KANDIDATORIENTERING

6. MAY 2011

GROUP: **ALGORITHMS AND DATA STRUCTURES**

The group works on improved algorithms and data structures for fundamental problems in classical computational models, as well as in newer models such as the external memory and cache-oblivious models that take the hierarchical memory of modern machines into account. The group especially works on so-called I/O-efficient algorithms, that is, algorithms that are designed to efficiently process truly massive datasets that must reside on slow secondary storage devices. It also has a focus on algorithm engineering that covers the design and analysis of practical algorithms, efficient implementation of these algorithms, as well as experimentation that provide insight into their applicability and further improvements.

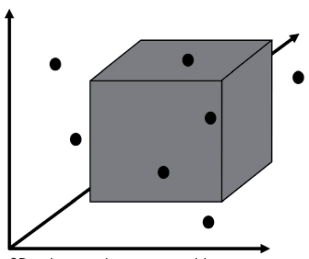
The group is organized around the Center for Massive Data Algorithms, or MADALGO, a Center of Excellence supported by the Danish National Research Foundation. (2007-2017)

RESEARCH PROJECTS

Processing and simulation on **terrain data** is an ongoing research topic within the group. Recently we e.g. have developed I/O efficient algorithms for computing contour lines from terrain data, and in the area of terrain analysis, we have worked extensively on terrain water flow modeling problems, including the so-called terrain flooding problem.

Range searching is the problem of storing a set of points (or other geometric objects) and to report which objects are within a query range. We have considered various one- and two-dimensional internal memory range searching problems. In one dimension we have presented space optimal data structures for returning the elements in a subrange of an array in sorted order, data structures for returning the median element in a subarray, and for finding the most frequent element (mode) in any subarray. In one and two dimensions we have studied the problem of storing an array of values such that the minimum element in a rectangular query region can be reported efficiently with minimal space usage. The higher-dimensional orthogonal range reporting problem is a classical and longstanding open problem. We have developed a space and query optimal three-dimensional structure and showed that the query time has to increase with dimension.

The blue parts of the map to the right denotes land that would flood if the ocean around Denmark rose 3.5 meters. (Data provided by COWI)



3D orthogonal range searching

COURSES

INTRODUCTORY
Algorithms and Data Structures 1(Q3)
Algorithms and Data Structures 2(Q4)

ADVANCED
Computational Geometry(Q1+Q2)

Advanced Algoritms:
Data Structures(Q1+Q2)
Streaming Algorithms (Q4)
I/O Algorithms(Q3+Q4)

RELATED COURSES

"Students who liked these courses also liked"

Randomized Algorithms(Q3)
Dynamic Algorithms(Q4)
String Algorithms(Q4)
Optimization(Q3)
Combinatorial Search(Q4)
Complexity Theory(Q1+Q2)

SCIENTIFIC STAFF

Permanent Staff
Lars Arge (professor)
Gerth Stølting Brodal (associate professor)

Affiliated post docs
Lap Kei Lee
Elad Verbin
Qin Zhang
Nodari Sitchinava
Henrik Blunck
Brody Sandel

PHD STUDENTS

Freek van Walderveen: "I/O Efficient Algorithms for Spatial Data"
Casper Kejlberg-Rasmussen: "Implicit and Cache-Oblivious Data Structures"
Pooya Davoodi: "Succint Data Structures for Range Searching"
Jakob Truelsen: "Implicit Dicitonaries and Range Mode Data Structures"
Kasper Dalgaard Larsen: "Higher Dimensional Range Searching"
Mark Greve: "One-dimensional Range Searching Problems"
Konstantinos Tsakalidis: "Range Searching in Dynamic Planar Point Sets"
Jesper Erenskjold Moeslund: "Fine Resolution Geospatial Modelling of Contemporary and Future Plant Diversity in Denmark"
Lasse Kosetski Deleuran: "Line Simplification"
Morten Revsbæk: "Algorithms for Massive Terrain Data"
Jesper Asbjørn Sindahl Nielsen: "Quality Assurance in Large Scale Digital Preservation"

MASTER'S THESIS EXAMPLES

David Kjær: Range Median Algorithms.

Jonas Suhr Christensen: Experimental Study of Kinetic Geometric t-Spanner Algorithms.

Henrik B. Kirk: Searching with Dynamic Optimality: In Theory and Practice.

Krzysztof Piatkowski: Implementering og udvikling af maksimum delsum algoritmer.

Claus Andersen: An optimal minimum spanning tree algorithm.

Jonas Maturana Larsen and Michael Nielsen: En undersøgelse af algoritmer til løsning af generalized movers problem i 3D.

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