

Education

Doctor of Philosophy, Computer Science, University of North Carolina – Chapel Hill, December 2012
Thesis: Degree-Driven Design of Geometric Algorithm for Point Location, Proximity and Volume Calculation
Advisor: Dr. Jack Snoeyink

Masters of Science, Computer Science, Courant Institute, New York University, May 2007
Thesis: Degeneracy Proof Predicates for the Additively Weighted Voronoi Diagram
Advisor: Dr. Chee Yap

Bachelors of Arts, Computer Science, Colgate University, May 2003
Honors in Computer Science, Dean's Award for Academic Excellence

Professional and Professional Experience

January 2017—Present: Assistant Professor, Gianforte Faculty Fellow

August 2016–December 2016: Adjunct Assistant Professor

School of Computing, Montana State University, Bozeman, MT

January 2017–Present: Technical Advisor

November 2015–January 2017: Engineer

Nowsta, New York, NY

Nowsta is a payments and logistics platform that provides next day payment processing. Some technical projects include: leading the development of the payments platform and the worker recommendation engine, redesigning the messaging system, and architecting the CI/CD system. Non-technical projects included presentations to investors, writing job descriptions, and interviewing candidates for technical positions

November 2015–Present: Technical Advisor

April 2015–November 2015: Director of Engineering

February 2015–April 2015: Engineering Team Lead

February 2014–February 2015: Lead Cloud Developer

ProductionPro, LLC, New York, NY

ProductionPro is a collaboration system used for film, theatre, and television. First technical hire; grew the technical team to six engineers (and still growing). Led the design and implementation of ProductionPro from paper prototype to its initial release. Some technical projects include the: architecture of the backend systems using AWS and Firebase, internal and external server APIs and data models using Django; authentication and security systems using Django and Node.js; the real-time collaboration systems; and script-interpreter, our natural language processing systems. Non-technical projects included presentations to investors, writing job descriptions, and interviewing candidates for technical positions.

February 2013–February 2014: Senior Engineer at Bettis Atomic Power Laboratory

Bechtel Marine Propulsion Corporation, West Mifflin, Pa

MC21 is a continuous energy Monte Carlo particle transport simulation code. As a member of the MC21 core team, I led the development of the geometric kernel. Designed and implemented algorithms; reviewed and approved contributed code; planned future development (features, timelines, etc.); reported to funding sources; participated in subcontracts.

September 2007–December 2012: Research Assistant of Dr. Jack Snoeyink

University of North Carolina-Chapel Hill, Chapel Hill, NC

Developed and implemented practical and exact geometric algorithms that are robust to numerical inaccuracies by treating precision as a limited resource. Some applications include physical simulation, constructive solid geometry (CSG), image processing, post office queries, k -nearest neighbor queries for crystallographic symmetry groups, surface simplification of irregular terrain data and data structures for streaming input. Member of the Computational Geometry Group.

June 2010–August 2010: Internship at Bettis Atomic Power Laboratory

Bechtel Marine Propulsion Corporation, West Mifflin, Pa

Designed and implemented an algorithm for computing the volume of arbitrarily complex objects directly from their constructive solid geometry (CSG) representation. Considered multiple approaches such as sampling, octree decomposition, meshing and Collins decomposition; however, on their own each approach was either too slow, required too much precision or created too much structure for applications involving a large number of 3d quadratic surfaces. The newly developed algorithm overcame these limitations. The algorithm directly processed the input surfaces, thereby avoiding the slow convergence of Monte Carlo and octree decomposition. In addition, the algorithm only resolves the topological features that significantly affect the volume; therefore, it does not require the height precision of meshing approaches. Finally, the algorithm is output sensitive, avoiding the exponential structure created by Collins decomposition.

May 2009–July 2009: Internship at Bettis Atomic Power Laboratory

Bechtel Marine Propulsion Corporation, West Mifflin, Pa

Derived and implemented a compact representation for objects defined by Boolean operations of implicit surfaces. This representation provides a reduced memory footprint and supports algorithms for rapidly evaluating the point inside/outside predicates. Applied advanced techniques from computational topology and numeric computational geometry to create a new, topologically consistent algorithm that ensures robust particle tracking in physical simulations without the need for exact arithmetic. The improved tracking algorithm was applied to a Monte Carlo radiation transport simulation and resulted in shorter simulation times with fewer lost particles, even for extremely complex model geometries.

June 2008–August 2008: Internship at Bettis Atomic Power Laboratory

Bechtel Bettis Inc, West Mifflin, Pa

Investigated convergence criteria, numerical stability and parameter optimization for an Arnoldi model reduction method for second order dynamical systems; Developed and tested a large scale, parallel implementation of this method using MATLAB's Distributed Computing Toolbox.

June 2007–August 2007: Internship sponsored by the NSF-IRES REUSSI program

National de Recherche en Informatique et Automatique, INRIA, Sophia-Antipolis, France

Started the parallel branch of Computational Geometry Algorithms Library (CGAL) as well as designed and implemented a parallel Delaunay triangulation algorithm as part of the Geometrica Group.

February 2006–July 2007: Exact Geometric Computation Lab, advisor Dr. Chee Yap

Courant Institute of Mathematical Sciences, New York University, New York

Assisted in the testing and debugging of CORE library v2.

July 2006–July 2007: Student Employment NYU, advisor Dr. Panos Mavromatis Director of Music Theory

Steinhardt School of Education, New York University, New York

Creating user interface libraries to ease the creation of music applications and applying it to the development of an AI based tutor application to train composers in counterpoint techniques.

May 2006–July 2006: Internship sponsored by the NSF-IRES REUSSI program

National de Recherche en Informatique et Automatique, INRIA, Sophia-Antipolis, France

Implemented predicates to reduce the algebraic degree of the Computational Geometry Algorithms Library (CGAL) implementation of the additively weighted Voronoi diagram as part of the Geometrica Group.

November 2004–May 2006: iPod Genius, Mac Specialist, ICS

Apple Computers Inc, SoHo, NY and Menlo Park, NJ

Prepared Early Field Failure Analysis on Nano and Version 5 (Video) iPods; Handled iPod related service issues; Presented GarageBand and iPod workshops; Installed airport, ram and video cards in Apple computers; Assisted customers with the purchase of Apple products; Worked with back of house issues such as inventory and product shrinkage avoidance.

August 2003–October 2004: Research Assistant of Dr. James Abello

Center for Discrete Mathematics and Theoretical Computer Science, DIMACS, Rutgers University, Piscataway, NJ

Designed and implemented applications for use in the SEER Cancer data project; Investigated and implemented semi-external graph algorithms for processing graphs larger than 650,000 vertices and 6.5 million edges; Created applications for preprocessing SEER Cancer data for visualization.

January 2003–May 2003: Research Assistant of Dr. Thomas Parks

Colgate University, Hamilton, NY

Implemented algorithms in the java implementations of Process Networks (PN) and Communicating Sequential Processes to demonstrate the scalability of the PN Framework as well as compare the performance of the two systems.

June 2001–August 2001: Research Assistant of MacArthur Fellow Dr. Gary Urton

Colgate University, Hamilton, NY

Investigated aspects of Incan culture and linguistic theory to assist in the design of a database of 23 Incan Quipus for use in understanding their communicative purpose.

April 2001–June 2003: Lab Administrator

Colgate Student Operated User Resource Center – SOURCE, Colgate University, Hamilton, NY

Managed a staff of six System Analysts; Advised Laboratory Manager on reoccurring system problems; Administered and performed upgrades and maintenance on all computers in all campus public laboratories; Provided technological assistance, computer repairs and upgrades for students.

Current Grants

Collaborative Research: ABI Innovation: Biofilm Resource and Information Database (BRAID): A Tool to Fuse Diverse Biofilm Data Types

August 2017–July 2020 (est.), National Science Foundation, DBI 1661530, \$299, 853.

PI: David L. Millman; co-PI: Brendan Mumey

Senior Personnel: Brittany Terese Fasy and Matthew Fields

Collaborative Grant: DBI 1661527 (PI Ramaraj, NCGR).

Undergraduate Research Assistants

McNair Scholars: Justin O’Dea (AY ‘16-17), Angus Tomlinson (AY ’17-)

REU Students: Kira Wencek (U. Rhode Island ’17)

MSU USP & IMBRE Advisees (Undergraduate Research Grants): Alex Calderwood (AY ‘16), Carie Pointer (AY ’17-), Britnay Gibbs (AY ‘17-), Levi Rak (AY Spr. ’18-)

Other MSU Undergraduate Research Advisees: Brett Layman, Brendan Kristiansen

Graduate Teaching

Instructor, Advanced Databases, Fall 2018

Montana State University, Bozeman, MT

Instructor, Data Mining, Fall 2017

Montana State University, Bozeman, MT

Undergraduate Teaching

Instructor, Graphics, Spring 2018

Montana State University, Bozeman, MT

Instructor, Programming Languages, Spring 2017

Montana State University, Bozeman, MT

Instructor, Introduction to Scientific Programming, Summer 2012

UNC-Chapel Hill, Chapel Hill, NC

Graduate Research Consultant and Teaching Assistant, Intro to Scientific Programming, Fall 2008

UNC-Chapel Hill, Chapel Hill, NC

Honors and Awards

Academic

Heidelberg Laureate Forum, 2013 – named 1 of 200 young researchers selected to participate in the First Heidelberg Laureate Forum. The forum provided the opportunity for selected young researchers and recipients of the Turing award, Fields medal, and Abel prize to meet and discuss directions in research.

Department of Energy Rickover Fellowship, 2010 – 2012 – award from the Naval Reactors division of the U.S. Department of Energy (DOE) covers two full years of graduate study with a stipend.

Travel Grant, 2012, \$400 from Rutgers University to attend the 2012 International Symposium on Voronoi Diagrams.

Young Researchers Grant, 2010 – award from the SAGA Network to attend the Fall School on ShApes Geometry and Algebra located at Kolympari, Greece; covers registration, accommodation, board and 800 euro for travel.

Google Lime Scholarship, 2009 – award from Google and the Lime foundation, named 1 of 5 Google Lime scholars. Recipient of \$10,000 academic scholarship and invited to all-expenses paid 2010 Google Scholars retreat at Google Headquarters in Mt. View, California.

Travel Grant, 2009, \$400 from Tufts University to attend the 2009 Fall Workshop on Computational Geometry.

Travel Grant, 2008, \$400 from Rensselaer Polytechnic Institute to attend the 2008 Fall Workshop on Computational Geometry

Travel Grant, 2008, \$300 from Mathematical Association of America to attend Mathfest, 2008

Summer Research Grant, 2001 Summer stipend from the Colgate Division of Natural Sciences to assist in the creation of a database of 23 Incan Quipus for Anthropologic study.

Professional

Recipient of the Apple Best of Brand Award: Awarded to the Apple employee who most exemplifies the ideals of Apple as decided by co-workers, 2005.

Ranked #69 in Apple world wide sales performance, 2005.

Patents

1. Alexander Libby and David L. Millman. System and Method for Providing a Visual Scroll Representation of Production Data, 2016, U.S. Provisional Patent Application 15/288,572, October 7, 2016

Refereed Journal Articles

2. David P. Griesheimer, *et al*, MC21 Version v.6.0 – A Continuous-Energy Monte Carlo Particle Transport Code with Integrated Reactor Feedback Capabilities. *Annals of Nuclear Energy*, 82, 29–40, 2015
3. David P. Griesheimer, David L. Millman, and Clarence R. Willis. Analysis of distances between inclusions in finite binary stochastic materials. *Journal of Quantitative Spectroscopy and Radiative*, 112(4):577–598, March 2011.
4. Vicente H.F. Batista, David L. Millman, Sylvain Pion, and Johannes Singler. Parallel geometric algorithms for multi-core computers. *Computational Geometry*, 43(8):663 – 677, 2010. Special Issue on the 25th Annual Symposium on Computational Geometry (SoCG’09)

Refereed Conference Publications

Conference papers accepted as journal articles are only listed above (so each paper is listed once).

5. Brian R. Nease, Jeffery D. Densmore, and David L. Millman. Residual Monte Carlo Using Kernel Density Estimators. *ANS Winter Meeting and Nuclear Technology Expo*, American Nuclear Society, 2014. Electronic Proceedings
6. David L. Millman, David P. Griesheimer, Brian R. Nease, and Jack Snoeyink. Computing Numerically-Optimal Bounding Boxes for Constructive Solid Geometry (CSG) Components in Monte Carlo Particle Transport Calculations. *SNA+MC 2013: Joint International Conference on Super Computing in Nuclear Applications + Monte Carlo*, 2013. Electronic proceedings
7. Brian R. Nease, David L. Millman, David P. Griesheimer, and Daniel F. Gill. Geometric Templates for Improved Tracking Performance in Monte Carlo Codes. *SNA+MC 2013: Joint International Conference on Super Computing in Nuclear Applications + Monte Carlo*, 2013, Electronic proceedings
8. David L. Millman, Steven Love, Timothy M. Chan, and Jack Snoeyink. Computing the Nearest Neighbor Transform Exactly with only Double Precision. In *ISVD 2012: Proceedings of the 9th International Symposium on Voronoi Diagrams in Science and Engineering*, pages 66-74, 2012
9. David L. Millman, David P. Griesheimer, Brian R. Nease, and Jack Snoeyink. Robust Volume Calculations for Constructive Solid Geometry (CSG) Components in Monte Carlo Transport Calculations. *PHYSOR 2012: Advances in Reactor Physics*, 2012. Electronic proceedings
10. David L. Millman and Jack Snoeyink. Computing planar Voronoi diagrams in double precision: a further example of degree-driven algorithm design. In *SCG '10: Proceedings of the 26th Annual Symposium on Computational Geometry*, pages 386-392, New York, NY, USA, 2010. ACM.
11. David L. Millman and Jack Snoeyink. Computing the implicit Voronoi diagram in triple precision. In *WADS '09: Proceedings of the 11th International Symposium on Algorithms and Data Structures*, volume 5664 of *Lecture Notes in Computer Science*, pages 495–506. Springer, 2009.
12. David P. Griesheimer and David L. Millman. Analysis of distances between inclusions in finite one-dimensional binary stochastic materials. In *M&C '09: Proceedings of the International Conference on Mathematics, Computational Methods and Reactor Physics*. American Nuclear Society, American Nuclear Society, May 2009. Electronic proceedings.

Other Publications

13. Brittany Terese Fasy and David L. Millman. Review of Polyhedral and Algebraic Methods in Computational Geometry by M. Joswig and T. Theobald. *SIGACT News*, 46(3): 17–20 , September 2015
14. Clinton Freeman, David L. Millman, Jack Snoeyink. Gift Wrapping the Integer Hull in the Plane. *EuroCG '14: 30th European Workshop on Computational Geometry*, 2014
15. Brittany Terese Fasy and David L. Millman. Review of How to fold it by J. O'Rourke. *SIGACT News*, 44(3):17–19, September 2013.
16. David L. Millman and Jack Snoeyink. Degree Algorithm Design for Computing Volumes of CSG Models. *YRF'12: Young Researches Forum at CG Week 2012*, Chapel Hill, NC, 2012.
17. David L. Millman and Vishal Verma. A slow algorithm for computing the Gabriel graph with double precision. In *CCCG '11: Proceedings of the 23rd Canadian Conference on Computational Geometry*, pages 485-487, 2011.
18. Brittany Terese Fasy and David L. Millman. Review of geometric algebra: an algebraic system for computer games and animation by J. Vince. *SIGACT News*, 42:46–48, March 2011.
19. Brittany Terese Fasy and David L. Millman. Review of geometric folding algorithms by authors: E.D. Demaine and J. O'Rourke. *SIGACT News*, 42:43–46, March 2011.

20. Matthew O'Meara, David L. Millman, Jack Snoeyink, and Vishal Verma. Maximum geodesic routing in the plane with obstacles. *CCCG '10: Proceedings of the 22nd Canadian Conference on Computational Geometry*, pages 107–108, 2010.
21. Vicente H. F. Batista, David L. Millman, Sylvain Pion, and Johannes Singler. Parallel multi-core geometric algorithms in CGAL. In *Workshop on Massively Multiprocessor and Multicore Computers*, 2009. Electronic proceedings.
22. Brittany Terese Fasy and David L. Millman. Review of higher arithmetic: An algorithmic introduction to number theory by H. M. Edwards (American Mathematical Society Student Mathematical Library vol. 45, 2008). *SIGACT News*, 40(2):38–41, 2009.
23. Timothy M. Chan, David L. Millman and Jack Snoeyink. Discrete Voronoi Diagrams and Post Office Query Structures without the InCircle Predicate. In *FWCG '09: Proceedings of the Nineteenth Annual Fall Workshop on Computational Geometry*, pages 33–34, 2009.
24. David L. Millman and Jack Snoeyink. Degree-driven algorithm design for computing the Voronoi diagram. In *FWCG '08: Proceedings of the Eighteenth Annual Fall Workshop on Computational Geometry*, pages 20–21, 2008.
25. Brittany Terese Fasy and David L. Millman. Review of geometric algebra for computer science by Leo Dorst, Daniel Fontijne, and Stephen Mann (Morgan Kaufmann Publishers, 2007). *SIGACT News*, 39(4):27–30, 2008.

Presentations

26. Robin Belton, Brittany Terese Fasy, David L. Millman, Angus Tomlinson and Kira Wencek, Analyzing Musical Compositions with Topological Data Analysis, Poster at Algebraic Topology: Methods, Computation and Science (ATMCS8) 2018, IST-Austria, June 2018
27. Britney Gibbs, David L. Millman and Brendan Mumey, Organizing and Analyzing Diverse Biofilm Data Types Using Ontology and Bayesian Networks, Nation Council on Undergraduate Research (NCUR) 2018, Oklahoma City, April 2018
28. Angus Tomlinson, Robin Belton, Kira Wencek, Brittany Terese Fasy, and David L. Millman, Representing Musical Structure with Simplicial Complexes, Poster at Emerging Researchers National (ERN) Conference in STEM 2018, Washington DC, February 2018
29. Kira Wencek, Robin Belton, Angus Tomlinson, Brittany Terese Fasy, and David L. Millman, Quantifying Music Complexity Using Topological Data Analysis, Poster at Emerging Researchers National (ERN) Conference in STEM 2018, Washington DC, February 2018
30. David L. Millman and Mike Whittie, What is Computer Science?, Montana State University, March 2017
31. David L. Millman, 'Start-Up' Your Career, Association for Women in Computing Seminar, Montana State University, February 2017
32. David L. Millman, Computing the Nearest Neighbor Transform Exactly with only Double Precision, Fourth Discrete Geometry and Algebraic Combinatorics Conference, University of Texas at Brownsville, April 2013.
33. David L. Millman, Robust Volume Calculations for CSG Components in MC Transport Calculations, Data Group Seminar, University of Utah, Salt Lake City, UT, February 2013
34. David L. Millman, Degree-Driven Design of Geometric Algorithms for Point Location, Proximity, and Volume Calculation, Theory Lunch, Carnegie Mellon University, Pittsburgh, PA, November 2012
35. David L. Millman, Degree-Driven Geometric Algorithm Design, Graduating Bits session at Innovations in Theoretical Computer Science, Cambridge, MA, January 2012

36. David L. Millman, Approximate volumes of tremendous constructive solid geometry models. Poster presentation at Fall School on ShApes, Geometry and Algebra (SAGA), Kolymari, Greece, October 2010
37. David L. Millman, Two examples of degree-driven algorithm design, Guest lecture at The Institute of Science and Technology (IST) Austria in Maria Gugging, Austria, December 2009 and Duke University, Durham, NC February 2010
38. Brittany Terese Fasy and David L. Millman. Numerical issues in a geometric problem. Guest lecture, Duke University, Durham, NC, October 2008.
39. Brittany Terese Fasy and David L. Millman. Exploring computational mathematics: Unfolding polyhedra. Contributed paper session at MathFest, Madison, WI, August 2008.
40. David L. Millman. Lower degree predicates for the additively weighted Voronoi diagram. Poster presentation at Mathematic Association of America, Mathfest, Madison, WI, August 2008.
41. David L. Millman. Streaming processing of spatial data. Presentation at University Research Day 2008, Chapel Hill, NC, March 2008.
42. David L. Millman. A parallel Delaunay triangulation algorithm for CGAL. Presentation at REUSSI Seminar 2007, INRIA-Rocquencourt and Geometrica group, INRIA-Sophia-Antipolis, France, June and July 2007.
43. David L. Millman. Reducing the degree of the Apollonius diagram predicates. Presentation at REUSSI Seminar 2006, INRIA-Rocquencourt, France, July 2006.

Under Review or In Preparation

44. Brittany Terese Fasy, Xiaozhou He, Zhihui Liu, Samuel Micka, David L. Millman, Binhai Zhu *Locality-Sensitive Searching in the Space of Persistence Diagrams*
45. David L. Millman, Jack Snoeyink *Robust Particle Tracking: How to avoid costly simulation errors applying computational geometry ideas to a problem with inexact input*
46. Robin Lynne Belton, Brittany Terese Fasy, Rostik Mertz, Samuel Micka, David L. Millman, Daniel Salinas, Anna Schenfish, Jordan Schupbach and Lucia Williams, *Learning Simplicial Complexes from Persistence Diagrams*
47. Brittany Terese Fasy, Stacey Hancock, Samuel Micka, David L. Millman, James Soddy, Allison Theobald *Computer Science Students' Perspectives on Plagiarism*

Event Organizing

Educational Forum on the Teaching of Computational Geometry and Topology: Some History, Current Practice, and Future Trends. Co-organizers David L. Millman and Joe Mitchell

Professional Affiliations

Association for Computing Machinery (ACM), 2008–Present
Mathematical Association of America (MAA), 2008–Present
Society for Industry and Applied Mathematics (SIAM), 2007–Present
American Nuclear Society, 2010–Present

Professional Service

Referee, European Symposium on Algorithms (2018)
Referee, SIAM: Algorithm Engineering Experiments (2017)
Referee, Women In Computational Topology (2017)
Program Committee, International Workshop on Release Engineering (RELENG) 2016
Referee, Grace Hopper Conference, (2015-2018)

Book Reviewer, ACM Special Interest Group Algorithms and Computational Theory (SIGACT) (2008-2013)
Referee, ACM Symposium on Computational Geometry (2009,2011-2013, 2015)
Referee, Shape Modeling International (2011-2012)
Referee, ICST Transactions on Algorithms Engineering (2011)
Referee, Canadian Conference on Computational Geometry (2011)
Referee, International Journal of Computational Geometry and Applications (IJCGA) (2010)
Referee, IEEE Computer Graphics and Applications (2009)
Referee, IEEE Robotics and Automation Magazine (2008)

Art & Music

Cave: An Art-Science Installation. The NeuroCave Collaborative. Holter Museum of Art, August 2017-December 2017

Recorded drum set, percussion, electronics, vocals, arranged and co-wrote Defenestrate Time, “When We’re Alone”, released August 2007.

Recorded drum set on the EP, Wholesale, “Saying More by Saying Less” released Spring 1999 on Exit 6 records