

PAUL A. NAVRÁTIL

815A Brazos #406
Austin, Texas 78701

p.a.navratil@gmail.com
512-796-9020

EDUCATION

Ph.D. Computer Science, The University of Texas at Austin, 2010
Thesis: “Memory-Efficient, Scalable Ray Tracing”
Supervisors: Donald S. Fussell, Calvin Lin

M.S. Computer Science, The University of Texas at Austin, 2006

B.S. Computer Science with honors, The University of Texas at Austin, 1999
Special honors in Computer Science

B.A. Plan II with honors, The University of Texas at Austin, 1999
Dean's Distinguished Graduate in Liberal Arts
Plan II Model Thesis award
Phi Beta Kappa inductee

EMPLOYMENT HISTORY

Director of Visualization – Texas Advanced Computing Center (2017 – present)

- Oversee visualization research activities
- Lead remote visualization and large-scale visualization algorithm research efforts
- Eighteen-member team with seven direct reports (as of FY20-21)

Research Scientist – Texas Advanced Computing Center (2016 – present)

- Technical lead for remote visualization systems
- Conduct research in parallel visualization algorithms on multi- and many-core architectures
- Design next-generation remote visualization resources and remote interfaces leveraging web technologies

**Adjunct Professor – Division of Statistics and Scientific Computation,
The University of Texas at Austin** (2011 – present)

- Teach advanced computing curriculum at both the undergraduate and graduate levels
- Develop curriculum for advanced computing courses at both the undergraduate and graduate levels.

Manager - Scalable Visualization Technologies – Texas Advanced Computing Center (2011 – 2017)

- Oversee large-scale visualization resources and visualization research activities
- Lead remote visualization and large-scale visualization algorithm research efforts
- Ten direct reports: eight full-time staff, one contractor, one graduate research assistant

Research Associate – Texas Advanced Computing Center (2010 – 2016)

- Technical lead for remote visualization systems
- Conduct research in parallel visualization algorithms and distributed GPU acceleration
- Design next-generation remote visualization resources

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Visualization Scientist (RESA V) – Texas Advanced Computing Center (2007 – 2010)

- Developed large-scale, distributed memory ray tracing system
- Technical lead for primary remote visualization systems
- Manager for \$500,000 visualization laboratory renovation

Graduate Intern Technical – Intel Corporation (summer 2006)

- Studied performance characteristics of real-time ray tracers (summer 2006, supervisor: James Hurley)
 - Instrumented two state-of-the-art ray tracers to measure performance characteristics and opportunities for optimization
 - Investigated integrating novel algorithm for coherent processing of secondary rays with existing real-time ray tracing system

Graduate Research Assistant – Los Alamos National Laboratory (summer 2005)

- Investigated cache-efficient ray tracing methods for direct volume visualization (summer 2005, supervisor: Allen McPherson)
 - Developed optimized ray tracer to perform direct volume visualization
 - Measured performance of several ray traversal algorithm to determine most suitable method for direct volume visualization

Graduate Research Assistant – University of Texas at Austin (2001 – 2007)

- Developed scientific visualizations and visualization technology (2006 – 2007, supervisor: Greg S. Johnson)
 - Developed localized interpolation technique for cosmological point-based datasets to facilitate isosurface extraction and visualization
 - Visualizations published in International Science Grid This Week, The Alcalde
- Investigated cache-efficient ray tracing methods for current-generation hardware (2003 - 2006, supervising professor: Bill Mark, with Don Fussell and Calvin Lin)
 - Developed novel ray traversal algorithm to yield superior cache utilization
 - Implemented framework to study cache performance of acceleration structures
 - Developed equations to predict cache behavior of ray traversal

Graduate Research Assistant – University of Texas at Austin (2001 – 2007)

- Investigated compiler assisted optimizations and error detection for OpenGL library (2002 - 2003, supervising professor: Calvin Lin)
 - Developed semantic error checking on OpenGL applications and potential library specific-optimizations to OpenGL-based application code using research compiler and user-supplied semantic annotations for library functions
- Investigated representing event probability in a conceptual knowledge system (2001 - 2002, supervising professor: Bruce Porter)
 - Explored adding syntax and semantics for probability to a component-based knowledge system
 - Developed representations of concepts from cell synthesis in a component-based knowledge system (a system where complex concepts are built from simpler concepts)

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Software Engineer – Liaison Technology, Inc. (1999 – 2001)

- co-developed patented algorithm and core algorithm code for data-mining semi-structured data
- code formed core of two product lines through multiple release cycles
- lead engineer on multiple critical-path product features
- lead technical contact for business development and sales

Lab Research Assistant II – Applied Research Laboratories (1997-1998)

- enhanced existing data-mining prototype to improve acquisition of semi-structured data
- developed graphical user interface (GUI) for prototype

BOOKS

Paul Navrátil, Maytal Dahan, editors. Special Issue XSEDE16 & PEARC17 – Practice and Experience in Advanced Research Computing. Concurrency and Computation: Practice and Experience (CPE). 2019.

Paul Navrátil, Maytal Dahan, David Hart, Alana Romanella, Nitin Sukhija, editors. Proceedings of the Fifth Extreme Science and Engineering Discovery Environment Conference (XSEDE16). July 2016.

Carsten Dachsbacher, **Paul Navrátil**, editors. Proceedings of the Eurographics Symposium on Parallel Graphics and Visualization. May 2015.

Paul A. Navrátil. Memory-Efficient, Scalable Ray Tracing. Ph.D. Dissertation, Department of Computer Science, The University of Texas at Austin. August 2010.

JOURNAL ARTICLES

Greg Abram, **Paul Navrátil**, David Rogers and James Ahrens. Distributed Multi-tenant In Situ Analysis using Galaxy. In *In Situ Visualization for Computational Science*, Hank Childs, ed., 2020.

Will Usher, Hyungman Park, Myoungkyu Lee, **Paul Navrátil**, Donald Fussell and Valerio Pascucci. A Simulation-Oblivious Data Transport Model for Flexible In Transit Visualization. In *In Situ Visualization for Computational Science*, Hank Childs, ed., 2020.

H. Childs, S.D. Ahern, J. Ahrens, A.C. Bauer, J. Bennett, E.W. Bethel, P.-T. Bremer, E. Brugger, J. Cottam, M. Dorian, S. Dutta, J. M. Favre, T. Fogal, S. Frey, C. Garth, B. Geveci, W. F. Godoy, C. D. Hansen, C. Harrison, B. Hentschel, J. Insley, C. R. Johnson, S. Klasky, A. Knoll, J. Kress, M. Larsen, J. Lofstead, K.-L. Ma, P. Malakar, J. Meredith, K. Moreland, **P. Navrátil**, P. O’Leary, M. Parashar, V. Pascucci, J. Patchett, T. Peterka, S. Petruzza, N. Podhorszki, D. Pugmire, M. Rasquin, S. Rizzi, D. H. Rogers, S. Sane, F. Sauer, R. Sisneros, H.-W. Shen, W. Usher, R. Vickery, V. Vishwanath, I. Wald, R. Wang, G. H. Weber, B. Whitlock, M. Wolf, H. Yu, and S. B. Ziegeler. A Terminology for In Situ Visualization and Analysis Systems. *International Journal of High Performance Computing Applications*, 34(6):676–691, November 2020.

Ingo Wald, Greg P. Johnson, Jeff Amstutz, Carson Brownlee, Aaron Knoll, Jim Jeffers, Johannes Günther, **Paul Navrátil**. OSPRay – A CPU Ray Tracing Framework for Scientific Visualization. *IEEE Transactions on Visualization and Computer Graphics (Proceedings of IEEE Visualization)*, 23:1, January 2017, 931–940.

Paul A. Navrátil, Hank Childs, Donald S. Fussell, Calvin Lin. Exploring the Spectrum of Dynamic Scheduling Algorithms for Scalable Distributed-Memory Ray Tracing. *IEEE Transactions on Visualization and Computer Graphics*. 20:6, June 2014. 893—906.

Aaron Knoll, Ingo Wald, **Paul Navrátil**, Anne Bowen, Khairi Reda, Michael E. Papka, Kelly Gaither. RBF Volume Ray Casting on Multicore and Manycore CPUs. *Computer Graphics Forum (Proceedings of Eurographics Conference on Visualization)*. 33:3, 2014.

Joshua D. Rhodes, Charles R. Upshaw, Chioke B. Harris, Colin M. Meehan, David A. Walling, **Paul A. Navrátil**, Ariane L. Beck, Kazunori Nagasawa, Robert L. Fares, Wesley J. Cole, Harsha Kumar, Roger D. Duncan, Chris L. Holcomb, Thomas F. Edgar, Alexis Kwasinski, Michael E. Webber. Experimental and Data Collection Methods for a Large-Scale Smart Grid Deployment: Methods and First Results. *Energy*, 65:1, February 2014. 462—471.

Paul A. Navrátil, Jarrett L. Johnson and Volker Bromm. Visualization of Cosmological Point-Based Datasets. *IEEE Transactions on Visualization and Computer Graphics (Proceedings of IEEE Visualization 2007)*, November 2007.

OTHER REFEREED PAPERS

Stephanie Zeller, Francesca Samsel, **Paul Navrátil**. Environmental Visualization: Moving Beyond the Rainbows. In *Proceedings of PEARC20*. July 30, 2020.

Christiaan Gribble, Victor Eijkhout, **Paul Navrátil**. Implementing a Prototype System for 3D Reconstruction of Compressible Flow. In *Proceedings of PEARC20*. July 28, 2020.

Colin Ware, Francesca Samsel, David Rogers, **Paul Navrátil**, Ayat Mohammed. Designing Pairs of Colormaps for Visualizing Bivariate Scalar Fields. In *Proceedings of EuroVis 2020*. May 26, 2020.

João Barbosa, **Paul Navrátil**. High-fidelity Rendering for Large Tiled Displays. In *Proceedings of the Intel eXtreme Performance User Group (IXPUG) Conference 2019*. September 25, 2019.

Francesca Samsel, Trinity Overmyer, Paul Navrátil. “Highlight Insert Colormaps: Luminance for Focused Data Analysis.” Accepted to EG EuroVis. June 2019.

Greg Abram, **Paul Navrátil**, Pascal Grossett, David Rogers, James Ahrens. “Galaxy: Asynchronous Ray Tracing for Large High-Fidelity Visualization.” Accepted to IEEE Large Data Analysis and Visualization. October 2018.

Hyungman Park, Donald Fussell, **Paul Navrátil**. “SpRay: Speculative Ray Scheduling for Large Data Visualization.” Accepted to IEEE Large Data Analysis and Visualization. October 2018.

Paul Navrátil, Jim Jeffers. “IXPUG In Situ Workshop Report – Best Practices and Lessons Learned.” IXPUG Annual Meeting, Austin, Texas, September 2017.

Matt Larsen, Stephanie Labasan, **Paul Navrátil**, Jeremy Meredith, Hank Childs. Volume Rendering via Data-Parallel Primitives. *Proceedings of the Eurographics Symposium on Parallel Graphics and Visualization*. May 2015.

Matt Larsen, Jeremy Meredith, **Paul Navrátil**, Hank Childs. Ray-Tracing within a Data Parallel Framework. *Proceedings of IEEE Pacific Visualization Symposium*, April 2015. 279—286.

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- Aaron Knoll, Cody Hammock, Jo Wozniak, Nathaniel Mendoza, **Paul Navrátil**, Brandt Westing. Picowalls: Portable Tiled Display Walls from Pico Projector Arrays. Proceedings of VISTech 2013. November 22, 2013.
- Aaron Knoll, Ingo Wald, **Paul A. Navrátil**, Michael E. Papka, Kelly P. Gaither. Ray Tracing and Volume Rendering Large Molecular Data on Multi-Core and Many-Core Architectures. Proceedings of UltraVis 2013. November 17, 2013.
- Cyrus Harrison, **Paul A. Navrátil**, Maysam Moussalem, Ming Jiang, Hank Childs. Efficient Dynamic Derived Field Generation on Many-Core Architectures Using Python. Proceedings of Workshop on Python for High Performance and Scientific Computing (PyHPC) 2012. November 16, 2012.
- Paul A. Navrátil**, William L. Barth, Hank Childs. Virtual Rheoscopic Fluids for Dense Large-Scale Fluid Flow Visualizations. Proceedings of IEEE Symposium on Large Data Analysis and Visualization (LDAV) 2012. October 14-15, 2012.
- Gregory P. Johnson, Gregory D. Abram, Brandt Westing, **Paul A. Navrátil**, Kelly P. Gaither. DisplayCluster: An Interactive Visualization Environment for Tiled Displays. Proceedings of IEEE Cluster 2012. September 24-28, 2012.
- Paul A. Navrátil**, Donald S. Fussell, Calvin Lin and Hank Childs. Dynamic Scheduling for Large-Scale Distributed-Memory Ray Tracing. Proceedings of Eurographics Symposium on Parallel Graphics and Visualization (EGPGV) 2012. 61—70. May 13-14, 2012. **Awarded Best Paper**
- Byungil Jeong, **Paul A. Navrátil**, Kelly P. Gaither, Gregory Abram and Gregory P. Johnson. Configurable Data Prefetching Scheme for Interactive Visualization of Large-Scale Volume Data. Proceedings of Visualization and Data Analysis (VDA) 2012. 8294-17. January 23-25, 2012.
- Hank Childs, Eric Brugger, Brad Whitlock, Jeremy Meredith, Sean Ahern, Kathleen Bonnell, Mark Miller, Gunther H. Weber, Cyrus Harrison, David Pugmire, Thomas Fogal, Christoph Carth, Allen Sanderson, E. Wes Bethel, Marc Durant, David Camp, Jean M. Favre, Oliver Rübel, **Paul Navrátil**, Matthew Wheeler, Paul Selby and Fabien Vivodtzev. VisIt: An End-User Tool for Visualizing and Analyzing Very Large Data. Proceedings of the 2011 SciDAC Conference. July, 2011.
- Paul A. Navrátil**, Donald S. Fussell, Calvin Lin. Increasing Hardware Utilization for Peta-Scale Visualization. Proceedings of the High-End Visualization Workshop. December, 2010.
- S. Daruru, S. Dhandapani, G. Gupta, I. Iliev, W. Xu, **P. Navrátil**, N. Marin, J. Ghosh. Distributed, Scalable Clustering for Detecting Halos in Terascale Astronomy Datasets. Proceedings of KDCloud-10. December 2010.
- Paul A. Navrátil**, Brandt Westing, Greg P. Johnson, Ashwini Athyle, Jose Carreno, Freddy Rojas. A Practical Guide to Large-Tiled Displays. Proceedings of the International Symposium on Visual Computing 2009.
- Paul A. Navrátil**, Donald S. Fussell, Calvin Lin and William R. Mark. Dynamic Ray Scheduling for Improved System Performance. Proceedings of the Symposium on Interactive Ray Tracing, 2007.
- Bruce Porter, Ken Barker, James Fan, **Paul A. Navrátil**, Dan Tecuci, Peter Yeh and Peter Clark. "Mining Answers from Texts and Knowledge Bases: Our Position." Mining Answers from Texts and Knowledge Bases: Papers from the 2002 AAAI Spring Symposium (TR SS-02-06), Sanda M. Harabagiu and Vinay Chaudhri, ed. pp 80 - 81.

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