunay Triangulator", 1996

(2) Guibas and Stolfi, "Primitives for the Manipulation of General Subdivisions and the Computation of Voronoi Diagrams", 1985

(3) Dwyer, "A Faster Divide-and-Conquer Algorithm for Constructing Delaunay Triangulations", 1987

Introduction: Overview

Educational Problems:

- ▶ Duality to Voronoi Diagrams
- ▶ Incremental, Sweepline, Divide-and-Conquer Algorithms
- ▶ Varying Data Structures

Here: Triangular Data Structure and Divide-and-Conquer Algorithm

- ▶ Smallest Data Structure
- ▶ Fastest Algorithm
- ▶ Robust when using tweaks

Background

Geometric Primitives

Data Structures

Algorithm

Implementation Aspects

Applications

Conclusions

Thank you for Your Attention!

References

(1) Jonathan Richard Shewchuk. "Triangle: Engineering a 2D Quality Mesh Generator and Delaunay Triangulator". In: *Applied Computational Geometry: Towards Geometric Engineering*. Ed. by Ming C. Lin and Dinesh Manocha. Vol. 1148. Lecture Notes in Computer Science. From the First ACM Workshop on Applied Computational Geometry. Springer-Verlag, May 1996, pp. 203–222. URL: https://people.eecs.berkeley.edu/~jrs/papers/triangle.pdf (visited on 11/07/2020).

(2) Leonidas Guibas and Jorge Stolfi. "Primitives for the Manipulation of General Subdivisions and the Computation of Voronoi Diagrams". In: *ACM Transactions on Graphics* 4 (April 1985), pp. 74–123. DOI: 10.1145/282918.282923. URL: http://sccg.sk/~samuelcik/dgs/quad_edge.pdf (visited on 11/07/2020).

(3) Rex A. Dwyer. "A Faster Divide-and-Conquer Algorithm for Constructing Delaunay Triangulations". In: *Algorithmica* 2 (November 1987), pp. 137–151. DOI: 10.1007/BF01840356.

(4) Dani Lischinski. *Incremental Delaunay Triangulation.*

(7) Christoph Burnikel. *Delaunay Graphs by Divide and Conquer*. 1998. URL: https://pure.mpg.de/rest/items/item_1819432_4/component/file_2599484/content (visited on 11/07/2020).

(8) V. Fuetterling, C. Lojewski, and F.-J. Pfreundt. "High-Performance Delaunay Triangulation for Many-Core Computers". In: *High Performance Graphics* 2014 (2014), pp. 97–104. DOI: 10.2312/hpg.20141098.

(9) D. T. Lee and B. J. Schachter. "Two Algorithms for Constructing a Delaunay Triangulation". In: *International Journal of Computer and Information Sciences* 9 (1980), pp. 219–242. DOI: 10.1007/BF00977785.

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(11) Jyrki Katajainen and Markku Koppinen. "Constructing Delaunay Triangulations by Merging Buckets in Quad-Tree Order". In: *Fundamenta Informaticae* 11 (April 1988), pp. 275–288.