Laura I. Toma

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Interests

My research area is the theory and practice of memory-efficient algorithms and data structures for applications that involve large, high-resolution data in geographic information systems (GIS). I am interested in algorithms for fundamental problems on terrains such as visibility, flooding, sea level rise and least-cost-path surfaces. My goal is to come up with approaches that can be theoretically proven efficient (e.g. CPU-efficient, IO-efficient, cache-efficient, PRAM-efficient), and at the same time are simple, exploit realistic featues of data and work well in practice. In recent years I started to work on Computer Science Education in order to grow as an educator and to support the diverse and large classes of students who are taking Computer Science.

Education

2003	Ph.D. in Computer Science, Duke University Dissertation: I/O - Efficient Graph Algorithms and Applications to Geographic Information Systems Advisor: Lars Arge, Committee: Pankaj Agarwal, Herbert Edelsbrunner, Helena Mitasova
2002	MS in Computer Science, Duke University
1996	MS, University Politehnica Bucuresti
1995	BS, University Politehnica Bucuresti

Academic Positions

2019-present	Professor, Department of Computer Science, Bowdoin College
2022-present	Chair, Department of Computer Science, Bowdoin College
2018	University of Canterbury Visiting Erskine Fellowship
2014-2018	Chair, Department of Computer Science, Bowdoin College
2009-2019	Associate Professor, Department of Computer Science, Bowdoin College
2003-2009	Assistant Professor, Department of Computer Science, Bowdoin College

Grants

2007-2013 Laura Toma. NSF Theoretical Foundations. *Scalable Algorithms for Realistic Terrain Processing in GIS*. ($260,000).

Honors and Awards

2017 Best-paper award at ACM ICER 2017.
An Instrument to Assess Self-Efficacy in Introductory Algorithms Courses, with Holger Danielsiek and Jan Vahrenhold.

2009 Best-paper award at ACM SIGSPATIAL GIS 2009.
Improved Visibility Computation on Massive Grid Terrains, with Jeremy Fishman* and Herman Haverkort.

Publications (by category)

Publications are available at `http://www.bowdoin.edu/~ltoma/research.html`. Authors are listed in alphabetical order of the last name according to common practice in theoretical computer science. Bowdoin student authors are marked with *.

Book Chapters

- Viewshed Analysis: An algorithmic perspective.
  Laura Toma. In Sandra Lopez Varela, editor, *SAS Encyclopedia of Archeaological Sciences*, Wiley Blackwell, 2017.
- Quadtrees and Morton Indexing.
  Herman Haverkort and Laura Toma. In Ming-Yang Kao, editor, *Encyclopedia of Algorithms*, second edition, pages 1637-1642. Springer 2016.
- External memory list ranking.
  Riko Jacob, Ulrich Meyer and Laura Toma. In Ming-Yang Kao, editor, *Encyclopedia of Algorithms*, second edition, pages 1117-1121, Springer, 2016.
- Terrain Modeling for the Geosciences.
  Herman Haverkort and Laura Toma. In Teofilo Gonzales, Jorge Diaz-Herrera, and Allen Tucker, editors, *Computing Handbook,Third edition: Computer Science and Software Engineering*, chapter 31. CRC Press, 2014.
- I/O-Efficient Algorithms for Sparse Graphs.
  Laura Toma and Norbert Zeh. Chapter 5 in: Ulrich Meyer, Peter Sanders, and Jop Sibeyn, editors, *Algorithms for Memory Hierarchies*, volume 2625 of Lecture Notes in Computer Science, pages 85-109. Springer-Verlag, 2003.

Journal and Conference Articles

- A multiresolution approach for viewsheds on 2D terrains. Andrew Prescott* and Laura Toma. In *Proceedings of the 26th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems (ACM SIGSPATIAL GIS 2018)*, edited by Guting R., Tamassia R., Xiong L.. ACM 2018. Acceptance ratio: 30/150 = 20%
- Self-Efficacy, Cognitive Load and Emotional Reactions in Collaborative Algorithms Labs – A Case Study. Laura Toma and Jan Vahrenhold. In *Proceedings of the 14th ACM International Computing Education Research (ICER 2018)*, edited by Malmi L., McCartney R., pages 1-10, New York, NY. ACM Press 2018. Acceptance ratio: 28/125=22%.
- Reprint: An Instrument to Assess Self-efficacy in Introductory Algorithms Courses. Holger Danielsiek, Laura Toma and Jan Vahrenhold. In ACM Inroads 9, Nr. 1: pages 56-65
- An Instrument to Assess Self-efficacy in Introductory Algorithms Courses. Holger Danielsiek, Laura Toma and Jan Vahrenhold. In *Proceedings of the 13th ACM International Computing Education Research (ICER 2017)*, edited by Tenenberg J., Chinn D., Malmi L., Korhonen A., Sheard J., pages 217-225, New York, NY. ACM Press, 2017. Acceptance ratio: 29/108=27%. **Best-paper award**.
- A comparison of I/)-efficient algorithms for visibility computation on massive grid terrains. Herman Haverkort and Laura Toma. arXiv, 2015.
- On IO-efficient Viewshed Algorithms and Their Accuracy. Herman Haverkort, Laura Toma and Bob PoFang Wei*. In *Proceedings of the 21st ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems (ACM SIGSPATIAL GIS 2013)*. ACM 2013. Acceptance ratio: 39/202 = 19%
- An Edge Quadtree for External Memory. Herman Haverkort, Mark McGranaghan*, and Laura Toma. In *Proceedings of the 12th International Symposium on Experimental Algorithms (SEA 2013)*, Rome, Italy, 2013. Acceptance ratio: 32/73 = 44%
- I/O-efficient Algorithms on Near-planar Graphs. Herman Haverkort and Laura Toma. *Journal of Graph Algorithms and Applications (JGAA)*, 15(4):503-532, 2011.
- Star-Quadtrees and Guard-Quadtrees: I/O-Efficient Indexing for Fat Triangulations and Low-density Subdivisions. Mark de Berg, Herman Haverkort, Shripad Thite and Laura Toma. *Computational Geometry: Theory and Applications (CGTA)*, 43(5):493-513, 2010.
- The Complexity of Flow on Fat Terrains and its IO-Efficient Computation. Mark de Berg, Otfried Cheong, Herman Haverkort, Jung-Gun Lim and Laura Toma. *Computational Geometry: Theory and Applications (CGTA)*, 43(4):331-356, 2010.
- Computing Visibility on Terrains in External Memory. Herman Haverkort, Laura Toma and Yi Zhuang*. *ACM Journal of Experimental Algorithmics*, 13(5), 2009.
- Improved Visibility Computation on Massive Grid Terrains. Jeremy Fishman*, Herman Haverkort and Laura Toma. In *Proceedings of the 17th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems (ACM SIGSPATIAL GIS 2009)*. ACM 2009. Acceptance ratio: 38/185 = 20.5%.**Best-paper award**.
- Terracost: A Versatile and Scalable Approach to Computing Least-Cost-Path Surfaces for Massive Grid-Based Terrains. Thomas Hazel*, Laura Toma, Jan Vahrenhold and Rajiv Wickremesinghe. *ACM Journal of Experimental Algorithmics*, 12 (1.9), 2008.
- I/O-Efficient Map Overlay and Point Location in Low-Density Subdivisions. Mark de Berg, Herman Haverkort, Shripad Thite, Laura Toma. In Tokuyama, editor, *Proceedings of the 18th Annual International Symposium on Algorithms and Computation (ISAAC 2007)*, volume 4835 of Lecture Notes in Computer Science, pages 500-511. Springer-Verlag, 2007. Acceptance ratio: 77/202 = 38%

- I/O-Efficient Flow Modeling on Fat Terrains. Mark de Berg, Otfried Cheong, Herman Haverkort, Jung-Gun Lim and Laura Toma. In Frank Dehne, Jörg-Rüdiger Sack, Norbert Zeh, editors, *Proceedings of the 10th International Workshop on Algorithms and Data Structures (WADS 2007)*, volume 4619 of Lecture Notes in Computer Science, pages 239-250. Springer-Verlag, 2007. Acceptance ratio: 40/150=27%
- Computing Visibility on Terrains in External Memory. Herman Haverkort, Laura Toma and Yi Zhuang*. In *Proceedings of the 9th Workshop on Algorithm Engineering and Experiments / Workshop on Analytic Algorithms and Combinatorics (ALENEX/ANALCO 2007)*, pages 13-22. 2007. Acceptance ratio: 15/60 = 15%
- I/O-Efficient Algorithms on Near-Planar Graphs. Herman Haverkort and Laura Toma. In J. Correa, A. Hevia and M. Kiwi, editors, *Proceedings of the 7th Latin American Theoretical Informatics Symposium (LATIN 2006)*, volume 3887 of Lecture Notes in Computer Science, pages 580-591. Springer-Verlag, 2006. Acceptance ratio: 66/224 = 29%
- Terracost: A Versatile and Scalable Approach to Computing Least-Cost-Path Surfaces for Massive Grid-Based Terrains. Thomas Hazel, Laura Toma, Jan Vahrenhold and Rajiv Wickremesinghe. In *Proceedings of the 21st Annual ACM Symposium on Applied Computing (SAC 2006)*, pages 52-57. ACM, 2006. Acceptance ratio: 300/900=30%
- External Data Structures for Shortest Path Queries on Planar Digraphs. Lars Arge and Laura Toma. In *Proceedings of the 16th International Symposium on Algorithms and Computation (ISAAC 2005)*, volume 3827 of Lecture Notes in Computer Science, pages 328-338. Springer-Verlag, 2005. Acceptance ratio: 112/549=20%
- External memory Algorithms for Diameter and All–Pairs Shortest Paths on Sparse Graphs. Lars Arge, Ulrich Meyer and Laura Toma. In *Proceedings of the 31st International Colloquim on Automata, Languages and Programing (ICALP 2004)*, volume 3142 of Lecture Notes in Computer Science, pages 146-157. Springer-Verlag, 2004. Acceptance ratio: 69/272=25%
- Simplified I/O-Efficient Algorithms for Planar DAGs. Lars Arge and Laura Toma. In *Proceedings of the 9th Scandinavian Workshop on Algorithm Theory (SWAT 2004)*, volume 3111 of Lecture Notes in Computer Science, pages 493-503. Springer-Verlag, 2004. Acceptance ratio: 40/121=30%
- I/O-Efficient Algorithms for Planar Digraphs. Lars Arge, Laura Toma and Norbert Zeh. In *Proceedings of the Fifteenth ACM Symposium on Parallelism in Algorithms and Architectures (SPAA 2003)*, pages 85-93, ACM 2003.
- Flow Computation on Massive Grids. Laura Toma, Rajiv Wickremesinghe, Lars Arge, Jeff Chase, Jeffrey S. Vitter, Patrick Halpin, Dean Urban. In *Proceedings of the Ninth ACM International Symposium on Advances in Geographic Information Systems (ACM-GIS 2001)*, pages 82-87, ACM 2001.
- On External-Memory Planar Depth-First Search. Lars Arge, Ulrich Meyer, Laura Toma and Norbert Zeh. In *Proceedings of the Seventh International Workshop on Algorithms and Data Structures (WADS 2001)*, volume 2125 of Lecture Notes in Computer Science, pages 471-482. Springer-Verlag, 2001.
- On External-Memory MST, SSSP and Multi-way Planar Graph Separation. Lars Arge, Gerth Brodal and Laura Toma. In *Proceedings of the Seventh Scandinavian Workshop on Algorithm Theory (SWAT 2000)*, volume 1851 of Lecture Notes in Computer Science, pages 433-447. Springer-Verlag, 2000.
- I/O-Efficient Algorithms for Problems on Grid-based Terrains. Lars Arge, Laura Toma and Jeffrey. S. Vitter. In *Proceedings of the 2nd Workshop on Algorithm Engineering and Experiments (ALENEX 2000)*. 2000.

Other Publications

- A multiresolution approach for viewsheds and total viewsheds on 2D terrains (long version). Andrew Prescott and Laura Toma. arXiv, 2019
- An efficient algorithm for mapping inundation due to sea-level rise and storm surges. Zoe Aarons*, Corinne Alini*, Eileen Johnson and Laura Toma. arXiv, 2019.
- Viewsheds on Terrains in External Memory. Laura Toma. In *ACM SIGSPATIAL GIS Newsletter*, 2012.
- I/O-Efficient Map Overlay and Point Location in Low-density Subdivisions. Mark de Berg, Herman Haverkort, Shripad Thite and Laura Toma: *Proceedings of the 23rd European Workshop on Computational geometry (EWCG 2007)*, pages 73-76. 2007.
- Scalable Raster-to-TIN simplification. Jonathan Todd* and Laura Toma: *Free and Open Source Software for Geoinformatics (FOSS4G 2006)*. 2006.
- TerraCost: A Versatile and Scalable Approach for Computing Least-Cost-Path Surfaces on Massive Raster Terrains. Thomas Hazel*, Laura Toma, Jan Vahrenhold and Rajiv Wickremesinghe: *Free and Open Source Software for Geoinformatics (FOSS4G 2006)*. 2006.
- River Networks and Watershed Maps of Triangulated Terrains Revisted. Hee-Kap Ahn, Mark de Berg, Otfried Cheong, Herman Haverkort, Frank van der Stappen, and Laura Toma: *Proceedings of the 22nd European Workshop on Computational geometry (EWCG 2006)*, pages 173-176. 2006.
- TPIE User Manual and Reference. Lars Arge, Rakesh Barve, David Hutchinson, Octavian Procopiuc, Laura Toma, Jan Vahrenhold, Darren Vengroff and Rajiv Wickremesinghe. 2005.
- On External-Memory MST, SSSP and Multi-way Planar Graph Separation. Lars Arge, Gerth Brodal and Laura Toma. In *Journal of Algorithms*, 53 (2):186-206, 2004.
- Efficient Flow Computation on Massive Grid Terrains Datasets. Lars Arge, Jeff Chase, Patrick Halpin, Laura Toma, Dean Urban, Jeffrey S. Vitter and Rajiv Wickremesinghe. In *Geoinformatica, International Journal on Advances of Computer Science for Geographic Information Systems*, 7(4):104-128, 2003.
- On External-Memory Planar Depth-First Search. Lars Arge, Ulrich Meyer, Laura Toma and Norbert Zeh. In *Journal of Graph Algorithms and Applications*, 7(2):105-129, 2003.
- GIS-Based Stream Network Analysis for the Upper Rio Chagres River Basin, Panama. David Kinner, Helena Mitasova, R. Harmon, Laura Toma, R. Stallard. In *Water Science and Technology Library*, volume 52, pages 83-95, 2006. Springer. Also in *Proceedings of the Symposium: The Rio Chagres: A Multidisciplinary Profile of a Tropical Watershed*. 2003.
- External memory Graph Algorithms and Applications to Geographic Information Systems. Laura Toma. Ph.D. Thesis. Duke University. 2003.
- I/O-Efficient Algorithms for Problems on Grid-based Terrains. L. Arge, L. Toma and J. S. Vitter. In *Journal of Experimental Algorithmics*, 6(1), 2001.
- I/O-Efficient Graph Algorithms and Applications. Laura Toma. M.Sc. Thesis, Duke University. 2001.
- On Applications of Genetic Programming. Laura Toma. M.Sc. Thesis, University Politehnica Bucharest. 1996.

Conference Presentations and Invited Talks

Nov. 2018: A multiresolution approach for viewsheds on 2D terrains. ACM SIGSPATIAL GIS 2018.

Febr. 2014: An IO-efficient edge quadtree. At Dagstuhl seminar series: Data Structures and Advanced Methods of Computation on Big Data, Dagstuhl, Germany.

Nov. 2013: On IO-efficient viewshed algorithms and their accuracy. At ACM SIGSPATIAL GIS 2013, Orlando, FL.

June 2013: An edge-quadtree for external memory. At SEA 2013, Rome, Italy.

March 2011: An edge-quadtree for external memory. At U. Maine Orono, NCGIA, ME.

May 2010: Scalable algorithms for computing visibility on terrains. At Williams College, Williamstown, MA.

Nov. 2009: Improved visibility computation on massive grid terrains. At ACM GIS 2009, Seattle, WA.

Febr. 2009: I/O-Efficient Indexes for Triangulations and Subdivisions. At Dartmouth College, Hanover, NH.

Oct. 2008: r.viewshed: A simple, fast and scalable approach for computing visibility in GRASS. At FOSS4G 2008, Cape Town, SA.

Febr. 2008: I/O-Efficient Map Overlay for Low-Density Subdivisions. At Dagstuhl seminar series: Data Structures and Advanced Models of Computation, Dagstuhl, Germany.

Jan. 2007: Computing Visibility on Terrains in External Memory, ALENEX/ANALCO 2007, New Orleans, USA.

Sept. 2006: Terracost: A Versatile and Scalable Approach to Computig Least-Cost-Path Surfaces on Massive Raster Terrains. At FOSS4G 2006, Lausanne, Switzerland.

July 2006: Simplified I/O-Efficient algorithms for planar DAGs. At Dutch Computational Geometry Day 2006, Eindhoven, NL.

March 2006: I/O-Efficient Algorithms on Near-planar Graphs. At LATIN 2006, Valdivia, Chile.

Dec. 2005: I/O-efficient Data Structures for Shortest Path Queries on Planar Digraphs. At ISAAC 2005, China.

Dec. 2005: I/O-efficient Data Structures for Shortest Path Queries on Planar Digraphs. At KAIST, South Korea.

July 2004: Simplified I/O-Efficient algorithms for planar DAGs. At Dagstuhl Seminar Series: Cache-Oblivious and Cache-Aware Algorithms, Dagstuhl, Germany.

July 2004: Simplified I/O-Efficient algorithms for planar DAGs. At The 9th Scandinavian Workshop on Algoithmmic Theory, SWAT 2004.

July. 2004: Simplified I/O-Efficient algorithms for planar DAGs. At U. Leicester, UK.

Dec. 2003: External Memory Graph Algorithms and Application to GIS. At Dartmouth College, Hanover, NH.

Sept. 2002: Flow Computation on Massive Grid Terrains. At Open Source Free Software GIS - GRASS users conference 2002. Trento, Italy.

Sept. 2002: Flow Computation on Massive Grid Terrains. At University of Münster, Münster, Germany.

Mar. 2002: I/O-Efficient Algorithms on Sparse Graphs. At Dagstuhl Seminar: Algorithms for Memory Hierarchies, Dagstuhl, Germany.

Apr. 2001: Flow Computation on Massive Grids. At the 16th Annual Symposium of the U.S. Chapter of International Association of Landscape Ecology (US-IALE'01), Arizona State University, Tempe, Arizona.

Nov. 2001: Digital Terrain Analysis for Massive Grids. At Ninth ACM International Symposium on Advances in Geographic Information Systems (ACMGIS'01), Atlanta, GA.

Aug. 2001: On External Memory Planar Depth-First Search. At seventh International Workshop on Algorithms and Data Structures (WADS 2001), Brown University Providence, Rhode Island.

July 2000: On External Memory MST, SSSP and Multi-way Planar Graph Separation. At seventh Scandinavian Workshop on Algorithm Theory (SWAT 2000), Bergen, Norway.

Jan. 2000: I/O-Efficient Algorithms for Problems on Grid-Based Terrains. At second Workshop on Algorithm Engineering and Experimentation (ALENEX'00), San Francisco, California.

1998: I/O-Efficient Algorithms for Problems on Grid-Based Terrains. At fourth Center for Geometric Computing Workshop on Computational Geometry (CGC'99), John Hopkins University, Baltimore, MD.

Selected Projects

- `blockedViewshed`: A module for computing viewsheds and total viewsheds using a two-level approach: first filter out blocks that are guarenteed to be invisible using a low-resolution grid, then compute the visibility of the remaining blocks using full-resolution data. Achieves a speedup of 20 or more on large, high-resolution grids. With Andrew Prescott (Bowdoin'18).
- `slrflood`: A set of modules for computing inundation due to overlapping sea level rise and base storm events, using the approach proposed by New York City Panel on Climate Change (NPCC2). With Cory Alini (Bowdoin'18) and Eileen Johnson.
- `ioviewshed`: A set of modules for computing the viewshed of a point on a grid terrain, that is, the part of the terrain that is visible to a specified viewpoint. The underlying algorithms are theoretically efficient while being fast in practice; they can compute visibility for terrains of up to 25GB in a few hours on a low-cost machine. Ported into open-source GIS GRASS as r.viewshed in GRASS. With Yi Zhuang (Bowdoin '08), Jeremy Fishman (Bowdoin'09), Bob PoFang Wei (Bowdoin'10) and Herman Haverkort.
- `refine`: A module for simplifying grid terrains into triangular meshes within a specified error threshold. Uses a tiled approach that makes it efficient for very large terrains. Ported as open-source module in GRASS. With Jonathan Todd (Bowdoin '05).
- `terracost`:A module for computing multiple-source least-cost-path surfaces on massive grid terrains. The basic idea is to compute an equivalent, smaller graph by partitioning the grid into sub-grids and replacing each sub-grid with a complete graph on its boundary vertices. This graph has the property that it maintains shortest path costs between vertices in the original grid, while having smaller size. With Thomas Hazel(Bowdoin '06) and Jan Vahrenhold.
- `terraflow`: A module for computing flow accumulation on massive grid terrains. Uses IO-efficient algorithms and achieves at least an order of magnitude speedup compared to the similar algorithm in ArcGIS. Ported as an open-source module in GRASS.

Student Presentations

- Corinne Alini: Efficient computations of flooding scenarios for the coast of Maine. At *Coastal Studies Center Summer Research Symposium*, July 2017, Bowdoin College.

- Angus Gorman: Creating flood-maps that incorporate sea-level rise. At *Coastal Studies Center Summer Research Symposium*, July 2016, Bowdoin College.
- Harry Kalodner: Geometric flow on triangulated terrains. Talk at *Bowdoin President Science Symposium*, October 2011.
- Jonathan Todd: Scalable Raster-to-TIN simplification. At the *Free and Open Source Software for Geoinformatics (FOSS4G)* 2006.
- Thomas Hazel: TerraCost: A Versatile and Scalable Approach for Computing Least-Cost-Path Surfaces on Massive Raster Terrains. At the *The 21st Annual ACM Symposium on Applied Computing (SAC)* 2006.

Student Posters

- Corinne Alini: Efficient computations of flooding scenarios for the coast of Maine. Poster at GHC 2018, Houston, TX.
- Corinne Alini: Efficient computations of flooding scenarios for the coast of Maine. Poster at President's Symposium, October 2017, Bowdoin College.
- Phillip Wang: Towards automatic detection of archaeological looting using computational methods. Poster at President's Symposium, October 2017, Bowdoin College.
- Angus Gorman: Creating flood-maps that incorporate sea-level rise. Poster at President's Symposium, October 2016, Bowdoin College.
- David Reichert: A new approach for computing viewsheds on blocked terrains. Poster at President's Symposium, October 2016, Bowdoin College.
- Dan Cohen: An algorithm for matching tours and tour guides with improved diversity. Poster at President's Symposium, October 2015, Bowdoin College.
- Kevin Zmozynsly and Danny Byrnes: Blocking a grid for faster visibility computation. Poster at President's Symposium, October 2015, Bowdoin College.
- Harry Kalodner: Geometric flow on triangulated terrains. Poster and talk at Bowdoin President Science Symposium, October 2011.

Student Research

2022-2023	Lily Smith (honors): A quadtree-based muulti-resolution approach for visibility computation on grid terrains.
	Caspian Ahlberg (IS fall'22): Learning Graphics: A tentative syllabus and set of projects.
2021-2022	Tugi Davaadorj: Using a quadtree decomposition for level-of-detail visibility computation.
2017-2018	Andrew Prescott (honors): A two-level approach for viewsheds and total viewsheds on 2D terrains.
	Phillip Wang (IS fall'17): Towards automatic detection of archaeological looting using computational methods.
Summer 2017	Corinne Alini: Efficient Computation of Flooding Scenarios for the Coast of Maine (Bowdoin Rusack fellowship, co-advised with Eileen Johnson, ES).

	Conor Belfield: A Hybrid Parallel Approach for computing Total Viewsheds (Bowdoin Kibbe fellowship).
	Phillip Wang: Exploring Automatic Detection of Archaeological Looting Using Computational Methods (Bowdoin Surdna fellowship).
Summer 2016	David Reichert: Towards faster viewshed analysis on terrains (Bowdoin Kibbe fellowship).
	Angus Gorman: Creating Flood Risk Maps with Sea Level Rise (Bowdoin Rusack fellowship, co-advised with Eileen Johnson, ES).
	Garrett Carver: Identifying Building Footprints in Aerial LiDAR data for the Coastal Maine (Bowdoin Rusack fellowship, co-advised with Eileen Johnson, ES).
	Noah Verzani: Computational Determination of Elastic Constants for Crystal Lattices (Bowdoin E.O. LaCasce Jr. Physics Fellowship, co-advised with Madeleine Msall, Physics).
2015-2016	Dan Cohen (IS spring'15), Andrew Murowchick (IS fall'15), Colin Reynolds (IS fall'15), Noah Verzani (IS spring'16), Jasper Houston (IS spring'16),
Summer 2015	Tucker Gordon: A parallel SMP algorithm for the total viewshed computation on Bowdoin's computing grid (Bowdoin Maine Space Grant).
Summer 2014	Kevin Zmozynsky:Towards an output sensitive viewshed algorithm (Bowdoin Kibbe fellowship).
	Daniel Byrnes: Towards an output sensitive viewshed algorithm (Bowdoin Maine Space Grant fellowship).
	Daniel Cohen: A Tool for Managing Tour Guide Scheduling (Bowdoin Gibbons fellowship).
Summer 2013	Noam Terman (NSF)
Summer 2012	Andrew Daniels (NSF), Noam Terman (NSF)
Summer 2011	Judy Yang (NSF), Stephan Danyluk (NSF), Richard Hopkins (NSF), Harry Kalodner (NSF), Ben Mende (Maine Space Grant)
Summer 2010	Chris O'Donnell (NSF), Bob Wei (NSF)
Summer 2009	Yuna Oh: Porting a viewshed algorithm to GRASS GIS (NSF)
	Mark McGranaghan: A cache-oblivious algorithm for constructing edge quadtrees (Freedman fellowship)
	Jeremy Fishman: Improved visibility computation on massive grid terrains (NSF)
	Chris O'Donnell (NSF)
	Bob Wei: Computing visibility with linear interpolation (NSF)
Summer 2008	William Richard (NSF), Carl Morrisey (NSF), Chris O'Donnell (NSF grant)
Summer 2007	Yi Zhuang: An IO-efficient algorithm for computing the intersection of a set of segments (Bowdoin Freedman fellowship)
Summer 2006	Yi Zhuang: An IO-efficient line-sweep algorithm for computing viewsheds (Bowdoin Surdna fellowship)
Summer 2005	Richard Hoang (Bowdoin Surdna fellowship)
	Jonathan Todd: A scalable algorithm for simplifying grid terrain into triangular meshes.
Summer 2004	Thomas Hazel: Terracost–Computing shortest paths in external memory (Bowdoin Surdna fellowship)

Honors Thesis Advised

2022-2023 Lily Smith, *A quadtree-based multi-resolution approach for visibility computation on grid terrains.*

2017-2018 Andrew Prescott, *A new approach for computing viewsheds on grid terrains.*

2009-2010 Mark McGranaghan, *FleetDB: A main memory functional database.*

2009-2010 Bob Wei, *An investigation of approximate visibility.*

2007-2008 Yi Zhuang, *A Simple, Practical and Scalable Approach to Map Overlay.*

2004-2005 Jonathan Todd, *I/O-Efficient Refinement of Triangulated Terrains.*

2004-2005 Thomas Hazel, *I/O-Efficient Shortest-paths on Grid-based Terrains.*

Teaching

Bowdoin College, 2003-present

- Introduction to Computer Science
- Data Structures
- Algorithms
- Spatial Data Structures
- When RAM is not enough: Computing with massive data
- Algorithms for GIS
- Computational Geometry

Duke University, 2002

- Introduction to the Design and Analysis of Algorithms

Service

Professional Service

- Program Committees: SEA 2009, ACM SIGSPATIAL GIS 2010, ESA 2010, ALENEX 2011, SEA 2011, ACM SIGSPATIAL GIS 2011, ACM SIGSPATIAL GIS 2012, GHC 2013 Poster Commitee, ACM SIGSPATIAL GIS 2013, ALENEX 2014, ACM SIGSPATIAL GIS 2014, ACM SIGSPATIAL GIS 2015
- Reviewer for Algorithmica, CGTA, Information Processing Letters (IPL), IEEE Potentials, SIAM Journal on Computing, Journal of Discrete Algorithms (JDA), Acta Informatica, Computers and Geosciences, Cartographica, SODA, ESA, ICDE, CCCG, STACS, ALENEX, SWAT, WADS.

Bowdoin College Service

- Bowdoin Science Experience (BSE) instructor/advisor 2017, 2014, 2011
- Committees: Courriculum implementation committee (CIC) (2021-present). Student fellowships (2013-2015). GWS (2011, 2013). Research Oversight Committee (2010-2012). Oversight Committee on Multicultural Affairs (2008-2010). Recording Committee (2007-2008). Faculty Fellowships and Scholarships Committee (2004-2006).

Selected CS Department Service

- Chair 2014-2018, 2022-present.
- Tenure track search committee member, 2022-2023, 2021-2022, 2020-2021, 2019-2020, 2017, 2016, 2015, 2010, 2006
- Faculty mentor for BWICS (Bowdoin Women in Computer Science) 2008-present. Organized trips to GHC'2022 (18 students). GHC'2018 (19 students). GHC'2017 (13 students). GHC'2016 (14 students) GHC'2015 (10 students) GHC'2010 (2 students).

Community Service

2017 Careers in Computer Science, BWICS panel discussion at Curtis Library, Brunswick, November 8th, 2017.