

PG-452: Seminar Topics

Stefan Edelkamp, Shahid Jabbar, Tillman Mehler

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1 Algorithms

1.1 External Memory Algorithms

- Breimann and Vahrenhold, External Memory Computational Geometry Revisited, in Meyer, Sanders, Sibeyn (Eds.) Algorithms for Memory Hierarchies, LNCS 2625, Springer-Verlag, 2003.
- Edelkamp, Localizing A*, in Proceedings of AAAI 2000, Austin, TX, 2000.
- Edelkamp, External A*, unpublished manuscript.

1.2 Geometric Containers Static + Dynamic

- Wagner and Willhalm, *Geometric speed-up techniques for finding shortest paths in large sparse graphs*, in Giuseppe Di Battista and Uri Zwick, editors, Proc. 11th European Symposium on Algorithms (ESA 2003), LNCS 2832, pp. 776–787. Springer, 2003.
- Wagner, Willhalm, and Zaroliagis, *Dynamic shortest path containers*, in Alberto Marchetti-Spaccamela, editor, Proc. Algorithmic Methods and Models for Optimization of Railways 2003, Electronic Notes in Theoretical Computer Science, 2003.

1.3 Dynamic Shortest Paths

- Ahuja, Orlin, Pallottino, and Scutella, *Dynamic Shortest Paths Minimizing Travel Times and Costs*, Networks, vol. 41, pp. 197–205, 2003 (previously appeared as TR 01-23, Dipartimento di Informatica, Universita di Pisa, 2001)
- Frigioni, Marchetti-Spaccamela, Nanni. *Fully Dynamic Shortest Paths in Digraphs with Arbitrary Arc Weights*. Journal of Algorithms, vol. 49(1), pp. 86–113, Elsevier Science, 2003.

1.4 GPS-Route

- Jabbar, *GPS-based Navigation in Static and Dynamic Environments*, Master's thesis, Institut fuer Informatik, Universitaet Freiburg, 2003.
- Edelkamp, Jabbar, and Willhalm, *Geometric Travel Planning*, in Proc. of ITCS-03, Shanghai, China, 2003.

1.5 Geometric Search

Chapter 5 and 10 from Computational Geometry book by de Berg *et. al.* 2nd edition.

- Chapter 5: Orthogonal Range Searching
 - 1 -Dimensional Range searching
 - Kd-Trees
 - Range Trees
 - Higher-Dimensional Range Trees
 - General Sets of Points
 - Fractional Cascading
- Chapter 10: More Geometric Data Structures, Windowing.
 - Interval Trees
 - Priority Search Trees
 - Segment Trees

Lectures for the course on Computational Geometry by Prof. Ottmann (Freiburg). Available online at:

<http://ad.informatik.uni-freiburg.de/lehre/ss03/geomalg/index.html>

2 GPS Devices / Hardware / Map

2.1 Geometric Filtering

Combining the inertial information from external sources like speed-o-meter, with GPS data - Kalman filter. Resources:

- The Kalman filter: Navigation's Integration Workhorse.
<http://www.cs.unc.edu/~welch/kalman/Levy1997/>
- Student project report: *Design and Characterization of a Strapdown Inertial Navigation System based on Low Cost Sensors* available at
<http://www.electronic-engineering.ch/study/ins/ins.html>

- List of resources including source code on Kalman filter.
<http://www.cs.unc.edu/~welch/kalman/>
- Guttman, *Robuste Navigation autonomer mobiler Systeme*, PhD dissertation, Universitaet Freiburg, 1999.

2.2 Geometric Rounding

- Mehlhorn, *Geometric Rounding, notes for mini-course*, (only an overview)
<http://www.mpi-sb.mpg.de/~mehlhorn/SelectedTopics02/GeometricRounding/GeometricRounding.html>
- Hersherberger and Snoeying, *Speeding up the Douglas-Peucker line - simplification algorithm*, technical report TR-92-07, University of British Columbia, Canada, 1992.
- de Berg, van Kreveld and Schirra, *A new approach to subdivision simplification*, in Proc. of Auto-Carto 12, pages 79-88, 1995.

2.3 Map Generation

- Edelkamp and Schroedl, *Route Planning and Map Inference with Global Positioning Traces*, in Klein, Six, Wegner (Eds.) Computer Science in Perspective, LNCS 2598, Springer-Verlag, 2003.
- Agrawala and Stolte, *Rendering effective route maps: improving usability through generalization*, in Proc. of Siggraph'01, pp. 241-249, 2001.

2.4 Electronic Maps + GPS Devices

- **Survey** on current GPS technology, GPS data format (NMEA), GPS devices.
- A good starting point is
<http://www.colorado.edu/geography/gcraft/notes/gps/gps.html>
- What kind of different electronic maps are available in the market ?
- Survey on the availability of raster and vector maps.
- Map format (e.g. NOS/NIS format used in TOP 50 maps)
<http://www.aeroplanner.com/dev/NosGeo.cfm>. There is an ActiveX control also available that can read maps. How could it be helpful to us ?
- Survey of different GIS softwares.
- Survey of different cartographic research groups e.g. at Uni. Bonn and FH Karlsruhe.

3 Simulation + Implementation

3.1 Traffic Models

- Survey of different traffic models and traffic simulation tools. A good starting point is <http://www.microsimulation.drfox.org.uk/>.
- Study of the GPS simulator available at <http://www.lichtenheld-mch.de/gpssim.htm>

3.2 Algorithm Animation

- Study of VEGA, its extensibility, its limitations, its advantages and disadvantages.
- Ch.A. Hipke and S. Schuierer. *VEGA: A user centered approach to the distributed visualization of geometric algorithms*, in Proc. of the 7-th International Conference in Central Europe on Computer Graphics, Visualization and Interactive Digital Media (WSCG'99), pages 110–117, 1999.
- Christoph A. Broecker (fr. Hipke), *Verteilte Visualisierung geometrischer Algorithmen und Anwendungen auf Navigationsverfahren in unbekannter Umgebung*, PhD dissertation, Institut fuer Informatik, Universitaet Freiburg, 1999.
- Overview of the EON algorithm animation library.
- Survey of different algorithm animation systems. A good starting point is the Multimedia group at Freiburg.

3.3 LEDA + CGAL

- Study of LEDA. Its features for computational geometry, ability to handle floating point operations and graphics. Installation problems with LEDA. Reference materials:
 - LEDA manual available with the software and also on the internet.
 - LEDA book by Mehlhorn and Naeher.
- Introduction on CGAL. The comparison of geometrical algorithms available to LEDA's. Its floating point kernel comparison with that of LEDA.

3.4 Mobile Programming

- Client/server-based programming for Pocket PCs using Embedded Visual C++.
- How can we avoid re-coding of the system for mobile devices and internet ? We want to avoid Java. Can the ActiveX controls or some new technology be of some help ?