Thomas Mølhave (Moelhave)

SCALGO
Aabogade 34
8200 Aarhus N
Denmark

http://scalgo.com
http://cs.duke.edu/~thomasm/
thomas@moelhave.com

Position

CTO, Co-founder, SCALGO, 2009-present
Adjunct Factulty, Department of Computer Science, Duke University, 2013-present

Employment

CTO, Co-founder — October 2009-present
Aarhus, Denmark — Scalable Algorithmics (SCALGO)
SCALGO was founded in 2009 in Aarhus, Denmark with the mission to bring cutting-edge massive terrain data-processing technology to market. SCALGO software builds on more than two decades of basic and applied research on I/O-efficient and geometric algorithms.

CEO, Co-founder — 2013-2015
Durham, NC USA — Scalable Algorithmics USA

Research Scientist — January 2011-September 2013
Durham, NC, USA — Duke University
Worked at the Department of Computer Science with Pankaj Agarwal on algorithms and data structures for large geospatial data and ecological modeling.

Postdoctoral Associate — September 2009-December 2010
Durham, NC, USA — Duke University
Worked at the Department of Computer Science with Pankaj Agarwal on algorithms and data structures for large geospatial data sets and ecological modeling.

Summer Intern — June-August, 2007
Shannon Laboratories, NJ, USA — AT&T Research
Worked with Adam Buchsbaum on algorithms on graphs and on optimizing and analyzing various branch prediction algorithms.

Student Programmer — 2003-2005
University of Aarhus, Denmark — CAVI
OpenGL 3D Graphics Programming on desktop machines and clusters.

Entrepreneurship

I co-founded the Danish company Scalable Algorithmics (SCALGO) in November 2009 and the US company SCALGO USA in July 2013.

Education

PhD Computer Science, University of Aarhus, August 2005 - Sep 2009. Adviser: Lars Arge.
MSc, Computer Science, 2007.
BSc, Computer Science (Minor in Mathematics), 2004.

Research Interests

Algorithms and data structures in the cache-oblivious, memory resilient, and external memory models. Computational geometry. Geographic information systems.

Dissertation

1. Thomas Mølhave. *Handling Massive Terrains and Unreliable Memory.* PhD thesis, Aarhus University, Department of Computer Science, 8 2009

Conference Papers

2. Allan Grønlund Jørgensen, Gabriel Moruz, and Thomas Mølhave. Priority queues resilient to memory faults. In *WADS '07: Proceedings of the 10th International Workshop on Algorithms and Data Structures*, volume 4619 of *Lecture Notes in Computer Science*, pages 127–138. Springer-Verlag, 8 2007
3. Gerth Stølting Brodal, Rolf Fagerberg, Irene Finocchi, Fabrizio Grandoni, Giuseppe Italiano, Allan Grønlund Jørgensen, Gabriel Moruz, and Thomas Mølhave. Optimal resilient dynamic dictionaries. In *ESA '07: Proceedings of the 15th annual European symposium on Algorithms*, volume 4708 of *Lecture Notes in Computer Science*, pages 347–358. Springer-Verlag, 10 2007
4. Andrew Danner, Thomas Mølhave, Ke Yi, Pankaj K. Agarwal, Lars Arge, and Helena Mitasova. TerraStream: From elevation data to watershed hierarchies. In *GIS '07: Proceedings of the 15th Annual ACM International Symposium on Advances in Geographic Information Systems*, pages 1–8. ACM, 11 2007
5. Pankaj K. Agarwal, Lars Arge, Thomas Mølhave, and Bardia Sadri. I/O-efficient algorithms for computing contours on a terrain. In *SCG '08: Proceedings of the 24th Annual Symposium on Computational Geometry*, pages 129–138. ACM, 6 2008
6. Lars Arge, Thomas Mølhave, and Norbert Zeh. Cache-oblivious red-blue line segment intersection. In *ESA '08: Proceedings of the 16th annual European symposium on Algorithms*, pages 88–99. Springer-Verlag, 9 2008
7. Gerth Stølting Brodal, Allan Grønlund Jørgensen, and Thomas Mølhave. Fault tolerant external memory algorithms. In *WADS '09: Proceedings of the 11th Algorithms and Data Structures Symposium*, volume 5664 of *Lecture Notes in Computer Science*, pages 411–422. Springer-Verlag, 8 2009
8. Gerth Brodal, Allan Jørgensen, Gabriel Moruz, and Thomas Mølhave. Counting in the presence of memory faults. In *ISAAC '09: Proceedings of the 20th Annual International Symposium on Algorithms and Computation*, volume 5878, pages 842–851. Springer-Verlag, 12 2009
9. Jesper Moeslund Eshøj, Peder Klith Bøcher, Jens-Christian Svenning, Thomas Mølhave, and Lars Arge. Impacts of 21st century sea-level rise on a major city (Aarhus, Denmark) - an assessment based on fine-resolution digital topography and a new flooding algorithm. In *IOP Conf. Series: Earth and Environmental Science*, volume 8, pages 12—22, 11 2009

10. Thomas Mølhave, Pankaj K. Agarwal, Lars Arge, and Morten Revsbæk. Scalable algorithms for large high-resolution terrain data. In *COM.Geo '10: Proceedings of the 1st International Conference and Exhibition on Computing for Geospatial Research & Application*. ACM, 6 2010
11. Alex Beutel, Thomas Mølhave, and Pankaj K. Agarwal. Natural neighbor interpolation based grid dem construction using a GPU. In *GIS '10: Proceedings of the 18th ACM SIGSPATIAL International Symposium on Advances in Geographic Information Systems*, pages 172–181. ACM, 11 2010. Best paper award
12. Lars Arge, Kasper Green Larsen, Thomas Mølhave, and Freek van Walderveen. Cleaning massive sonar point clouds. In *GIS '10: Proceedings of the 18th ACM SIGSPATIAL International Symposium on Advances in Geographic Information Systems*, pages 152–161. ACM, 11 2010
13. Pankaj K. Agarwal, Thomas Mølhave, and Bardia Sadri. I/O-efficient contour queries on terrains. In *SODA '11: Proceedings of the 22nd Annual ACM-SIAM Symposium on Discrete Algorithms*. SIAM, 1 2011
14. Pankaj K. Agarwal, Thomas Mølhave, Hai Yu, and James S. Clark. Exploiting temporal coherence in forest dynamics. In *SCG '11 Proceedings of the 27th Annual Symposium on Computational Geometry*. ACM, 6 2011
15. Alex Beutel, Thomas Mølhave, Pankaj K. Agarwal, Arnold P. Boedihardjo, and James A. Shine. Terranni: Natural neighbor interpolation on a 3D grid using a GPU. In *GIS '11 Proceedings of the 19th ACM SIGSPATIAL International Symposium on Advances in Geographic Information Systems*. ACM, 11 2011
16. Lars Arge, Lasse Deleuran, Thomas Mølhave, Morten Revsbæk, and Jakob Truelsen. Simplifying massive contour maps. In *ESA '12 Proceedings of the 20th European Symposium on Algorithms*, volume 7501, pages 96–107. Springer-Verlag, 9 2012
17. Niel Lebeck, Thomas Mølhave, and Pankaj K. Agarwal. Computing highly occluded paths on a terrain. In *GIS '13: Proceedings of the 21th ACM SIGSPATIAL International Symposium on Advances in Geographic Information Systems*, pages 14–23. ACM, 11 2013
18. Swaminathan Sankararaman, Pankaj K. Agarwal, Thomas Mølhave, Jiangwei Pan, and Arnold P. Boedihardjo. Model-driven matching and segmentation of trajectories. In *GIS '13: Proceedings of the 21th ACM SIGSPATIAL International Symposium on Advances in Geographic Information Systems*, pages 234–243. ACM, 11 2013
19. Niel Lebeck, Thomas Mølhave, and Pankaj K. Agarwal. Computing highly occluded paths using a sparse network. In *GIS '14: Proceedings of the 22th ACM SIGSPATIAL International Symposium on Advances in Geographic Information Systems*. ACM, 11 2014
20. Pankaj K. Agarwal, Thomas Mølhave, Morten Revsbæk, Issam Safa, Yusu Wang, and Jungwoo Yang. Maintaining contour trees of dynamic terrains. In *SCG '15 Proceedings of the 31th Annual Symposium on Computational Geometry*, pages 796–811, 2015

Journal Papers

21. Souparno Ghosh, Alan E. Gelfand, and Thomas Mølhave. Attaching uncertainty to deterministic spatial interpolations. *Statistical Methodology*, 9(1-2):251 – 264, 2012

22. Pankaj K. Agarwal, Alex Beutel, and Thomas Mølhave. TerraNNI: Natural neighbor interpolation on 2D and 3D grids using a GPU. *Transactions on Spatial Algorithms and Systems*, 2015. To Appear

Other

23. Gerth Stølting Brodal, Rolf Fagerberg, Allan Grønlund Jørgensen, Gabriel Moruz, and Thomas Mølhave. Optimal resilient dynamic dictionaries. Technical Report DAIMI PB-585, Department of Computer Science, Aarhus University, 11 2007
24. Lars Arge and Thomas Mølhave. GIS ved MADALGO. *Geoforum*, 104:10–12, 5 2009
25. Gerth Stølting Brodal, Allan Grønlund Jørgensen, and Thomas Mølhave. Fault tolerant external memory algorithms. *MASSIVE '09: Proceedings of the Workshop on Massive Data Algorithmics*, 6 2009
26. Pankaj K. Agarwal and Thomas Mølhave. Modeling and analyzing massive terrain data. *National Science Foundation TeraGrid Workshop on Cyber-GIS*, 2 2010
27. Alex Beutel, Thomas Mølhave, and Pankaj K. Agarwal. Volumetric grid construction using 3d natural neighbor interpolation on the GPU. *MASSIVE '11: Proceedings of the Workshop on Massive Data Algorithmics*, 6 2011
28. Thomas Mølhave. Using TPIE for processing massive data sets in C++. *ACM SIGSPATIAL Special*, 8 2012. Invited abstract

Abstracts

29. Andrew Danner, Thomas Mølhave, Ke Yi, Pankaj K. Agarwal, Lars Arge, and Helena Mitasova. Massive terrain data processing: Scalable algorithms. FOSS4G '06 Presented at Free And Open Source Software for Geoinformatics, 9 2006
30. Lars Arge, Thomas Mølhave, Jakob Truelsen, and Johnny K. Rasmussen. Hvor løber vandet hen? Oversvømmelsesberegninger på store højdemodeller. Kortdage '09 Presented at Kortdage, 11 2009
31. Lars Arge, Thomas Mølhave, and Morten Revsbæk. Flood risk analysis using massive LiDAR terrain data. ELMF '11 Presented at the European LiDAR Mapping Forum, 11 2011
32. Lars Arge, Lasse Deleuran, Thomas Mølhave, Morten Revsbæk, and Jakob Truelsen. Detaljerede og brugbare landsdækkende konturkort. Kortdage '12 Presented at Kortdage, 11 2012
33. Lars Arge, Thomas Mølhave, and Morten Revsbæk. Beregning af national oversvømmelsesrisiko. Kortdage '12 Presented at Kortdage, 11 2012
34. Lars Arge, Thomas Mølhave, Morten Revsbæk, Jakob Truelsen, and Freek van Walderveen. Analyzing big terrain data from space. Presented at European Space Agency - Big Data From Space, 6 2013
35. Lars Arge, Thomas Mølhave, and Morten Revsbæk. Tilgængeligt, troværdigt og handlingsrettet terrændata. Kortdage '13 Presented at Kortdage, 11 2013

Invited Talks

From Point Clouds to 2D and 3D Grids: A Natural Neighbor Interpolation Algorithm using the GPU, MADALGO Seminar, Aarhus, Denmark, 2011

Natural neighbor interpolation based grid DEM construction using a GPU, Dagstuhl Seminar on Computational Geometry, Schloss Dagstuhl, Germany, 2011

I/O-Efficient Contour Queries on Terrains, Dagstuhl Seminar on Data Structures, Schloss Dagstuhl, Germany, 2010

I/O-Efficient Contour Queries on Terrains, Duke Algorithms Seminar, Durham, NC, 2010

Algorithms for Handling Massive (Elevation) Datasets, Geoforum Højdedataseminar

I/O-Efficient Algorithms for Computing Contour Lines on a Terrain, MADALGO Seminar, Aarhus, Denmark, 2009

Fault Tolerant Algorithms and Data Structures, Duke Algorithms Seminar, Durham, NC, 2007

Awards and Grants

STTR Phase I grant for Scalable Algorithmics USA in 2013, $150000.

Winner of Best Paper Award at ACM-GIS 2010 for the paper "Natural neighbor interpolation based grid DEM construction using a GPU".

Ph.D. Scholarship from the Oticon Foundation (2005), DKK 100 000 ($17 250).

Service

Program Committee member ALENEX 2014

2011 Committee member for Senior Thesis of Alexander Beutel (Duke).

Reviewer: Visualization 2007, Algorithmica, Latin American Theoretical Informatics Symposium (LATIN) 2008, Workshop on Experimental Algorithmics (WEA) 2008, Combinatorial Pattern Matching (CPM) 2008, IEEE's Transactions on Visualization and Computer Graphics, ACM Symposium on Principles of Database Systems (PODS) 2010, Scandinavian Symposium and Workshops on Algorithm Theory (SWAT) 2010, International Symposium on Experimental Algoritms (SEA) 2010, ACM-SIGSPATIAL International Conference on Advances in Geographic Information Systems (GIS) 2010, International Symposium on Algorithms and Computation (ISAAC) 2010,2013, ACM-SIGSPATIAL International Conference on Advances in Geographic Information Systems (GIS) 2011,2013, Transactions on Knowledge and Data Engineering (2012,2013)

President of the *Junior Club*, the society of PhD Students at the Department of Computer Science and Information Science, University of Aarhus, 2007-2008.

Bartender, Computer Science Friday Bar, University of Aarhus, 2003-2004.

Tutor for new students at the Faculty of Science, University of Aarhus, 2002-2003.

Conference Talks

Exploiting Temporal Coherence in Forest Dynamics, 27th Annual Symposium on Computational Geometry (SCG), Paris, France, 2011

Volumetric Grid Construction using 3D Natural Neighbor Interpolation on the GPU, Workshop on Massive Data Algorithmics (MASSIVE), Paris, France, 2011

Scalable Algorithms for Large High-Resolution Terrain Data, 1st International Conference on Computing for Geospatial Research & Application (COM.GEO), Washington DC, USA, 2010

Fault Tolerant External Memory Algorithms, 11th International Workshop on Algorithms and Data Structures (WADS), Banff, Canada, 2009

Cache-Oblivious Red-Blue Line Segment Intersection, 16th Annual European Symposium on Algorithms (ESA), Karlsruhe, Germany, 2008

Priority Queues Resilient to Memory Faults, 10th International Workshop on Algorithms and Data Structures (WADS), Halifax, Canada, 2007

Optimal Resilient Dynamic Dictionaries, 15th Annual European Symposium on Algorithms (ESA), Eilat, Israel, 2007

Teaching Experience

Teaching Assistant, Algorithms and Data Structures, spring 2006, spring 2007, spring 2008, spring 2009.

Teaching Assistant, Computability and Logic, fall 2006, fall 2008.

Teaching Assistant, Introduction to Programming, fall 2005.

Software

STREAM and TerraSTREAM (2005-current): `http://terrain.cs.duke.edu`.
As part of the STREAM Project I construct algorithms and software to model and analyze water flow, and derived properties, of large terrains.

TPIE (2005-current): `http://madalgo.au.dk/tpie`
The TPIE library simplifies implementation of external memory algorithms in C++.

vplayer (2005): `http://daimi.au.dk/~thomasm/vplayer/`
vplayer is a simple video player I developed using xine (xine-lib) and SDL with OpenGL. It plays synchronized video across a cluster consisting of multiple nodes and a single master responsible for audio output.

Activities

Visiting Scholar at Duke University, Durham NC September-December 2007

Contestant at the Northwestern European Programming Contest 2003,2004,2005.

Coach for the Aarhus teams at the Northwestern European Programming Contest 2006, 2008.

Attended the Summer School on Game Theory in Computer Science, University of Aarhus 2006.

Attended the Summer School on Data Stream Algorithms in Computer Science, University of Aarhus 2007.

Attended the Summer School on Cache-Oblivious Algorithms, University of Aarhus 2008.