Computational topology: Lecture 2

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1. Introduction to Computational Geometry and Topology

2. Line segment intersection

Introduction to Computational Geometry and Topology

COMPUTATIONAL GEOMETRY,

Michael Ian Shamos, Yale University, 1978

Abstract

This thesis is a study of the computational aspects of geometry within the framework of analysis of algorithms.It develops the mathematical techniques that are necessary for the design of efflcent al~orithms and applies them to a wide variety of theoretical and practical problems. Particular attention Is given to proving lower bounds on running time and to analyzing the average-case performance of geometric algorithms. The approach taken Is to Isolate a computational feature that Is common to a large class of problems. It turns out, for example, that determining whether any two of N line segments In the plane overlap Is an e3sential step in many intersection applications. An optimal algorithm. for this problem,. therefore, becomes an Important geometric tool that can be used to build other, more ccmp!!cated, fast algorithms. This method Is employed in a unified attack on the problem of the convex hull, various geometric search problems, finding the Intersection of objects and ,“,up-stlons Involving the proximity of points In the plane. What emerges Is a modern, coherent discipline that Is successful at merging classical geometry with computational compit!xity. Among the major new results presented are a convex hull algorithm with expected running time that Is linear In the number of input points, an O(N log N) algorithm for linear programming In two variables (which Is superior to the Simplex method), and an O(N log N) algorithm for constructing a minimum spanning tree on a finite set of points In the plane.

Computational Topology

CPS296.1: COMPUTATIONAL TOPOLOGY by Herbert Edelsbrunner, at Duke University, and at Institute of Science and Technology Austria

CS 598: Computational Topology, Spring 2013 by Jeff Erickson, at University of Illinois

Books

- Computational Topology: An Introduction
- Computational Geometry: Algorithms and Applications

Line segment intersection

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