

Cláudio T. Silva

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Research Interests

- Visualization and Data Analysis, e-Science, Geometry Processing, Scientific Data Management, Computer Graphics, Applications of Computational Techniques to Medicine, Oceanography, Biology and Engineering, High-Performance Computing Systems.

Professional Experience

- School of Computing, University of Utah.
 - Associate Professor (October 2003–)
- Scientific Computing and Imaging (SCI) Institute, University of Utah.
 - Associate Director (January 2008–May 2009)
 - Faculty Member (October 2003–)
- VisTrails, Inc. (2007–) [University of Utah startup company: www.vistrails.com]
 - Co-founder
 - Chief Scientist
- Participating Guest Researcher (April 2003–), Lawrence Livermore National Laboratory.
- Faculty Scholar (January 2003–March 2003), Lawrence Livermore National Laboratory.
- Associate Professor (September 2002–April 2006; on leave starting October 2003), Department of Computer Science & Engineering, OGI School of Science & Engineering, Oregon Health & Science University.
- Information Visualization Research Department, AT&T Labs-Research.
 - Principal Member of Technical Staff (April 2002–September 2002)
 - Senior Member of Technical Staff (July 1999–April 2002)
- Adjunct Assistant Professor, Department of Applied Mathematics and Statistics, State University of New York at Stony Brook, July 1998–July 2000.
- Research Staff Member, Visual and Geometric Computing, IBM T. J. Watson Research Center, December 1997–July 1999.

- Research Associate, Computational Geometry Lab (Joseph S.B. Mitchell, Director). Department of Applied Mathematics and Statistics, State University of New York at Stony Brook, September 1996–December 1997.
- Researcher, Visualization Group, Sandia National Laboratories, May 1995–December 1997.
- Teaching and Research Assistant, Visualization Lab (Arie Kaufman, Director). Department of Computer Science, State University of New York at Stony Brook, 1991–1995.
- Summer Intern, Brookhaven National Laboratories, 1992.
- Summer Intern, Philips Laboratories, 1991.

Professional Preparation

- Post-doc, Applied Mathematics and Statistics 1996-7
State University of New York at Stony Brook
Concentration Area: Computational Geometry
Mentor: Professor Joseph S.B. Mitchell
- Ph.D., Computer Science December 1996
State University of New York at Stony Brook
Dissertation Title: “Parallel Volume Rendering of Irregular Grids”
Advisor: Distinguished Professor Arie E. Kaufman
- M.S., Computer Science May 1993
State University of New York at Stony Brook
- B.S., Mathematics July 1990
Universidade Federal do Ceará (Brazil)

Honors, Distinctions, and Achievements

- “Computing and Rendering Point Set Surfaces” (article published in 2003) is the 2nd most cited paper in the 15-year history of the IEEE Transactions on Visualization and Computer Graphics with over 600 citations.
- 2009 Utah Innovation Awards, VisTrails Provenance Plugin for Autodesk Maya.
- IEEE Senior Member (since 2008).
- Best paper award, IEEE Shape Modeling International 2008.
- Best paper award, IEEE Visualization 2007.
- Best paper finalist, IEEE Shape Modeling International 2007.
- Dean’s Teaching Commendation, Spring 2007.
- IBM Faculty Award, 2007. (Includes 30K cash gift.)
- IBM Faculty Award, 2006. (Includes 30K cash gift.)
- IBM Faculty Award, 2005. (Includes 20K cash gift.)

- Best paper finalist, IEEE Visualization 2001.
- Best paper finalist, IEEE Visualization 1999.
- IBM First Plateau Invention Award, 1999.
- IBM Research Division “accomplishment list” for MPEG-4 3D Model Coding, 1998.
- National Science Foundation Post-Doctoral CISE Associateship Award, 1996–1997.
- Best paper finalist, ACM/IEEE Volume Visualization 1996.
- Doctoral Fellowship – Brazilian Research Council (CNPq – Brazil), 1991–1995.
- 1st place, Entrance exam, Mathematics, Federal University of Ceara, Brazil.

Research Funding

From late 1997 to 2002, I worked at industrial research labs where all funding was internal. I only started actively pursuing grants after joining academia in late 2002. Since then, I have received over 30 grants, contracts, and gifts from a number of sources (including DOE, NIH, NSF, ARO, IBM) totaling over 13 million dollars. Besides academic research funding, I have helped VisTrails Inc. obtain funding from the University of Utah, State of Utah, NSF, and DOE funding for business and product development.

Active Grants and Contracts

National Institutes of Health, *NCRR ARRA Administrative Supplement - Translational*, D. A. McClain (PI), L. Cannon-Albright, P. Renshaw, C. Silva, J. Freire, D. A. Yurgelun-Todd. US\$ 998,137 (2009-2011).

National Science Foundation, *III: Medium: Provenance Analytics: Exploring Computational Tasks and their History*, J. Freire (PI) and C. Silva (co-PI). US\$ 957K (2009-2012).

National Science Foundation, *II-NEW: The Utah Acquisition and Rapid Prototyping Laboratory*, A. Bargteil (PI), E. Cohen (co-PI), R. M. Kirby (co-PI), and C. Silva (co-PI). US\$ 391K (2009-2012).

Department of Energy, *Towards a multi-threaded data-driven streaming execution model for VTK*, C. Silva (PI), C. Hansen, and V. Pascucci. US\$ 126K (2009).

National Science Foundation, *Where the Ocean Meets the Cloud: Ad Hoc Longitudinal Analysis and Collaboration Over Massive Mesh Data*, C. Silva (PI) and J. Freire (co-PI). US\$ 190K. (2009-2011) (This is a collaborative proposal with B. Howe, University of Washington.)

ExxonMobil, *Imaging, Visualization, and Modeling Research Center*, R. Whitaker (PI), C. Hansen (co-PI), V. Pascucci (co-PI), and C. Silva (co-PI). US\$ 2.2M (2008–2013).

National Science Foundation, *CDI-Type II: Collaborative Research: The Open Wildland Fire Modeling E-community: a virtual organization accelerating research, education, and fire management technology*, ATM-0835821, C. Johnson (PI) and C. Silva (co-PI). US\$ 641,790 (Utah portion out of a total project budget of US\$ 1.65M). (2008-2012). Collaborative proposal with NCAR and University of Colorado at Denver.

Department of Energy. SBIR Phase I: Provenance-Enabling DOE Visualization Applications. Steven P. Callahan (PI); Co-PIs: Juliana Freire and Cláudio Silva US\$ 100,000 (2008–2009). The SBIR Phase II has been recommended for funding for US\$ 750,000 (2009-2011).

National Science Foundation, SBIR Phase I and IB: A Collaborative Architecture to Support Large-Scale Exploratory Workflows, IIP-0712592, Steven P. Callahan (PI); Co-PIs: Juliana Freire and Cláudio Silva. US\$ 150,000 (2007).

State of Utah, Centers of Excellence. Center for Software Process Automation and Exploratory Data Mining. Greg Jones, Juliana Freire and Cláudio Silva. US\$ 200,000 (2008–2009).

Department of Energy, *Integrating VisIt and VisTrails Software*, C. Silva. US\$ 53,209 (2009).

National Science Foundation, *CRI: IAD A Service-Oriented Architecture for The Computation, Visualization, and Management of Scientific Data*, CNS-0751152, C. Silva (PI), J. Freire, S. Joshi, R. M. Kirby (co-PIs). US\$ 500,000 (2008-2011).

National Science Foundation, *Science and Technology Center for Coastal Margin Observation and Prediction*, OCE-0424602, A. Baptista (PI, OHSU), J. Freire and C. Silva (Utah co-PIs), Total: (approx) US\$ 20,000,000; Utah portion: US\$ 478,563 (2006-11).

Department of Energy, *Scientific Data Management Enabling Technology Center*, DOE SciDAC II. A. Shoshani (PI, LBNL), C. Silva (Utah PI), Total: (approx) US\$ 16,500,000; Utah portion: US\$ 910,000 (2006-11).

Department of Energy, *VACET: Visualization and Analytics Center for Enabling Technologies*, DOE SciDAC II. C. Johnson, C. Hansen, C. Silva, S. Parker, A. Sanderson, X. Tricoche (Utah Team), Total: (approx) US\$ 11,000,000; Utah portion: US\$ 2,790,726 (2006-11).

Past Grants

National Science Foundation, *MSPA-MCS: Collaborative Research: New Methods for Robust, Feature-Preserving Surface Reconstruction*, CCF-0528201 and CCF-0528209, C. Silva (lead PI, Utah), J. Mitchell (PI, Stony Brook). Total: US\$ 480,686 (2005-8); Utah portion: US\$ 275,599 (2005-8).

National Science Foundation, *SEIII: Managing Complex Visualizations*, IIS-0513692, J. Freire (PI) and C. Silva (co-PI). US\$ 530,252 (2005-8). REU supplement: US\$ 12,000 (2006).

National Science Foundation, *U.S. Brazil Collaborative Research: 3D Modeling and Visualization*, OISE-0405402, C. Silva (PI), E. Praun (co-PI) and R. Whitaker (co-PI). US\$ 85,000 (2004-6). REU supplements: US\$ 15,000 (2005).

State of Utah, Centers of Excellence. *Center for Management of Exploratory Workflows-Business Team*, J. Freire (PI) and C. Silva (co-PI), US\$ 50,000 (2007-8).

Department of Energy, *Topic in Visualization Research*, C. Silva (PI), C. Hansen and J. Freire (co-PIs). US\$ 200,000 (2007-8).

National Institutes of Health, *High Resolution Mapping Of Placental Gene Expression*, C. Silva (co-I), J. Pentecost (PI, OHSU). Approximately US\$ 210,000 (2005-7).

National Science Foundation, *Interactive Out-Of-Core Visualization of Large Polygonal Datasets*, CCF-0401498, Cláudio Silva (PI). US\$ 178,488 (2003-6). REU supplements: US\$ 12,000 (2004); US\$ 12,000 (2005).

Department of Energy, *Using Morse Theory in the Parameterization of Arbitrary 2-Manifolds*, C. Silva (PI). US\$ 35,306 (2006).

Department of Energy, *Advanced Volume Rendering Techniques*, C. Silva (PI). US\$ 90,000 (2006).

Department of Energy, *Utah Advanced Visualization Center*, C. Hansen (PI) and C. Silva (co-PI). US\$ 680,000 (2003-6).

National Science Foundation, *A Cluster Infrastructure to Support Retrieval, Management and Visualization of Massive Amounts of Data*, EIA-0323604, J. Freire (PI) and C. Silva (co-PI). US\$ 110,000 (2003-5). Institutional matching funds: US\$ 55,000.

Department of Defense (Army STTR), *A Scalable System for Enormous Dataset Volume Visualization on Commodity Hardware* (Phase I), W911INF-05-C-0107, D. Weinstein (PI, Visual Influence), C. Silva (PI, Utah), and J. Freire (co-PI). Phase I: US\$ 94,704 (2005-6).

Department of Energy, *Studying The Topology of Point-Set Surfaces*, C. Silva (PI). US\$ 37,492 (2005).

University of Utah Seed Grant, *Digital Geometry Processing Techniques for Spatial Genomics*, C. Silva (PI). US\$ 27,000 (2004-5).

Department of Energy, *Advanced Scientific Visualization Techniques*, C. Silva (PI). US\$ 56,000 (2004-5).

Department of Energy, *Rendering of Isosurfaces Using Implicit Occluders*, C. Silva (PI). US\$ 22,919 (2003).

Department of Energy, *Visualization of Adaptive Mesh Refinement in SAMRAI*, C. Silva (PI). US\$ 22,170 (2003).

Department of Energy, *Developing Techniques for High-Resolution Interactive Volume Rendering of Large Unstructured Volumetric Grids on Clusters of Commodity PCs*, C. Silva (PI). US\$ 92,984 (2003-4).

Department of Energy, *High-Performance Visualization*, J. Mitchell (PI) and C. Silva (co-PI). US\$ 303,196 (1996-2001).

National Science Foundation, *Efficient Geometric Algorithms in Support of Virtual Reality Systems*, Post-Doctoral CISE Associateship Award, CCR-9626370. J. Mitchell (PI) and C. Silva. US\$ 46,000 (1996-98).

Department of Energy, *Support for Research Assistant – Cláudio T. Silva*, A. Kaufman (PI). (approx) US\$ 50,000. (1995-96).

Patents (8 granted; 3 pending)

- [1] US utility patent application no. 11/697,922, *Managing Provenance of the Evolutionary Development of Workflows*, filed by the University of Utah on 04/09/07.
- [2] US utility patent application no. 11/697,926, *Managing Provenance for an Evolutionary Workflow Process in a Collaborative Environment*, filed by the University of Utah on 04/09/07.
- [3] US utility patent application no. 11/697,929, *Analogy Based Updates for Rapid Development of Data Processing Results*, filed by the University of Utah on 04/09/07.
- [4] US patent 6,968,299, *Method and apparatus for reconstructing a surface using a ball-pivoting algorithm*, issued to IBM on November 22, 2005.
- [5] US patent 6,933,946, *Method for out-of-core rendering of large 3D models*, issued to AT&T on August 23, 2005.
- [6] US patent 6,831,636, *System and Process for Level of Detail Selection Based on Approximate Visibility Estimation*, issued to IBM on December 14, 2004.
- [7] US patent 6,801,215, *Hardware-Assisted Visibility-Ordering Algorithm*, issued to AT&T on October 5, 2004.
- [8] US patent 6,452,596, *Methods and Apparatus for the Efficient Compression of Non-manifold Polygonal Meshes*, issued to IBM on September 17th, 2002.
- [9] US patent 6,445,389, *Compression of Polygonal Models with Low Latency Decompression*, issued to IBM on September 3rd, 2002.
- [10] US patent 6,414,680, *System, Program Product And Method Of Rendering A Three Dimensional Image On a Display*, issued to IBM on July 2nd, 2002.
- [11] US patent 6,356,262, *System And Method For Fast Polyhedral Cell Sorting*, issued to IBM on March 12th, 2002.

Open-Source Software

Most of the software that our group produces gets released as open source. Listed below are some of our major pieces of software. For a more complete list, please refer to our group web pages.

- **DEFOG:** DEFOG is a new information visualization system. It is based on a model for visualization where each element is backed by all of its data regardless of how it is represented in the visualization. Users are free to add, copy, select, reorder, and group objects before and after a visualization has been applied. Objects from different visualizations can be easily combined or a subset of objects in a visualization can be selected and visualized in a different manner. It is currently being used in a number of projects, including the analysis of metabolic pathway (collaboration with researchers at the University of Washington) and large-scale genotype/phenotype data analysis (collaboration with the School of Medicine at the University of Utah).
- **VisTrails:** VisTrails (<http://www.vistrails.org>), an open-source, provenance-aware scientific workflow management system that provides support for exploratory computational tasks, such as simulations, data analysis and visualization. Since its beta release in 2007, VisTrails has had over 10,000

downloads. VisTrails is being adopted by many large-scale projects, and has also been used as a teaching tool at a number of institutions worldwide. Furthermore, many ideas from the system have been incorporated into other major workflow systems like Taverna and Kepler. Parts of it have been licensed for use in commercial products.

- **HAVS:** The Hardware Assisted Visibility Sorting (HAVS) algorithm for direct volume rendering of unstructured grids is available on sourceforge: <http://havs.sourceforge.net>. HAVS has also been incorporated into leading visualization packages, most notably VTK and Paraview, which are used by thousands of people. The k -buffer idea that was invented as part of HAVS has now been extended and made available by NVIDIA (see Stencil Routed K-Buffer on the NVIDIA Direct3D 10 sample page).
- **afront:** Afront is an advancing front triangulation algorithm that works in a variety of meshing scenarios. It creates adaptive triangulations that maintain smooth gradation to prevent poor quality triangles. It is also able generate meshes from other meshes (remeshing), from volumetric models (both regular and irregular) grids, and from point sets. Furthermore, it can create meshes that cover entire surfaces or just localized regions, taking into account (annotated) sharp features. It has many practical applications, including the generation of high-quality isosurfaces for computer simulations. The source code is available at <http://afront.sourceforge.net>, and it has been downloaded over a 1,000 times.
- **GTB:** The Graphics Toolbox, available at <http://sourceforge.net/projects/gtb>, is a set of C++ classes for 2D and 3D graphics. The iWalk out-of-core rendering system for large models is built on top of GTB (and included in the distribution). iWalk's original out-of-core design predates similarly-featured commercial products (such as Interviews3D from 3Dinteractive GmbH) by several years.

Publications

A number in **bold** after a publication is the number of citations of that publication as computed by Google Scholar.¹ Overall, there have been over **4000** citations to my work. These include some of the top cited papers published at the IEEE Visualization conferences and the IEEE Transactions on Visualization and Computer Graphics journal. My “h-index” is 34.

Journal Publications (53)

- [1] *Verifiable Visualization for Isosurface Extraction*, T. Etienne, C. Scheidegger, L. G. Nonato, R. M. Kirby, and C. Silva. IEEE Transactions on Visualization and Computer Graphics (Proceedings of IEEE Visualization 2009).
- [2] *VisMashup: Streamlining the Creation of Custom Visualization Applications*, E. Santos, L. Lins, J. Ahrens, J. Freire, and C. Silva. IEEE Transactions on Visualization and Computer Graphics (Proceedings of IEEE Visualization 2009).
- [3] *Semi-Regular Quadrilateral Remeshing from Simplified Base Domains*, J. Daniels, E. Cohen, and C. Silva. Computer Graphics Forum (Proceedings of Symposium on Geometry Processing 2009), 28(5):1427–1435, 2009.

¹scholar.google.com; please note the reported numbers vary over time, sometimes increasing or decreasing slightly.

- [4] *Localized Quadrilateral Coarsening*, J. Daniels, E. Cohen, and C. Silva. Computer Graphics Forum (Proceedings of Symposium on Geometry Processing 2009), 28(5):1436–1444, 2009.
- [5] *Robust Topology-Based Multiscale Analysis of Scientific Data*, A. Gyulassy, L. G. Nonato, P.-T. Bremer, C. Silva, and Valerio Pascucci. Computing in Science and Engineering, to appear.
- [6] *Fast 4-way parallel radix sorting on GPUs*, L. Ha, J. Krueger, and C. Silva. Computer Graphics Forum, accepted.
- [7] *Effects of 10Hz rTMS on the neural efficiency of working memory*, G. A. Preston, E. W. Anderson, E. Wassermann, T. Goldberg, and C. Silva, Journal of Cognitive Neuroscience, accepted.
- [8] *Image-Space Acceleration for Direct Volume Rendering of Unstructured Grids using Joint Bilateral Upsampling*, S. P. Callahan and C. Silva, Journal of Graphics Tools, accepted.
- [9] *Bandwidth Selection and Reconstruction Quality in Point-Based Surfaces*, H. Wang, C. E. Scheidegger, and C. Silva, IEEE Transactions on Visualization and Computer Graphics, 15(4):572–582, 2009.
- [10] *Marching Cubes without Skinny Triangles*, C. Dietrich, J. Comba, L. Nedel, C. Scheidegger, J. Schreiner, and C. Silva. Computing in Science and Engineering, 11(2):82–87, 2009.
- [11] *Improving Mesh Quality of Marching Cubes Using Edge Transformations*, C. Dietrich, J. Comba, L. Nedel, C. Scheidegger, J. Schreiner, and C. Silva. IEEE Transactions on Visualization and Computer Graphics, 15(1):150–159, 2009.
- [12] *Quadrilateral Mesh Simplification*, J. Daniels, C. Silva, J. Shepherd, and E. Cohen, ACM Transactions on Graphics (Proceedings of SIGGRAPH Asia 2008).
- [13] *The Need for Verifiable Visualization*, R. M. Kirby and C. Silva. IEEE Computer Graphics and Applications, 28(5):78–83, 2008.
- [14] *Interactive Transfer Function Specification for Direct Volume Rendering of Disparate Volumes*, F. Bernardon, L. Ha, S. Callahan, J. Comba, and C. Silva. Computing in Science and Engineering, 2008.
- [15] *VisComplete: Automating Suggestions for Visualization Pipelines*, D. Koop, C. Scheidegger, S. Callahan, J. Freire, and C. Silva. IEEE Transactions on Visualization and Computer Graphics (Proceedings of IEEE Visualization 2008), 14(6):1691–1698, 2008.
- [16] *Edge Groups: A New Approach to Understanding the Mesh Quality of Marching Methods*, C. Dietrich, J. Comba, L. Nedel, C. Scheidegger, and C. Silva. IEEE Transactions on Visualization and Computer Graphics (Proceedings of IEEE Visualization 2008), 14(6):1651–1658, 2008.
- [17] *Revisiting Histograms and Isosurface Statistics*, C. Scheidegger, J. Schreiner, B. Duffy, H. Carr and C. Silva. IEEE Transactions on Visualization and Computer Graphics (Proceedings of IEEE Visualization 2008), 14(6):1659–1666, 2008.
- [18] *Spline-Based Feature Curves from Point-Sampled Geometry*, J. Daniels, T. Ochotta, L. Ha, and C. Silva. The Visual Computer, 24(6):449–462, 2008.
- [19] *Scientific Exploration in the Era of Ocean Observatories*, A. Baptista, B. Howe, J. Freire, D. Maier, and C. Silva. Computing in Science and Engineering, 10(3):53–58, 2008.
- [20] *Provenance for Computational Tasks: A Survey*, J. Freire, D. Koop, E. Santos, and C. Silva. Computing in Science and Engineering, 10(3):11–21, 2008.

- [21] *Provenance in Comparative Analysis: A Study in Cosmology*, E. W. Anderson, J. Ahrens, K. Heitmann, S. Habib, and C. Silva. *Computing in Science and Engineering*, 10(3):30-37, 2008.
- [22] *Robust Soft Shadow Mapping with Depth Peeling*, L. Bavoil, S. Callahan, and C. Silva. *Journal of Graphics Tools*, 13(1):19-30, 2008.
- [23] *Tackling the Provenance Challenge One Layer at a Time*, C. Scheidegger, D. Koop, E. Santos, H. Vo, S. Callahan, J. Freire, and C. Silva. *Concurrency And Computation: Practice And Experience*, 20(5):473–483, 2008.
- [24] *Direct Volume Rendering: A 3D Plotting Technique for Scientific Data*, S. P. Callahan, J. H. Callahan, C. E. Scheidegger, and C. Silva, *Computing in Science and Engineering*, 10(1):88-92, 2008.
- [25] *Provenance for Visualization: Reproducibility and Beyond*, C. Silva, J. Freire, and S. P. Callahan, *Computing in Science and Engineering*, 9(5):82-89, 2007.
- [26] *Querying and Creating Visualizations by Analogy*, C. E. Scheidegger, H. T. Vo, D. Koop, J. Freire, and C. Silva. *IEEE Transactions on Visualization and Computer Graphics (Proceedings of IEEE Visualization 2007)*, 13(6):1560-1567. **Best paper award.**
- [27] *An Adaptive Framework for Visualizing Unstructured Grids with Time-Varying Scalar Fields*, F. Bernardon, S. Callahan, J. Comba, and C. Silva. *Parallel Computing*, 33(6):391–405, 2007.
- [28] *Streaming Simplification for Tetrahedral Meshes*, H. Vo, S. Callahan, P. Lindstrom, V. Pascucci, and C. Silva. *IEEE Transactions on Visualization and Computer Graphics*, 13(1):145-155, 2007.
- [29] *GPU-based Tiled Ray Casting using Depth Peeling*, F. Bernardon, C. Pagot, J. Comba, and C. Silva, *Journal of Graphics Tools*, 11(4):1–16, 2006.
- [30] *High-Quality Extraction of Isosurfaces from Regular and Irregular Grids*, J. Schreiner, C. Scheidegger, and C. Silva. *IEEE Transactions on Visualization and Computer Graphics (Proceedings of IEEE Visualization 2006)*, 12(5):1205–1212, 2006.
- [31] *Progressive Volume Rendering of Large Unstructured Grids*, S. Callahan, L. Bavoil, V. Pascucci, and C. Silva. *IEEE Transactions on Visualization and Computer Graphics (Proceedings of IEEE Visualization 2006)*, 12(5):1307-1314, 2006.
- [32] *Direct (Re)Meshing for Efficient Surface Processing*, J. Schreiner, C. Scheidegger, S. Fleishman, and C. Silva. *Computer Graphics Forum (Proceedings of Eurographics 2006)*, 25(3):527–536, 2006.
- [33] *A Survey of GPU-Based Volume Rendering of Unstructured Grids*, C. Silva, J. Comba, S. Callahan, and F. Bernardon, *Brazilian Journal of Theoretic and Applied Computing (RITA)*, 12(2):9–29, 2005.
- [34] *Robust Moving Least-squares Fitting with Sharp Features*, S. Fleishman, D. Cohen-Or, and C. Silva. *ACM Transactions on Graphics (Proceedings of SIGGRAPH 2005)*, 24(3):544–552, 2005.
- [35] *Hardware-Assisted Visibility Sorting for Unstructured Volume Rendering*, S. Callahan, M. Ikits, J. Comba, and C. Silva, *IEEE Transactions on Visualization and Computer Graphics*, 11(3):285–295, 2005.
- [36] *Image-Space Visibility Ordering for Cell Projection Volume Rendering of Unstructured Data*, R. Cook, N. Max, C. Silva, and P. Williams, *IEEE Transactions on Visualization and Computer Graphics*, 10(6):695–707, 2004.

- [37] *Progressive Point Set Surfaces*, S. Fleishman, M. Alexa, D. Cohen-Or, and C. Silva, ACM Transactions on Graphics, 22(4):997–1011, 2003.
- [38] *Out-Of-Core Sort-First Parallel Rendering for Cluster-Based Tiled Displays*, W. Corrêa, J. Klosowski, and C. Silva, Parallel Computing, Vol 29, pp. 325–338, 2003.
- [39] *Computing and Rendering Point Set Surfaces*, M. Alexa, J. Behr, D. Cohen-Or, S. Fleishman, D. Levin, and C. Silva, 9(1):3–15, IEEE Transactions on Visualization and Computer Graphics, 2003.
- [40] *A Survey of Visibility for Walkthrough Applications*, D. Cohen-Or, Y. Chrysanthou, C. Silva, and F. Durand, 9(3):412–431, IEEE Transactions on Visualization and Computer Graphics, 2003.
- [41] *Modeling and Rendering of Real Environments*, W. Corrêa, M. Oliveira, C. Silva, and J. Wang, 9(2):127–156, Brazilian Journal of Theoretic and Applied Computing (RITA), 2002.
- [42] *Efficient Conservative Visibility Culling Using The Prioritized-Layered Projection Algorithm*, J. Klosowski and C. Silva, 7(4):365–379, IEEE Transactions on Visualization and Computer Graphics, 2001.
- [43] *Out-Of-Core Rendering of Large Unstructured Grids*, R. Farias and C. Silva, 21(4):42–50, IEEE Computer Graphics and Applications, 2001.
- [44] *The Prioritized-Layered Projection Algorithm for Visible Set Estimation*, J. Klosowski and C. Silva, 6(2):108–123, IEEE Transactions on Visualization and Computer Graphics, 2000.
- [45] *Visualization Research with Large Displays*, B. Wei, C. Silva, E. Koutsofios, S. Krishnan, and S. North, 20(4):50–54, IEEE Computer Graphics and Applications, 2000.
- [46] *Surface Reconstruction using Lower Dimensional Incremental Delaunay Triangulation*, M. Gopi, S. Krishnan, and C. Silva, Computer Graphics Forum (Proceedings of Eurographics 2000), 19:467–478, 2000.
- [47] *Approximate Volume Rendering for Curvilinear and Unstructured Grids by Hardware-Assisted Polyhedron Projection*, N. Max, P. Williams, and C. Silva, 11:53–61, International Journal of Imaging Systems and Technology, 2000.
- [48] *Efficient Compression of Non-Manifold Polygonal Meshes*, A. Gueziec, F. Bossen, G. Taubin, and C. Silva, 14(1-3):137–166, Computational Geometry: Theory and Applications, 1999.
- [49] *The Ball-Pivoting Algorithm for Surface Reconstruction*, F. Bernardini, J. Mittleman, H. Rushmeier, C. Silva, and G. Taubin, 5(4):349–359, IEEE Transactions on Visualization and Computer Graphics, 1999.
- [50] *Fast Polyhedral Cell Sorting for Interactive Rendering of Unstructured Grids*, J. Comba, J. Klosowski, N. Max, J. Mitchell, C. Silva, and P. Williams, Computer Graphics Forum (Proceedings of Eurographics 1999), 18:367–376, 1999.
- [51] *External Memory Techniques for Isosurface Extraction in Scientific Visualization*, Y.-J. Chiang and C. Silva, In “AMS/DIMACS Proceedings of the DIMACS Workshop on External Memory Algorithms and Visualization”, J. Abello and J. Vitter, eds., DIMACS book series, American Mathematical Society, 1998. (Journal version of the presentation given at the workshop.)
- [52] *The Lazy Sweep Ray Casting Algorithm for Rendering Irregular Grids*, C. Silva and J. Mitchell, 3(2):142–157, IEEE Transactions on Visualization and Computer Graphics, 1997.

- [53] *PVR: High Performance Volume Rendering*, C. Silva, A. Kaufman, and C. Pavlakos, pp. 18–28, IEEE Computational Science and Engineering (Special Issue on Visual Supercomputing), Winter 1996.

Refereed Conference Publications (59)

- [54] *Enabling Advanced Visualization Tools in a Simulation Monitoring System*, E. Santos, J. Tierny, A. Khan, B. Grimm, L. Lins, J. Freire, V. Pascucci, C. Silva, S. Klasky, R. Barreto, N. Podhorszki, IEEE International Conference on e-Science 2009.
- [55] *Workflow Medleys: A New Approach to Construct Mashups*, E. Santos, D. Koop, H. Vo, E. Anderson, J. Freire, and C. Silva, Statistical and Scientific Database Management (SSDBM), 2009.
- [56] *Using Mediation to Achieve Provenance Interoperability*, T. Ellkvist, D. Koop, J. Freire, C. Silva, and L. Strömbäck, IEEE International Conference on Scientific Workflows 2009.
- [57] *End-to-End eScience: Integrating Workflow, Query, Visualization, and Provenance at an Ocean Observatory*, B. Howe, P. Lawson, R. Bellinger, E. Anderson, E. Santos, J. Freire, C. Scheidegger, A. Baptista, and C. Silva, IEEE International Conference on e-Science 2008.
- [58] *Effects of Texture and Color on the Perception of Medical Images*, I. Cheng, A. Badalov, C. Silva, and A. Basu. 30th IEEE Engineering in Medicine and Biology Society, 2008.
- [59] *A First Study on Clustering Collections of Workflow Graphs*, E. Santos, L. Lins, J. P. Ahrens, J. Freire, and C. Silva. Second International Provenance and Annotation Workshop (IPAW) 2008.
- [60] *Towards Provenance-Enabling ParaView*, S. P. Callahan, J. Freire, C. E. Scheidegger, C. Silva, and Huy T. Vo. Second International Provenance and Annotation Workshop (IPAW) 2008.
- [61] *Using Provenance to Support Real-Time Collaborative Design of Workflows*, T. Ellkvist, D. Koop, E. W. Anderson, J. Freire, and C. Silva. Second International Provenance and Annotation Workshop (IPAW) 2008.
- [62] *Examining Statistics of Workflow Evolution Provenance: A First Study*, L. Lins, D. Koop, E. W. Anderson, S. P. Callahan, E. Santos, C. E. Scheidegger, J. Freire, and C. T. Silva. Statistical and Scientific Database Management (SSDBM), 2008.
- [63] *Optimal Bandwidth Selection for MLS Surfaces*, H. Wang, C. E. Scheidegger, and C. Silva, IEEE International Conference on Shape Modeling and Applications (SMI), 2008. **Best paper award.**
- [64] *Quality Improvement and Boolean-Like Cutting Operations in Hexahedral Meshes*, J.F. Shepherd, Y. Zhang, C. Tuttle, and C. Silva, Proceedings of the 10th Conference of the International Society of Grid Generation, 2007.
- [65] *Hardware-Assisted Point-Based Volume Rendering of Tetrahedral Meshes*, E. Anderson, S. Callahan, C. Scheidegger, J. Schreiner, and C. Silva. SIBGRAPI 2007 – Brazilian Symposium on Computer Graphics and Image Processing, 2007.
- [66] *iRun: Interactive Rendering of Large Unstructured Grids*, H. Vo, S. Callahan, N. Smith, C. Silva, W. Martin, D. Owen, D. Weinstein. 7th Eurographics Workshop on Parallel Graphics and Visualization (EGPGV 2007), pages 93–100, 2007.
- [67] *Robust Smooth Feature Extraction from Point Clouds*, J. Daniels, L. Ha, T. Ochotta, and C. Silva. Shape Modeling International 2007, pages 123–133, 2007. **Best paper finalist.**

- [68] *Towards Development of a Circuit Based Treatment for Impaired Memory: A Multidisciplinary Approach*, E. Anderson, G. Preston, and C. Silva. IEEE Engineering in Medicine and Biology Conference (EMBS) 2007, 2007.
- [69] *Multi-Fragment Effects on the GPU using the k-Buffer*, L. Bavoil, S.P. Callahan, A. Lefohn, J.L.D. Comba, and C. Silva. ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games, pages 97–104, 2007.
- [70] *Volume Rendering of Time-Varying Scalar Fields on Unstructured Meshes*, F. Bernardon, S. Callahan, J. Comba, and C. Silva. 6th Eurographics Workshop on Parallel Graphics and Visualization (EGPGV 2006).
- [71] *Managing the Evolution of Dataflows with VisTrails*, S. P. Callahan, J. Freire, E. Santos, C. E. Scheidegger, C. Silva, and H. T. Vo, IEEE Workshop on Workflow and Data Flow for Scientific Applications (SciFlow) 2006.
- [72] *Visualizing Uncertainty with Uncertainty Multiples*, R. B. Gilbert, F. Tonon, J. Freire, C. Silva, and D. R. Maidment, American Society of Civil Engineers (ASCE) 2006 GeoCongress.
- [73] *VisTrails: Enabling Interactive Multiple-View Visualizations*, L. Bavoil, S. Callahan, P. Crossno, J. Freire, C. Scheidegger, C. Silva, and H. Vo. IEEE Visualization 2005, pp. 135–142, 2005.
- [74] *Interactive Rendering of Large Unstructured Grids Using Dynamic Level-Of-Detail*, S. Callahan, J. Comba, P. Shirley, and C. Silva. IEEE Visualization 2005, pp. 199–206, 2005.
- [75] *Hardware Accelerated Simulated Radiography*, D. Laney, S. Callahan, N. Max, C. Silva, S. Langer, and R. Frank. IEEE Visualization 2005, pp. 343–350, 2005.
- [76] *Triangulating Point Set Surfaces with Bounded Error*, C. Scheidegger, S. Fleishman, and C. Silva. Eurographics Symposium on Geometry Processing 2005, pp. 63–72, 2005.
- [77] *Simplification of Unstructured Tetrahedral Meshes by Point-Sampling*, D. Uesu, L. Bavoil, S. Fleishman, J. Shepherd, and C. Silva, pp. 157–165, Volume Graphics 2005, pp. 157–165, 2005.
- [78] *Implicit Occluders*, S. Pesco, P. Lindstrom, V. Pascucci, and C. Silva, IEEE Symposium on Volume Visualization and Graphics 2004, pp. 47–54, 2004. (Selected as one of the best papers, invited for journal submission.)
- [79] *On the Convexification of Unstructured Grids From A Scientific Visualization Perspective*, J. Comba, J. Mitchell, and C. Silva, Proceedings of Dagstuhl 2003. Scientific Visualization: Extracting Information and Knowledge from Scientific Datasets Editors: G.-P. Bonneau, T. Ertl, G. M. Nielson, Springer-Verlag, 2005.
- [80] *Visibility-Based Prefetching for Interactive Out-Of-Core Rendering*, W. Corrêa, J. Klosowski, and C. Silva, IEEE Parallel & Large-Data Visualization & Graphics Symposium 2003, pp. 1–8, 2003.
- [81] *Visualizing Spatial and Temporal Variability in Coastal Observatories*, W. Herrera-Jimenez, W. Corrêa, C. Silva, and A. Baptista, IEEE Visualization 2003, pp. 269–274, 2003.
- [82] *Volume Rendering for Curvilinear and Unstructured Grids*, N. Max, P. Williams, and C. Silva, Computer Graphics International, 2003.
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- [84] *A Generic Programming Approach to Multiresolution Spatial Decompositions*, V. Mello, L. Velho, P. Roma, and C. Silva, International Workshop on Visualization and Mathematics 2002, Berlin-Dahlem, Germany, 2002.
- [85] *Towards Point-Based Acquisition and Rendering of Large Real-World Environments*, W. Corrêa, S. Fleishman, and C. Silva, SIBGRAPI 2002 – Brazilian Symposium on Computer Graphics and Image Processing, 2002.
- [86] *A Memory Insensitive Technique for Large Model Simplification*, P. Lindstrom and C. Silva, pp. 121–126, IEEE Visualization 2001.
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- [88] *Point Set Surfaces*, M. Alexa, J. Behr, D. Cohen-Or, S. Fleishman, D. Levin, and C. Silva, IEEE Visualization 2001, pp. 21–28, 2001. **Best paper finalist.**
- [89] *A Unified Infrastructure for Parallel Out-Of-Core Isosurface and Volume Rendering of Unstructured Grids*, Y.-J. Chiang, R. Farias, C. Silva, and B. Wei, pp. 59–66, IEEE Parallel & Large-Data Visualization & Graphics Symposium 2001.
- [90] *Parallelizing the ZSWEEP algorithm for Distributed-Shared Memory Architectures*, R. Farias, and C. Silva, International Workshop On Volume Graphics 2001.
- [91] *A Hardware-Assisted Visibility-Ordering Algorithm With Applications to Volume Rendering*, S. Krishnan, C. Silva, and B. Wei, pp. 233–242, Data Visualization 2001 Joint Eurographics-IEEE TVCG Symposium on Visualization, 2001.
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- [95] *Rendering on a Budget: A Framework for Time-Critical Rendering*, J. Klosowski and C. Silva, pp. 115–122, IEEE Visualization, 1999. **Best paper finalist.**
- [96] *Efficient Compression of Non-Manifold Polygonal Meshes*, A. Gueziec, F. Bossen, G. Taubin and C. Silva, pp. 73–80, IEEE Visualization, 1999.
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- [98] *Greedy Cuts: An Advancing Front Terrain Triangulation Algorithm*, C. Silva and J. Mitchell, pp. 137–144, ACM Symposium on Geographic Information Systems 1998.
- [99] *An Exact Interactive Time Visibility Ordering Algorithm for Polyhedral Cell Complexes*, C. Silva, J. Mitchell, and P. Williams, pp. 87–94, ACM/IEEE Volume Visualization Symposium, 1998.
- [100] *Interactive Out-Of-Core Isosurface Extraction*, Y.-J. Chiang, C. Silva, and W. Schroeder, pp. 167–174, IEEE Visualization, 1998.

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- [105] *Three Dimensional Visualization of Proteins in Cellular Interactions*, C. Monks, P. Crossno, G. Davidson, C. Pavlakos, A. Kupfer, C. Silva and B. Wylie, pp. 363–366, IEEE Visualization, 1996.
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- [108] *Automatic Generation of Triangular Irregular Networks using Greedy Cuts*, C. Silva, J. S. B. Mitchell and A. Kaufman, pp. 201–208, IEEE Visualization, 1995.
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- [111] *Flow Surface Probes for Vector Field Visualization*, C. Silva, L. Hong and A. Kaufman, In “Scientific Visualization: Overviews, Methodologies and Techniques”, Dagstuhl ’94, G. Nielson, H. Mueller, and H. Hagen, eds., IEEE Computer Society Press, 1997.
- [112] *Minhoca Plus – A Local Area Network for Teaching*, J. Coelho, C. Silva, M. Vieira, and A. Oliveira, VII Brazilian Conference on Computer Networks, UFRGS, March 1989. (In Portuguese.)

Refereed Demos (2)

- [113] *Querying and Re-Using Workflows with VisTrails*, C. E. Scheidegger, H. T. Vo, D. Koop, J. Freire, and C. Silva, ACM SIGMOD 2008.
- [114] *VisTrails: Visualization meets Data Management*, S. P. Callahan, J. Freire, E. Santos, C. E. Scheidegger, C. Silva, and H. T. Vo, ACM SIGMOD 2006, pp. 745-747, 2006.

Book Chapters (4)

- [115] *Visualization for Data-Intensive Science*, C. Hansen, C. R. Johnson, V. Pascucci, and C. Silva. In *The Fourth Paradigm: Data Intensive Scientific Discovery*, K. Tolle, S. Tansley and T. Hey (Eds), to appear.
- [116] *Scientific Process Automation and Workflow Management*, B. Ludaescher, I. Altintas, S. Bowers, J. Cummings, T. Critchlow, E. Deelman, D. D. Roure, J. Freire, C. Goble, M. Jones, S. Klasky, T. McPhillips, N. Podhorszki, C. Silva, I. Taylor, and M. Vouk. In A. Shoshani and D. Rotem, editors, *Scientific Data Management: Challenges, Existing Technology, and Deployment*, Computational Science Series, chapter 13. Chapman & Hall/CRC, 2009.
- [117] *Modeling Cardiogenesis: The Challenges and Promises of 3D Reconstruction*, J. Pentecost, C. Silva, M. Pescitelli, and K. Thornburg, pp. 115–143, Vol. 56, *Current Topics in Developmental Biology*, 2003.
- [118] *Fast and Simple Occlusion Culling*, W. Corrêa, J. Klosowski, and C. Silva, pp. 353–358, *Game Programming Gems 3*, 2002.

Edited Proceedings (4)

- [119] *Proceedings of IEEE Visualization 2006*, E. Groeller, A. Pang, C. Silva, J. Stasko, and J. van Wijk, IEEE, ISSN 1077-2626, 2006.
- [120] *Proceedings of IEEE Visualization 2005*, C. Silva, E. Groeller, and H. Rushmeier, IEEE, 0-7803-9462-3, 2005.
- [121] *Proceedings of IEEE/SIGGRAPH Symposium on Volume Visualization and Graphics 2004*, D. Silver, T. Ertl, C. Silva, IEEE, 0-7803-8781-3, 2004.
- [122] *Proceedings of the IEEE Symposium on Parallel and Large-Data Visualization and Graphics 2003*, A. Koning, R. Machiraju, and C. Silva, IEEE, 0-7803-8122-X, 2003.

Journal Editorials (3)

- [123] *Guest Editorial: Special Section on Visualization 2005*, C. Silva, E. Groeller, and H. Rushmeier. *IEEE Transactions on Visualization and Computer Graphics*, 12(4):419–420, 2006.
- [124] *Special Issue: The First Provenance Challenge*, L. Moreau et al., *Concurrency and Computation: Practice and Experience*, 20(5):409–418, 2008.
- [125] *Guest Editorial: Special Issue on Computational Provenance*, C. Silva and J. Tohline, *Computing in Science and Engineering*, 10(3):9-10, 2008.

Invited Conference Publications (6)

- [126] *Software Infrastructure for Exploratory Visualization and Data Analysis: Past, Present and Future*, C. Silva and J. Freire, *Journal of Physics: Conference Series*, SciDAC 2008 Conference, July 2008.
- [127] *Comparing Techniques for Tetrahedral Mesh Generation*, M. Lizier, J. F. Shepherd, L. G. Nonato, J. Comba, and C. Silva. *Inaugural International Conference of the Engineering Mechanics Institute*, 2008.

- [128] *SciDAC visualization and analytics center for enabling technology*, E. W. Bethel, C. Johnson, K. Joy, S. Ahern, V. Pascucci, H. Childs, J. Cohen, M. Duchaineau, B. Hamann, C. Hansen, D. Laney, P. Lindstrom, J. Meredith, G. Ostrouchov, S. Parker, C. Silva, A. Sanderson, and X. Tricoche, Journal of Physics: Conference Series, SciDAC 2007 Conference, June 2007.
- [129] *Automation of Network-Based Scientific Workflows*, M. Vouk, I. Altintas, R. Barreto, J. Blondin, Z. Cheng, T. Critchlow, A. Khan, S. Klasky, J. Ligon, B. Ludaescher, P. A. Mouallem, S. Parker, N. Podhorszki, A. Shoshani, C. Silva, International Federation for Information Processing (IFIP), Volume 239, Grid-Based Problem Solving Environments, 2007.
- [130] *Managing Rapidly-Evolving Scientific Workflows*, J. Freire, C. Silva, S. P. Callahan, E. Santos, C. E. Scheidegger and H. T. Vo, Proceedings of the International Provenance and Annotation Workshop (IPAW), 2006. Invited paper corresponding to Keynote Talk.
- [131] *VACET: Proposed SciDAC2 Visualization and Analytics Center for Enabling Technologies*, E. Wes Bethel, C. Johnson, C. Hansen, S. Parker, A. Sanderson, C. Silva, X. Tricoche, V. Pascucci, H. Childs, J. Cohen, M. Duchaineau, D. Laney, P. Lindstrom, S. Ahern, J. Meredith, G. Ostouchov, K. Joy, B. Hamann, Journal of Physics: Conference Series, SciDAC 2006 Conference, Denver CO, 2006.

Invited Posters (1)

- [132] *Meet the Proposed SciDAC2 Visualization and Analytics Center for Enabling Technologies*, E. Wes Bethel, C. Johnson, C. Hansen, S. Parker, A. Sanderson, C. Silva, X. Tricoche, V. Pascucci, H. Childs, J. Cohen, M. Duchaineau, D. Laney, P. Lindstrom, S. Ahern, J. Meredith, G. Ostouchov, K. Joy, B. Hamann. Poster, 2006 SciDAC program meeting, Denver, CO.

Refereed Posters, SIGGRAPH Sketches, and Presentations (13)

- [133] *Simplifying the Design of Workflows for Large-Scale Data Exploration and Visualization*, J. Freire and C. Silva. In Proceedings of the Microsoft eScience Workshop, 2008.
- [134] *Using Mediation to Achieve Provenance Interoperability*, T. Ellkvist, D. Koop, J. Freire, C. Silva, and L. Strömbäck, IEEE International Conference on e-Science 2008.
- [135] *Enhanced neuronal efficiency and 10-12Hz spectral dynamics: Results from a concurrent EEG-TMS study*, G. A. Preston, E. W. Anderson, E. Wassermann, T. Goldberg, and C. Silva. 1st North American Symposium on TMS and Neuroimaging in Cognition and Behaviour, 2008.
- [136] *Towards Enabling Social Analysis of Scientific Data*, J. Freire and C. Silva, CHI Social Data Analysis Workshop, 2008.
- [137] *VisTrails: Using Provenance to Streamline Data Exploration*, E. W. Anderson, S. P. Callahan, D. A. Koop, E. Santos, C. E. Scheidegger, H. T. Vo, J. Freire, and C. Silva. Post Proceedings of the International Workshop on Data Integration in the Life Sciences (DILS) 2007. Invited for oral presentation.
- [138] *Effects of 10 Hz rTMS on Alpha Spectral Dynamics and Working Memory Performance*, G. A. Preston, E. W. Anderson, E. Wassermann, T. Goldberg, and C. Silva. Proceedings of Neuroscience Poster Session 2007.
- [139] *Real-Time Soft Shadows with Cone Culling*, L. Bavoil and C. Silva. ACM SIGGRAPH 2006 Sketches Program.

- [140] *Progressive Volume Rendering of Unstructured Grids on Modern GPUs*, S. Callahan, L. Bavoil, V. Pascucci, and C. Silva. ACM SIGGRAPH 2006 Sketches Program.
- [141] *Efficient Acquisition of Web Data Through Restricted Query Interfaces*, S. Byers, J. Freire, and C. Silva, WWW10, poster, 2001.
- [142] *Curvature-Based Estimation of Surface Sampling*, C. Silva and G. Taubin, SIAM Conference on Geometric Design, 1999.
- [143] *External Memory Techniques for Isosurface Extraction in Scientific Visualization*, Y.-J. Chiang and C. Silva, Third CGC Workshop on Computational Geometry, 1998.
- [144] *Lazy Sweep Ray Casting: A Fast Scanline Algorithm for Rendering Irregular Grids*, C. Silva and J. Mitchell, Second CGC Workshop on Computational Geometry, 1997.
- [145] *Automatic Generation of Triangular Irregular Networks using Greedy Cuts*, C. Silva, J. S. B. Mitchell and A. Kaufman, Fifth MSI-Stony Brook Workshop on Computational Geometry, 1995.

Other Publications (1)

- [146] *DOE's SciDAC Visualization and Analytics Center for Enabling Technologies - Strategy for Petascale Visual Data Analysis Success*, E. Bethel, C. Johnson, C. Aragon, Prabhat, O. Rbel, G. Weber, V. Pascucci, H. Childs, P.-T. Bremer, B. Whitlock, S. Ahern, J. Meredith, G. Ostrouchov, K. Joy, B. Hamann, C. Garth, M. Cole, C. Hansen, S. Parker, A. Sanderson, C. Silva, X. Tricoche, CTWatch Quarterly, Volume 3, Number 4, November 2007.

Selected Technical Reports (6)

- [147] *A Unified Projection Operator for Moving Least Squares Surfaces*, T. Ochotta, C. Scheidegger, J. Schreiner, R. Kirby, and C. Silva. SCI Institute Technical Report, No. UUSCI-2007-006, 2007.
- [148] *Visualization in Radiation Oncology: Towards Replacing the Laboratory Notebook*, E. W. Anderson, S. P. Callahan, G. T.Y. Chen, J. Freire, E. Santos, C. E. Scheidegger, C. Silva, and H. T. Vo, SCI Institute Technical Report UUSCI-2006-17, 2006.
- [149] *Simplification of Unstructured Tetrahedral Meshes by Point-Sampling*, D. Uesu, L. Bavoil, S. Fleishman, and C. Silva, SCI Institute Technical Report UUSCI-2004-005, 2004.
- [150] *Out-Of-Core Algorithms for Scientific Visualization and Computer Graphics*, C. Silva, Y.-J. Chiang, W. Corrêa, J. El-Sana, and P. Lindstrom, LLNL Technical Report UCRL-JC-150434-REV-1, 2003.
- [151] *iWalk: Interactive Out-Of-Core Rendering of Large Models*, W. Corrêa, J. Klosowski, and C. Silva, Technical Report TR-653-02, Princeton University, 2002.
- [152] *Final Report for the Tera Computer TTI CRADA*, G. Davidson, C. Pavlakos, and C. Silva, Sandia Report SAND97-0134, Sandia National Laboratories, 1997.
- [153] *Parallel Volume Rendering of Irregular Grids*, C. Silva, Ph.D. thesis, Department of Computer Science, State University of New York at Stony Brook, 1996.

Teaching

Graduate and Undergraduate Courses

Course number and name	Term	Enrollment
CS 6968: Geometry Processing	Spring 2009	13
CS 6630: Scientific Visualization	Fall 2008	26
CS 5630: Scientific Visualization	Fall 2008	6
CS 7960-002: Advanced Scientific Visualization	Spring 2008	11
CS 6630: Scientific Visualization	Fall 2007	33
CS 5630: Scientific Visualization	Fall 2007	5
CP SC 4960: Programming Challenges	Spring 2007	9
CP SC 6962: Algorithms	Fall 2006	19
CP SC 7960: Geometry Processing	Spring 2006	16
CP SC 4960: Programming Challenges	Spring 2006	16
CP SC 6962: Algorithms	Fall 2005	28
CP SC 3510: Advanced Algorithms and Data Structures	Spring 2005	78
CP SC 4960: Programming Challenges	Spring 2005	6
CP SC 6962: Algorithms	Fall 2004	11
CP SC 3510: Advanced Algorithms and Data Structures	Spring 2004	51
CP SC 5020: Advanced Algorithms and Data Structures	Spring 2004	6
CP SC 4960: Programming Challenges (joint with E. Praun)	Spring 2004	6
CSE 583: Real-time Rendering using Modern Graphics	Spring 2003	7

Post-doctoral Assistants (2 Post-doc)

Joel Daniels (Post-doc, since June 2009)

Lauro Lins (Post-doc, since November 2007; Co-advised with Juliana Freire)

Current Graduate Students (10 Ph.D.)

Carlos Scheidegger (Ph.D., since January 2005)

Huy T. Vo (Ph.D., since August 2005)

Emanuele Santos (Ph.D., since August 2005, Co-advised with Freire)

Linh K. Ha (Ph.D., since February 2006)

Erik Anderson (Ph.D., since May 2006)

David Koop (Ph.D., since August 2006, Co-advised with Freire)

Matt Berger (Ph.D., since September 2008)

Tiago Etienne (Ph.D., since September 2008)

Claurissa Tuttle (Ph.D., since September 2008)

Hao Wang (Ph.D., since September 2008)

Former Graduate Students and Post-doctoral Assistants (4 Post-doc, 5 Ph.D., 3 M.S.)

Tilo Ochotta (Post-doc, 2008–2009)

John Schreiner (Ph.D., University of Utah, 2008)

Steven P. Callahan (Ph.D., University of Utah, 2008)

Heballa Benan Alzahawi (M.S.–project option, University of Utah, 2008)

Yuan Zhou (Post-doc, University of Utah, 2007–2008)

Louis Bavoil (M.S.–thesis option, University of Utah, 2006)

Steven P. Callahan (M.S.–thesis option, University of Utah, 2005)
Shachar Fleishman (Post-doc, University of Utah, 2004–2005)
Sinesio Pesco (Post-doc, University of Utah, 2003–2004)
Dirce Uesu (Post-doc, University of Utah, 2003–2004)
Wagner Corrêa (Ph.D., Princeton University, 2003; Co-advised with Szymon Rusinkiewicz)
Ricardo Farias (Ph.D., SUNY-Stony Brook, 2001; Co-advised with Joseph Mitchell)
Tsung-Chin Ho (Ph.D., SUNY-Stony Brook, 2001; Co-advised with Joseph Mitchell)

Graduate Thesis Defense Committees

Luciano Barbosa (Ph.D., University of Utah, 2009)
Thiago Ize (Ph.D., University of Utah, 2009)
Aaron Knoll (Ph.D., University of Utah, 2008)
Guo-Shi Li (Ph.D., University of Utah, 2008)
Miriah D. Meyer (Ph.D., University of Utah, 2008)
Xianming Chen (Ph.D., University of Utah, 2007)
Jason F. Shepherd (Ph.D., University of Utah, 2007)
Joel D. Daniels II (M.S., University of Utah, 2005)

Other Advising and Mentoring

Mentor, Luiz Gustavo Nonato (Associate Professor, University of São Paulo, Brazil), August 2008–
P. Hendricks, since July 2009. NSF REU student.
P. Mates, since February 2009. NSF REU student.
C. Brooks, since September 2008. NSF REU student.
Undergraduate advisor, W. Tyler, since September–December 2005. NSF REU student.
Undergraduate advisor, E. Anderson, August 2004–January 2005. NSF REU student.
Undergraduate advisor, H. Vo, May 2004–May 2005. Continuing into Ph.D. program.
Undergraduate advisor, N. Smith, September 2005–March 2007. NSF REU student.
Undergraduate advisor, J. Callahan, Summer 2007–Summer 2008. NSF REU student.
Undergraduate advisor, H. Wang, December 2006–August 2008. Continuing into Ph.D. program.

Research mentor, M. Lizier, November 2007–July 2008.
Research Mentor, T. Ochotta, September 2006–February 2007.
Research mentor, F. Bernardon, June–September 2006.
Research mentor, Y. Lima, February–May, 2006.
Ph.D. advisor, W. Herrera-Jimenez, 01/2003–10/2003. Dropped for personal reasons.
Research mentor (with J. Freire), L. Rocha, April–November 2003.
Research mentor, AT&T Summer Internship Program, W. Corrêa (Princeton University), Summer 2002.
Research mentor, AT&T-Labs Fellowship Program, L. Lloyd, Summer 2002.
Research mentor, AT&T Summer Internship Program, S. Fleishman, Summer 2001.
Research mentor, AT&T URP (Under Represented Minority Program), B. Anthony, Summer 2000.

Selected Tutorials (20)

Provenance-Enabled Data Exploration and Visualization

IEEE Visualization 2009.

Provenance and Scientific Workflows: Supporting Data Exploration and Visualization

IEEE International Conference on e-Science 2008.
Visualization and Data Analysis with VisTrails
 SciDAC (Scientific Discovery through Advanced Computing) 2008.
GPU-Based Volume Rendering of Unstructured Grids
 SIBGRAPI 2005.
Multi-resolution Modeling, Visualization and Compression of Volumetric Data
 Eurographics 2004.
 IEEE Visualization 2003.
Out-Of-Core Algorithms for Scientific Visualization and Computer Graphics
 IEEE Visualization 2003.
 IEEE Visualization 2002.
High-Performance Visualization of Large and Complex Scientific Datasets
 ACM/IEEE SC 2002.
Rendering and Visualization in Affordable Parallel Environments
 IEEE Visualization 2001.
 Eurographics 2001.
 ACM SIGGRAPH 2000.
 IEEE Visualization 2000.
 ACM SIGGRAPH 1999.
 Eurographics 1999.
 Eurographics 1998.
Visibility, problems, techniques and applications
 ACM SIGGRAPH 2001.
 ACM SIGGRAPH 2000.
 Eurographics 1999.
Advances in Volume Visualization
 ACM SIGGRAPH 1998.

Selected Invited Talks (50)

High-Quality Isosurfaces and Surface Re(Meshing)
 Brown University, April 7th, 2009
 Linköping University (Norrköping Campus), January 20th, 2009
Introduction to Computational Provenance
 Workshop on Monte Carlo data evaluation, archiving and provenance, Inst. Theor. Physics, ETH, Nov. 2nd, 2008.
Introduction to VisTrails
 Workshop on Monte Carlo data evaluation, archiving and provenance, Inst. Theor. Physics, ETH, Nov. 2nd, 2008.
VisTrails: Provenance and Data Exploration
 Harvard University, April 9th, 2009
 NIH National Biomedical Computation Resource (NBCR) Summer Institute 2008, August 4th, 2008.
Software Infrastructure for Exploratory Visualization and Data Analysis: Past, Present and Future
 SciDAC (Scientific Discovery through Advanced Computing) 2008, July 17th, 2008.
Visualization at the University of Utah
 Linköping University, January 16th, 2009
 Workshop on Interactive Data Visualization (co-located with SIBGRAPI 2007), October 7th, 2007.
Supporting Data Exploration through Visualization
 Open Grid Forum 19, February 1st, 2007.
 IBM T. J. Watson Research Center, October 27th, 2006.
 International Fall School and Workshops, Universidad Nacional Autonoma de Mexico, October 18th, 2006.
Scalable Techniques for Scientific Visualization,
 IEEE EMBS Chapter talk, University of Alberta, August 1st, 2007.

CIG Computational Geodynamics and Scientific Computing Workshop, UT-Austin, October 17th, 2006.
 Microsoft eScience 2006, October 14th, 2006.

Surface Re(Meshing) and Applications
 Federal University of Rio Grande do Sul, August 3rd, 2006.
 Ayia Napa Summer Seminar 2006, June 29th, 2006.
 IMPA-Brazil, June 14th, 2006.

VisTrails: Visualization meets Data Management
 University of North Carolina at Chapel Hill, February 2nd, 2007.
 TU-Kaiserlautern, June 23rd, 2006.

Managing Complex Visualizations
 Harmon Pro Group Tech Conference, February 22nd, 2006.

Dynamic Level-Of-Detail Rendering of Unstructured Meshes
 Dagstuhl Scientific Visualization, June 9th, 2005.

Point-Set Surfaces: An Update and Recent Work,
 Lawrence Livermore National Laboratory, May 20th, 2005.

GPU-Based Scientific Visualization
 University of Texas at Dallas, March 28th, 2005.
 IBM T. J. Watson Research Center, November 22nd, 2004.
 Brigham Young University, September 23rd, 2004.

GPU-Based Unstructured Volume Rendering
 Technische Universität München, June 9th, 2004.
 University of Stuttgart, June 8th, 2004.

Using Points for Rendering and Modeling Surfaces
 UC-Davis, March 5th, 2003.
 UC-Berkeley, March 20th, 2003.
 Dagstuhl Scientific Visualization, June 5th, 2003.
 DIMACS Surface Reconstruction Workshop , April 30th, 2003.

Massive Polygonal Rendering
 Arctic Region Supercomputer Center, Alaska, August 6th, 2003.

Direct Volume Rendering Techniques for Unstructured Grids
 UC-Santa Barbara, March 13th, 2002.
 Univ. of Pittsburgh, April 4th, 2002.
 University of Miami, March 21st, 2002.
 Rutgers University, March 8th, 2002.
 UMass-Amherst, February 8th, 2002.
 OGI-OHSU, January 31st, 2002.

External Memory Algorithms for Scientific Visualization
 Michigan State University, December 3rd, 2001.

Surface Reconstruction Algorithms
 Princeton University, November 12th, 2001.

The ZSWEEP Algorithm for Rendering Irregular Grids
 LLNL, Livermore, October 12th, 2001.

Point-Set Surfaces
 LLNL, Livermore, October 10th, 2001.

Rendering Irregular Grids
 IMPA-Brazil, February 13th, 2001.

Towards Acquiring and Rendering Real-World Environments
 AT&T Cambridge, Sept. 3rd, 2001.

Challenges in Scientific Visualization

New York University, New York City, December 17th, 1999.

Sorting Polyhedra and Applications

Bell Labs, Murray Hill, New Jersey, October 28th, 1999.

CNUCE – CNR, Pisa, Italy, September 3rd, 1999.

Rutgers University, New Jersey, April 22nd, 1999.

Service

Internal Service

School of Computing

- Director, Graphics and Visualization Track, 2004–.
- Curriculum Committee
 - Member, 2004–.
 - Co-chair, 2007–2008.
- Member of Graduate Admissions Committee, 2005–.
- Member of Faculty Recruiting Committee (Theory sub-committee), 2006.
- Coach, Utah Programming Team, 2004–2006
 - We won 2nd place in the 2006 ACM Rocky Mountain Regional Contest, and best in Utah.
 - We won 2nd place in the 2005 ACM Rocky Mountain Regional Contest, and best in Utah.
 - (With E. Praun.) We won 3rd place in the 2004 ACM Rocky Mountain Regional Contest, and best in Utah.

Scientific Computing and Imaging (SCI) Institute

- Associate Director, January 2008–May 2009.
- Member of Graduate Recruiting Committee, 2005–.
- Member of IT Committee, 2005.

External Service

Journal Editorialships

- Editorial Board, Computer and Graphics (2008–).
- Co-Editor, Visualization Corner, Computing in Science and Engineering magazine (2007–).
- Guest Editor: Computing in Science and Engineering theme issue on Computational Provenance, 2008.
- Associate Editor, IEEE Transactions on Visualization and Computer Graphics (2002–2006).
- Guest Editor: IEEE Transactions on Visualization and Computer Graphics issue on IEEE Visualization 2006.

- Guest Editor: IEEE Transactions on Visualization and Computer Graphics issue on IEEE Visualization 2005.

Conference Chairing and Organization

- General Co-chair, IEEE Visualization 2010.
- Co-organizer, CSCW 2010 workshop on “The Changing Dynamics of Scientific Collaborations”
- Visualization area co-chair, 5th International Symposium on Visual Computing, 2009.
- Co-organizer, CHI 2009 workshop on “The Changing Face of Digital Science: Workshop on New Practices in Scientific Collaborations.”
- Papers Co-chair, IEEE Visualization 2006.
- Papers Co-chair, IEEE Visualization 2005.
- Best paper award selection committee, IEEE Visualization 2006.
- Best paper award selection committee (chair), IEEE Visualization 2005.
- Best paper award selection committee, IEEE Visualization 2004.
- Papers Co-chair, IEEE/SIGGRAPH Symposium on Volume Visualization and Graphics 2004.
- Co-chair, IEEE Parallel & Large-Data Visualization & Graphics Symposium 2003.
- Co-organizer, DIMACS Implementation Challenge on Surface Reconstruction, 2003.
- Co-organizer, DIMACS Workshop on Visualization and Data Mining, 2002.

Reviewing and Other Committee Participation

- Search committee for the Editor-in-Chief of IEEE Computer Graphics and Applications (2009).
- NIH Panelist for Software Maintenance Panel (twice).
- NSF Panelist, 2002-04, 2006, 2007, 2008.
- Member, geometry subcommittee, NIFTI Data Format Working Group of the National Institutes of Health, 2005–.
- Member, MPEG-4 3D Model Coding (3DMC) standardization committee, 1998-9.
- Symposium Committee, ACM/IEEE Volume Visualization 2000.
- Reviewer for: National Science Foundation, MacArthur Fellows Program, Dutch National Science Foundation (NWO), ACM SIGGRAPH (papers and courses), IEEE Visualization, ACM SIGMOD, ACM/IEEE Volume Visualization, IEEE Transactions on Visualization and Computer Graphics, IEEE Computer Graphics and Applications, Eurographics, Visual Computer, IEEE Transactions on Networking, Graphics Interface, Symposium on Interactive 3D, and several other conferences, journals, and funding agencies.
- Book reviewer for Morgan-Kaufmann Publishers, AK Peters.
- Member of ACM, IEEE, Eurographics.

Program Committees (71)

International Meeting High Performance Computing for Computational Science (VECPAR'10)
Symposium on Geometry Processing 2010
IEEE International Conference on Shape Modeling and Applications (SMI) 2010
Symposium on 3D Data Processing, Visualization, and Transmission (3DPVT) 2010
First International Workshop on Semantic Web and Provenance Management 2009 (SWPM09)
XX Brazilian Symp on Computer Graphics and Image Processing (SIBGRAPI) 2009
1st International Workshop on Provenance in Practice 2009 (PPW09)
Symposium on Geometry Processing 2009
VizMining 2009 Workshop at the 2009 SIAM International Conference on Data Mining
EuroVis 2009
Eurographics 2009 Symposium on Parallel Graphics and Visualization (EGPGV'09)
2009 SIAM/ACM Joint Conference on Geometric and Physical Modeling
IEEE International Conference on Shape Modeling and Applications (SMI) 2009
ACM Multimedia 2008 Technical Demonstrations
Knowledge-Assisted Visualization (KAV) 2008
International Symposium on Volume Graphics 2008 (VG08)
XIX Brazilian Symp on Computer Graphics and Image Processing (SIBGRAPI) 2008
Symposium on 3D Data Processing, Visualization, and Transmission (3DPVT) 2008
2nd International Provenance and Annotation Workshop (IPAW 2008)
ACM SIGGRAPH 2008 Papers Program
ACM Solid and Physical Modeling Symposium (SPM) 2008
IEEE International Conference on Shape Modeling and Applications (SMI) 2008
EuroVis 2008
International Conference on Computer Animation and Social Agents (CASA) 2008
Symposium on Geometry Processing 2008
Knowledge-Assisted Visualization (KAV) 2007
Pacific Graphics 2007
IEEE Visualization 2007
6th International Workshop on Volume Graphics (VG 2007)
3rd International Symposium on Visual Computing (ISVC 07)
ACM SIGGRAPH 2007 Sketches & Posters Program
XVIII Brazilian Symp on Computer Graphics and Image Processing (SIBGRAPI) 2007
7th Eurographics Workshop on Parallel Graphics and Visualization (EGPGV), 2007
Symposium on Geometry Processing 2007
Eurographics 2007
2nd International Symposium on Visual Computing (ISVC 06)
5th International Workshop on Volume Graphics (VG 2006)
3rd Ibero-American Symposium on Computer Graphics (SIACG 2006)
Symposium on 3D Data Processing, Visualization, and Transmission (3DPVT) 2006
Computer Graphics International 2006
Symposium on Point-Based Graphics 2006
Shape Modelling International 2006
Symposium on Geometry Processing 2006
XVIII Brazilian Symp on Computer Graphics and Image Processing (SIBGRAPI) 2006
6th Eurographics Workshop on Parallel Graphics and Visualization (EGPGV), 2006
Pacific Graphics 2005

XVII Brazilian Symp on Computer Graphics and Image Processing (SIBGRAPI) 2005
Symposium on Point-Based Graphics 2005
Symposium on Geometry Processing 2005
International Workshop on Volume Graphics 2005
Shape Modelling International 2005
7th Brazilian Symposium on Virtual Reality 2004
XVII Brazilian Symp on Computer Graphics and Image Processing (SIBGRAPI) 2004
Symposium on 3D Data Processing, Visualization, and Transmission (3DPVT) 2004
Pacific Graphics 2004
Second Symposium on Geometry Processing 2004
Fifth Eurographics Symposium on Parallel Graphics and Visualization 2004
Symposium on Point-Based Graphics 2004
Solid Modelling International 2004
Sixth Brazilian Virtual Reality Symposium (SVR) 2003
IEEE Visualization 2003
Symposium on Geometry Processing, 2003
IEEE Visualization 2002
ACM/IEEE Volume Visualization 2002
Fifth Brazilian Virtual Reality Symposium (SVR) 2002
International Workshop on 3D Digitization (3DD) 2002
Eurographics Workshop on Parallel Graphics and Visualization 2002
1st Ibero-American Symposium on Computer Graphics 2002
IEEE Visualization 2001
IEEE Parallel & Large-Data Visualization & Graphics Symposium 2001
International Workshop On Volume Graphics 2001
IEEE Visualization 2000