Semester Report WS05 of Kevin Buchin

Name:	Kevin Buchin
Supervisor:	Günter Rote
Field of Research:	Computational Geometry
Topic:	Geometric Structures on Point Sets
	Probabilistic Analysis of Geometric Algorithms
	Space-Filling Curves
PhD Student	in the program since May 2003

Field of Research and Results

In this semester I continued working on the incremental construction using space-filling curves, proving results for more general distributions. Together with Scot Drysdale I worked on incremental construction using spiral search, proving results on several variants of the algorithm. Together with Eyal Ackermann, Christian Knauer, and Günter Rote I worked on acyclic orientations of graph drawings. Together with Carola Wenk and Maike Buchin I worked on the Fréchet distance between simple polygons. Further I worked on topology control for ad-hoc networks.

For the incremental construction using space-filling curves I proved that the point location can be done in expected constant time per point, if the points are drawn from a normal distribution. The same result holds if the points are drawn from a uniform distribution (or any distribution with the density function bounded from above and away from zero from below) in a d-cube for any constant dimension d.

My work on the incremental construction using spiral search is concerned with an algorithm proposed by Peter Su and Scot Drysdale. We proved that the algorithm runs in expected linear time. This result generalizes to higher dimensions and also more general convex shapes (also in higher dimensions).

Together with Eyal Ackermann, Christian Knauer, and Günter Rote I worked on orienting topological graphs. The question we are working on is the following: Given a topological graph, find an orientation of the edges such that the induced orientation on the corresponding planar map has no cycles. We give results depending on the number of intersections the edges have.

In August 2005 I visited Carola Wenk at the University of Texas in San Antonio. Together with Maike Buchin and Carola Wenk I proved that the

Fréchet distance between simple poolygons is computable in polynomial time.

I participated in the *GI-Research Seminar on Sensor- and Ad-hoc Networks*. Together with Maike Buchin I gave a survey on topology control in sensor- and ad-hoc networks. I also gave a prove for the NP-hardness of minimizing the maximum interference at receiving nodes.

Activities

Talks

- *Flow Complex: General Structure and Algorithm*
  17th Canadian Conference on Computational Geometry in Windsor, Canada, August 12, 2005

- *A New Randomized Algorithm for Fast Delaunay Mesh Generation*
  Research Seminar of the Computer Science Department at the University of Texas at San Antonio, August 25, 2005

- *On the Delaunay triangulation of normally distributed points*
  Noon Seminar of the Theoretical Computer Science Group at Free University Berlin, September 22, 2005

- *On Biased Randomized Incremental Construction*
  5th Workshop on Combinatorics, Geometry, and Computation on Hiddensee, September 27, 2005

- *Constructing Delaunay Triangulations along Space-Filling Curves*
  2nd International Symposium on Voronoi Diagrams in Science and Engineering, in Seoul, Korea, October 12, 2005

- *Delaunay and Neighbor Based Topology Control for Ad Hoc Networks*
  Noon Seminar of the Theoretical Computer Science Group at Free University Berlin, November 17, 2005

- *Topology Control for Ad Hoc Networks (2)*
  GI-Dagstuhl Research Seminar, November 23, 2005

- *Minimizing Interference in Ad Hoc Networks*
  Noon Seminar of the Theoretical Computer Science Group at Free University Berlin, December 1, 2005

- *Incremental Construction of a Delaunay Triangulation with Lawson's Oriented Walk*
  Noon Seminar of the Theoretical Computer Science Group at Free University Berlin, February 16, 2006

Attended conferences and workshops

- *17th Canadian Conference on Computational Geometry*
  in Windsor, Canada, August 10 – 12, 2005
- *European Conference on Combinatorics, Graph Theory, and Applications* at Technical University Berlin, September 5 – 9, 2005
- *5th Workshop on Combinatorics, Geometry, and Computation*
  on Hiddensee, September 25 – 28, 2005
- *2nd International Symposium on Voronoi Diagrams in Science and Engineering* in Seoul, Korea, October 10 – 13, 2005
- *Algorithms for Sensor and Ad Hoc Networks*
  GI-Dagstuhl Research Seminar, November 23 – 25, 2005

Attended lectures and seminars

- *Monday Lectures and Colloquia*
  of CGC in Berlin
- *Noon Seminar* of the Theoretical Computer Science Group
  at Free University Berlin

Research Visit

- Research visit at the University of Texas at San Antonio
  with Dr. Carola Wenk, August 15 – 26, 2005

Preview

In the next semester I plan to finish my PhD. I plan to continue working on reusable, robust implementations of the algorithms in CGAL analysed in my work.