

Kyle Jordan Fox

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Research Interests

Algorithms and data structures; geometric algorithms; combinatorial optimization; applications of geometry and optimization to topological data analysis, trajectory analysis, computer graphics, and robotics

Education

- 2008–2013 **Ph.D. in Computer Science**, University of Illinois at Urbana-Champaign, December 2013
Advisor: Jeff Erickson
Thesis: *Fast algorithms for surface embedded graphs via homology*
- 2008–2010 **M.S. in Computer Science**, University of Illinois at Urbana-Champaign, December 2010
Advisor: Jeff Erickson
Thesis: *Online scheduling on identical machines using SRPT*
- 2004–2008 **B.S. in Computer Science**, University of Illinois at Urbana-Champaign, May 2008
Graduated with highest honors

Employment

- 2017–present **Assistant Professor**, Department of Computer Science, The University of Texas at Dallas
- 2014–2017 **Postdoctoral Associate**, Department of Computer Science, Duke University
- Spring 2014 **Postdoctoral Fellow**, Institute for Computational and Experimental Research in Mathematics, Brown University
- 2010, '11, '12 **Software Engineering Intern**, Google Inc. and Google Research
- 2009–2010 **Teaching Assistant**, Department of Computer Science, University of Illinois at Urbana-Champaign
- 2006–2009 **Developer**, University of Illinois Archives, University of Illinois at Urbana-Champaign

Awards and Honors

- Fall 2013 **Stutzke Dissertation Completion Fellowship**, University of Illinois at Urbana-Champaign
- April 2013 **C. W. Gear Outstanding Graduate Student Award**, Department of Computer Science, University of Illinois at Urbana-Champaign
- 2010–2013 **Department of Energy Office of Science Graduate Fellowship Award**, U.S. Department of Energy (one of 150 awarded out of 3200 applicants)
- 2008–2009 **Andrew and Shana Laursen Fellowship**, Department of Computer Science, University of Illinois at Urbana-Champaign
- April 2008 **C. W. Gear Outstanding Undergraduate Award**, Department of Computer Science, University of Illinois at Urbana-Champaign

November 2007 **Automatic Ph.D. Acceptance Award**, Department of Computer Science, University of Illinois at Urbana-Champaign
April 2007 **Daniel L. Slotnick Scholarship**, Department of Computer Science, University of Illinois at Urbana-Champaign
2004–2008 **Chancellor’s Scholar**, University of Illinois at Urbana-Champaign
2004–2008 **James Scholar**, University of Illinois at Urbana-Champaign

— Research —

Publications

Journal and Conference Papers

Each paper is listed once, even if it has appeared in multiple versions.

- [1] Minimum cut and minimum k -cut in hypergraphs via branching contractions. Joint with Debmalya Panigrahi and Fred Zhang. Accepted to *Proceedings of the 30th Annual ACM-SIAM Symposium on Discrete Algorithms* (SODA), 2019.
- [2] An efficient algorithm for computing high quality paths amid polygonal obstacles. Joint with Pankaj K. Agarwal and Oren Salzman. *ACM Transactions on Algorithms* (TALG), 14(4), Article No. 46, 2018. *Proceedings of the 27th Annual ACM-SIAM Symposium on Discrete Algorithms* (SODA), 1179–1192, 2016.
- [3] Trajectory planning for an articulated probe. Joint with Ovidiu Daescu and Ka Yaw Teo. *Proceedings of the 30th Canadian Conference on Computational Geometry* (CCCG), 296–303, 2018.
- [4] Holiest minimum-cost paths and flows in surface graphs. Joint with Jeff Erickson and Luvsandondov Lkhamsuren. *Proceedings of the 50th Annual Symposium on Theory of Computing* (STOC), 1319–1332, 2018.
- [5] Subtrajectory clustering: models and algorithms. Joint with Pankaj K. Agarwal, Kamesh Munagala, Abhinandan Nath, Jiangwei Pan, and Erin Taylor. *Proceedings of the 37th Annual Symposium on Principles of Database Systems* (PODS), 75–87, 2018.
- [6] Computing the Gromov-Hausdorff distance for metric trees. Joint with Pankaj K. Agarwal, Abhinandan Nath, Anastasios Sidiropoulos, and Yusu Wang. *ACM Transactions on Algorithms* (TALG), 14(2), Article No. 24, 2018. *Proceedings of the 26th International Symposium on Algorithms and Computation* (ISAAC), 529–540, 2015.
- [7] Energy efficient scheduling of parallelizable jobs. Joint with Sungjin Im and Benjamin Moseley. *Theoretical Computer Science* (TCS), 726:30–40, 2018. *Proceedings of the 24th Annual ACM-SIAM Symposium on Discrete Algorithms* (SODA), 948–957, 2013.
- [8] Maintaining Reeb graphs of triangulated 2-manifolds. Joint with Pankaj K. Agarwal and Abhinandan Nath. *Proceedings of the 37th Conference on Foundations of Software Technology and Theoretical Computer Science* (FSTTCS 2017), 8:1–8:14, 2018.
- [9] Faster algorithms for the geometric transportation problem. Joint with Pankaj K. Agarwal, Debmalya Panigrahi, Kasturi R. Varadarajan, and Allen Xiao. *Proceedings of the 33rd International Symposium on Computational Geometry* (SoCG), 7:1–7:16, 2017.
- [10] Minimum cycle and homology bases of surface embedded graphs. Joint with Glencora Borradaile, Erin Wolf Chambers, and Amir Nayyeri. *Journal of Computational Geometry* (JoCG), 8(2):58–79, 2017, special issue of invited papers from the 32nd International Symposium on Computational Geometry. *Proceedings of the 32nd International Symposium on Computational Geometry* (SoCG), 23:1–23:15, 2016.

- [11] A simple efficient approximation algorithm for dynamic time warping. Rex Ying, Jiangwei Pan, **Kyle Fox**, and Pankaj K. Agarwal. *Proceedings of the 24th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems* (ACM SIGSPATIAL), Article No. 21, 2016.
- [12] Massively parallel algorithms for computing TIN DEMs and contour trees for large terrains. Abhinandan Nath, **Kyle Fox**, Pankaj K. Agarwal, and Kamesh Munagala. *Proceedings of the 24th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems* (ACM SIGSPATIAL), Article No. 25, 2016.
- [13] Integrating and sampling cuts in bounded treewidth graphs. Joint with Ivona Bezáková and Erin W. Chambers. *Advances in the Mathematical Sciences: Research from the 2015 Association for Women in Mathematics Symposium*, 401–415, 2016.
- [14] Parallel algorithms for constructing range and nearest-neighbor searching data structures. Joint with Pankaj K. Agarwal, Kamesh Munagala, and Abhinandan Nath. *Proceedings of the 35th Annual Symposium on Principles of Database Systems* (PODS), 429–440, 2016.
- [15] Approximating dynamic time warping and edit distance for a pair of point sequences. Joint with Pankaj K. Agarwal, Jiangwei Pan, and Rex Ying. *Proceedings of the 32nd International Symposium on Computational Geometry* (SoCG), 6:1–6:16, 2016.
- [16] A polynomial-time bicriteria approximation scheme for planar bisection. Joint with Philip N. Klein and Shay Mozes. *Proceedings of the 47th Annual ACM Symposium on Theory of Computing* (STOC), 841–850, 2015.
- [17] Counting and sampling minimum cuts in genus g graphs. Joint with Erin W. Chambers and Amir Nayyeri. *Discrete & Computational Geometry*, 52(3):450–475, 2014, special issue of invited papers from the 29th Annual Symposium on Computational Geometry. *Proceedings of the 29th Annual Symposium on Computational Geometry* (SoCG), 249–258, 2013.
- [18] Spanning paths in Fibonacci-sum graphs. Joint with William B. Kinnersley, Daniel McDonald, Nathan Orlow, and Gregory J. Puleo. *The Fibonacci Quarterly*, 52(1):46–49, 2014.
- [19] Packet forwarding algorithms in a line network. Joint with Antonios Antoniadis, Neal Barcelo, Daniel Cole, Benjamin Moseley, Michael Nugent, and Kirk Pruhs. *Proceedings of the 11th Annual Latin American Theoretical Informatics* (LATIN), 610–621, 2014.
- [20] Online non-clairvoyant scheduling to simultaneously minimize all convex functions. Joint with Sungjin Im, Janardhan Kulkarni, and Benjamin Moseley. *Proceedings of the International Workshop on Approximation Algorithms for Combinatorial Optimization Problems* (APPROX), 142–157, 2013.
- [21] Weighted flowtime on capacitated machines. Joint with Madhukar Korupolu. *Proceedings of the 24th Annual ACM-SIAM Symposium on Discrete Algorithms* (SODA), 129–143, 2013.
- [22] Shortest non-trivial cycles in directed and undirected surface graphs. *Proceedings of the 24th Annual ACM-SIAM Symposium on Discrete Algorithms* (SODA), 352–364, 2013.
- [23] Global minimum cuts in surface embedded graphs. Joint with Jeff Erickson and Amir Nayyeri. *Proceedings of the 23rd Annual ACM-SIAM Symposium on Discrete Algorithms* (SODA), 1309–1318, 2012.
- [24] Upper bounds for maximally greedy binary search trees. *Proceedings of the Algorithms and Data Structures Symposium* (WADS), 411–422, 2011.
- [25] Online scheduling on identical machines using SRPT. Joint with Benjamin Moseley. *Proceedings of the 22nd Annual ACM-SIAM Symposium on Discrete Algorithms* (SODA), 120–128, 2011.

Revised as my Masters thesis for the Department of Computer Science, University of Illinois at Urbana-Champaign.

- [26] Scott Schwartz, Chris Prom, **Kyle Fox**, Paul Sorensen. Archon: facilitating global access to collections in small archives. *Proceedings of the 74th Annual IFLA General Conference and Council (WLIC)*, 2008.
- [27] Chris Prom, Chris Rishel, Scott Schwartz, **Kyle Fox**. A unified platform for archival description and access. *Proceedings of the ACM/IEEE Joint Conference on Digital Libraries (JCDL)*, 157-166, 2007.
- [28] Scott Schwartz, Chris Prom, Chris Rishel, **Kyle Fox**. Archon: a unified information storage and retrieval system for lone archivists, special collections librarians and curators. *Partnership: The Canadian Journal of Library and Information Practice and Research*, 1-17, 2007.

Current Submissions, Preprints, and Works in Progress

Other Publications

- [29] Geometric optimization revisited. Joint with Pankaj K. Agarwal and Esther Ezra. To appear as an invited survey in *Lecture Notes in Computer Science Volume 10000*, Bernhard Steffen and Gerhard Woeginger, editors, 2018.
- [30] Global minimum cuts in surface-embedded graphs. Joint with Erin W. Chambers, Jeff Erickson, and Amir Nayyeri. Invited to *Encyclopedia of Algorithms*, 2nd edition, Ming-Yang Kao, editor. Springer, New York, 2016. Sketches results from [23].
- [31] *Fast Algorithms for Surface Embedded Graphs via Homology*. Ph.D. dissertation, Department of Computer Science, University of Illinois at Urbana-Champaign, December 2013. Includes results from [23, 22, 17] and preliminary results on computing maximum flows in surface embedded graphs.
- [32] Collector for Glencora Borradaile, Philip N. Klein, Dániel Marx, and Claire Mathieu. Algorithms for Optimization Problems in Planar Graphs (Dagstuhl Seminar 13421). *Dagstuhl Reports* 3(10):36–57, 2013.
- [33] Faster shortest non-contractible cycles in directed surface graphs. *Computational Geometry: Young Researcher Forum*, 35-36, 2012. Sketches results from [22].

Talks

Invited Workshop Talks

- 2018 “Duality, flows, and shortest paths in planar graphs” [4]; SIAM Conference on Discrete Mathematics Minisymposium on Theoretical Computer Science as a New Discovery Engine of Discrete Mathematics, Denver, Colorado.
- 2017 “Faster algorithms for the geometric transportation problem” [9]; Dagstuhl Seminar on Computational Geometry, Schloß Dagstuhl, Wadern, Germany.
- 2016 “A polynomial-time bicriteria approximation scheme for planar bisection” [16]; Dagstuhl Seminar on Algorithms for Optimization Problems in Planar Graphs, Schloß Dagstuhl, Wadern, Germany.

Invited Talks at Institutions

- 2018 “Surface embedded graphs, shortest homology bases, and holiest paths” [10, 4]; The University of Texas at Dallas.
- 2017 “Maps between geometric data sets” [15, 11, 9]; The University of Arizona.
 “Algorithms for geometric data analysis” [15, 11, 9]; Colorado State University; New Jersey Institute of Technology; Texas A&M University; University of Minnesota; The University of Texas at Dallas; Virginia Tech.

- 2016 “Geometry and topology meet graph algorithms” [15, 16]; College of William and Mary; Duke University; Purdue University; University of California, Merced; University of Louisiana at Lafayette; Yahoo Labs.
- 2015 “An efficient algorithm for computing high-quality paths amid polygonal obstacles” [2]; Duke University.
 “Partition problems and exploiting graph structure” [16, 17]; Rochester Institute of Technology.
- 2014 “Minimum cuts in surface embedded graphs” [23, 17]; Duke University; Institute for Computational and Experimental Research in Mathematics, Brown University; Massachusetts Institute of Technology; The Ohio State University.
 “Extending classical scheduling models with a focus on modern technologies” [21, 7]; Google Inc.
 “On maximum s, t -flow in surface embedded graphs” [31]; Oregon State University.
- 2012 “Computing shortest non-trivial cycles in directed surface graphs” [22]; Washington University in St. Louis.

Talks Given for Refereed Papers and Abstracts

- 2018 “Holiest minimum-cost paths and flows in surface graphs” [4]; 50th Annual Symposium on Theory of Computing (STOC).
- 2016 “Minimum cycle and homology bases of surface embedded graphs” [10]; 32nd International Symposium on Computational Geometry (SoCG).
 “An efficient algorithm for computing high quality paths amid polygonal obstacles” [2]; 27th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA).
- 2015 “A polynomial-time bicriteria approximation scheme for planar bisection” [16]; 47th Annual ACM Symposium on Theory of Computing (STOC).
- 2013 “Counting and sampling minimum cuts in genus g graphs” [17]; 29th Annual Symposium on Computational Geometry (SoCG).
 “Weighted flowtime on capacitated machines” [21]; 24th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA).
 “Shortest non-trivial cycles in directed and undirected surface graphs” [22]; 24th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA).
- 2012 “Faster shortest non-contractible cycles in directed surface graphs” [33]; Computational Geometry: Young Researchers Forum.
 “Global minimum cuts in surface embedded graphs” [23]; 23rd Annual ACM-SIAM Symposium on Discrete Algorithms (SODA).
- 2011 “Upper bounds for maximally greedy binary search trees” [24]; Algorithms and Data Structures Symposium (WADS).
 “Online scheduling on identical machines using SRPT” [25]; 22nd Annual ACM-SIAM Symposium on Discrete Algorithms (SODA).

Additional Talks

- 2010 “Online scheduling on identical machines using SRPT” [25]; Fall 2010 Midwest Theory Day, Toyota Technological Institute at Chicago, Chicago, IL.

— Education —

Instruction at The University of Texas at Dallas

Numbers on the right reflect student agreement with the propositions “Overall, this course was excellent” and “Overall, this instructor was excellent”, respectively, rated on a 1–5 scale and summarized as an interpolated median.

Spring 2018	CS 6301: Special Topics in Computer Science — Computational Geometry	4.88/4.91 (N=20)
	SE 6301: Special Topics in Software Engineering — Computational Geometry	5.00/5.00 (N=1)
Fall 2017	CS 4349: Advanced Algorithm Design and Analysis	4.42/4.75 (N=15)

Mentorship

Current Students

- Jon Crain, Ph.D.
- Xinyi Li, Ph.D.

Undergraduate Mentoring at Duke University

2016–2017	Fred Zhang—starting a Ph.D. at Harvard University in Fall 2018
2015–2016	Rex Ying—currently a Ph.D. student at Stanford University

Guest Lectures Prior to Joining UT Dallas

Duke University

Spring 2017	COMPSCI 290: Undergrad Topics in Computer Science (Algorithmic Foundations of Data Science) (twice)
Spring 2016	COMPSCI 330: Undergrad Design and Analysis of Algorithms
Fall 2015	COMPSCI 330: Undergrad Design and Analysis of Algorithms
Spring 2015	COMPSCI 290: Undergrad Topics in Computer Science (Complexity Theory) (twice)
Fall 2014	COMPSCI 330: Undergrad Design and Analysis of Algorithms
Fall 2014	COMPSCI 532: Graduate Design and Analysis of Algorithms

Brown University

Spring 2014	CS 250: Optimization Algorithms for Planar Graphs
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University of Illinois at Urbana-Champaign

Spring 2010	CS 473: Undergraduate Algorithms
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Other Teaching Experience

Instruction for the Illini Swing Society

Spring 2013	Balboa
Fall 2012	Beginning Swing
Spring 2012	Beginning Lindy Hop
Fall 2011	Charleston
Spring 2011	Beginning Swing

Teaching Assistant at the University of Illinois at Urbana-Champaign

Spring 2010 CS 473: Undergraduate Algorithms

Fall 2009 CS 473: Undergraduate Algorithms

— Service —

The University of Texas at Dallas

Departmental Committees

- Graduate admissions (2017–2018)

Other University Service

- Outside Chair for doctoral oral exams
 - 2017: Abdullah N. Binthunaiyan (Geospatial Information Sciences)
- Member UT Dallas Institute for Interactive and Spatial Computing (UT-DIISC)

Earlier University Service

Duke University

- Coordinator for Algorithms Seminar Lecture Series (2016)
- Assisted in organizing Algorithms Seminar Lecture Series (2015)

University of Illinois at Urbana-Champaign

- Computer Science Grad Study Committee Grad Council Representative (2010–2011, 2012–2013)
- Computer Science Graduate Student Academic Council Member (2010–2013)
- Webmaster for the Illini Swing Society (2011–2013)
- Voluntarily read graduate student applications for the Computer Science Fellowship, Assistantship, and Admissions Committee (2010–2013)
- Leader for the Computer Science TA Career Path Workshop Group (2010)
- Secretary of the Computer Science Graduate Student Organization (2009–2010)

Professional

Conference Committee Chairing

- Posters and Demonstrations Chair, 3rd International Workshop on Interactive and Spatial Computing (2018)

Reviewing and Refereeing

- **Referee for** *ACM Transactions on Algorithms* (TALG); *Algorithmica*; *Ars Combinatoria*; *Information Processing Letters* (IPL); *International Journal of Computational Geometry and Applications* (IJCGA); *Journal of Combinatorial Optimization*; *Journal of Computational Geometry* (JoCG); *Journal of Scheduling*; *Scientific Annals of Computer Science*; *SIAM Journal on Computing* (SICOMP); *SIAM Journal on Discrete Mathematics* (SIDMA); *Theoretical Computer Science* (TCS)
- **External reviewer for** ACM-SIAM Symposium on Discrete Algorithms [SODA] (2013–2019); ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems [ACM SIGSPATIAL] (2015–2016); ACM Symposium on Theory of Computing [STOC] (2016–2017, 2019); Algorithms and Data Structures Symposium [WADS] (2013, 2017); Annual Symposium on Principles of Database

Systems [PODS] (2016); Canadian Conference on Computational Geometry [CCCG] (2018); European Symposium on Algorithms [ESA] (2013, 2016, 2018); IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science [FSTTCS] (2015); IEEE Symposium on Foundations of Computer Science [FOCS] (2014–2015, 2018); IFIP International Conference on Topics in Theoretical Computer Science [TTCS] (2015); International Colloquium on Automata, Languages, and Programming [ICALP] (2017); International Conference on Combinatorial Optimization and Applications [COCOA] (2018); International Symposium on Computational Geometry [SoCG] (2018); International Symposium on Graph Drawing [GD] (2014); International Symposium on Mathematical Foundations of Computer Science [MFCS] (2018); International Symposium on Parameterized and Exact Computation [IPEC] (2017); International Symposium on Theoretical Aspects of Computer Science [STACS] (2018); International Conference on Approximation Algorithms for Combinatorial Optimization Problems [APPROX] (2018); International Workshop on the Algorithmic Foundations of Robotics [WAFR] (2016); Scandinavian Symposium and Workshops on Algorithm Theory [SWAT] (2018); and Symposium on Computational Geometry [SoCG] (2014–2016)