

Benjamin Raichel: Curriculum Vitae

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Research Interests

Algorithms and theory; discrete and computational geometry; data science; combinatorial optimization; randomized and approximation algorithms.

Education

2011–2015 Ph.D., Computer Science, University of Illinois, Urbana-Champaign
Research supervised by Prof. Sariel Har-Peled
Thesis: In Pursuit of Linear Complexity in Discrete and Computational Geometry

2009–2011 M.S., Computer Science, University of Illinois, Urbana-Champaign
Research supervised by Prof. Sariel Har-Peled
Thesis: The Fréchet Revisited and Extended

2006–2009 B.S., Double major in Math and Physics, Minor in Computer Science,
University of Illinois, Urbana-Champaign, GPA: 3.97/4.0

2004–2006 Courses toward B.S. in Mathematics, Indiana University, Bloomington,
GPA 4.0/4.0

Publications

All papers published with alphabetical authors, except in non-theory conferences indicated by *.

Conference Papers

- [C1] with P. Afshani, M. de Berg, K. Buchin, J. Gao, M. Löffler, A. Nayyeri, R. Sarkar, H. Wang, and H. Yang. On cyclic solutions to the min-max latency multi-robot patrolling problem. To appear in *38th Symposium on Computational Geometry (SOCG)*, 2022.
- [C2] with *R. Sonthalia, G. Van Buskirk, B. Raichel, and A. Gilbert. How can classical multidimensional scaling go wrong? To appear in *Advances in Neural Information Processing Systems 34 (NeurIPS)*, 2021.
- [C3] with G. Klimentko. Fast and exact convex hull simplification. In *41st Annual Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS)*, volume 213 of *LIPICs*, pages 26:1–26:17, 2021.
- [C4] with H. Huang and G. Klimentko. Clustering with neighborhoods. In *32nd Int. Symposium on Algorithms and Computation (ISAAC)*, volume 212 of *LIPICs*, pages 6:1–6:17, 2021.

- [C5] with P. Afshani, M. de Berg, K. Buchin, J. Gao, M. Löffler, A. Nayyeri, R. Sarkar, H. Wang, and H. Yang. Approximation algorithms for multi-robot patrol-scheduling with min-max latency. In *Proc. of the 14th Workshop on the Algorithmic Foundations of Robotics (WAFR)*, volume 17 of *Springer Proceedings in Advanced Robotics*, pages 107–123. Springer, 2021.
- [C6] with C. Fan. Linear expected complexity for directional and multiplicative voronoi diagrams. In *28th Annual European Symposium on Algorithms (ESA)*, volume 173 of *LIPIcs*, pages 45:1–45:18, 2020.
- [C7] with G. Klimentko and G. Van Buskirk. Sparse convex hull coverage. In *32nd Canadian Conference on Computational Geometry (CCCG)*, pages 15–25, 2020.
- [C8] with H. Huang. Convex hull complexity of uncertain points. In *32nd Canadian Conference on Computational Geometry (CCCG)*, pages 6–14, 2020.
- [C9] with K. Buchin, C. Fan, M. Löffler, A. Popov, and M. Roeloffzen. Fréchet distance for uncertain curves. In *47th International Colloquium on Automata, Languages, and Programming (ICALP)*, volume 168 of *LIPIcs*, pages 20:1–20:20, 2020.
- [C10] with C. Fan, A. Gilbert, R. Sonthalia, and G. Van Buskirk. Generalized metric repair on graphs. In *17th Scandinavian Symposium and Workshops on Algorithm Theory (SWAT)*, volume 162 of *LIPIcs*, pages 25:1–25:22, 2020.
- [C11] with P. Afshani, M. de Berg, K. Buchin, J. Gao, M. Löffler, A. Nayyeri, R. Sarkar, H. Wang, and H. Yang. Approximation algorithms for multi-robot patrol-scheduling with min-max latency. To appear in *Proc. Workshop on Algorithmic Foundations of Robotics (WAFR)*, 2020.
- [C12] with N. Kumar, S. Sintos, and G. Van Buskirk. Approximating distance measures for the skyline. In *22nd Int. Conference on Database Theory (ICDT)*, pages 10:1–10:20, 2019.
- [C13] with A. Nayyeri. Viewing the rings of a tree: Minimum distortion embeddings into trees. In *Proc. 30th ACM-SIAM Symposium Discrete Algorithms (SODA)*, pages 2380–2399, 2019.
- [C14] with C. Fan and G. Van Buskirk. Metric violation distance: Hardness and approximation. In *Proc. 29th ACM-SIAM Symposium Discrete Algorithms (SODA)*, pages 196–209, 2018.
- [C15] with *G. Van Buskirk, B. Raichel, and N. Ruozzi. Sparse approximate conic hulls. In *Advances in Neural Information Processing Systems 30 (NeurIPS)*, pages 2531–2541, 2017.
- [C16] with C. Fan. Computing the Fréchet gap distance. In *Proc. 33rd Symposium on Computational Geometry (SOCG)*, pages 42:1–42:16, 2017.
- [C17] with A. Nayyeri. A treehouse with custom windows: Minimum distortion embeddings into bounded treewidth graphs. In *Proc. 28th ACM-SIAM Symposium Discrete Algorithms (SODA)*, pages 724–736, 2017.
- [C18] with N. Kumar, S. Suri, and K. Verbeek. Most likely Voronoi diagrams in higher dimensions. In *Proc. 36th Foundations of Software Technology and Theoretical Computer Science (FSTTCS)*, pages 31:1–31:14, 2016.
- [C19] with C. Seshadhri. Avoiding the global sort: A faster contour tree algorithm. In *Proc. 32nd Symposium on Computational Geometry (SOCG)*, pages 57:1–57:14, 2016.

- [C20] with A. Blum and S. Har-Peled. Sparse approximation via generating point sets. In *Proc. 27th ACM-SIAM Symposium Discrete Algorithms (SODA)*, pages 548–557, 2016.
- [C21] with A. Nayyeri. Reality distortion: Exact and approximate algorithms for embedding into the line. In *Proc. 56th Annual IEEE Symposium on Foundations of Computer Science (FOCS)*, pages 729–747, 2015.
- [C22] with S. Har-Peled, N. Kumar, and D. Mount. Space exploration via proximity search. In *Proc. 31st Symposium on Computational Geometry (SOCG)*, pages 374–389, 2015.
- [C23] with H. Chang and S. Har-Peled. From proximity to utility: A Voronoi partition of Pareto optima. In *Proc. 31st Symposium on Computational Geometry (SOCG)*, pages 689–703, 2015.
- [C24] with S. Har-Peled. On the complexity of randomly weighted Voronoi diagrams. In *Proc. 30th ACM Symposium on Computational Geometry (SOCG)*, pages 232–241, 2014.
- [C25] with S. Har-Peled. Net and prune: A linear time algorithm for euclidean distance problems. In *Proc. 45th Annual ACM Sympos. on Theory of Computing (STOC)*, pages 605–614, 2013.
- [C26] with N. Kumar. Fault tolerant clustering revisited. In *Proc. 25th Canadian Conference on Computational Geometry (CCCG)*, 2013.
- [C27] with A. Ene and S. Har-Peled. Geometric packing under non-uniform constraints. In *Proc. 28th ACM Symposium on Computational Geometry (SOCG)*, pages 11–20, 2012.
- [C28] with A. Driemel and S. Har-Peled. On the expected complexity of Voronoi diagrams on terrains. In *Proc. 28th ACM Symposium on Computational Geometry (SOCG)*, pages 101–110, 2012.
- [C29] with S. Har-Peled. The Fréchet distance revisited and extended. In *Proc. 27th ACM Symposium on Computational Geometry (SOCG)*, pages 448–457, 2011.

Journal Papers

- [J1] with C. Fan and G. Van Buskirk. Metric violation distance: Hardness and approximation. To appear in *Algorithmica*, 2022.
- [J2] with G. Klimentenko and G. Van Buskirk. Sparse convex hull coverage. *Computational Geometry*, 98:101787, 2021. CCCG 2020 special issue.
- [J3] with C. Fan. Computing the Fréchet gap distance. *Discrete & Computational Geometry*, 65(4):1244–1274, 2021.
- [J4] with A. Blum and S. Har-Peled. Sparse approximation via generating point sets. *ACM Transactions on Algorithms*, 15(3):32:1–32:16, 2019.
- [J5] with A. Ene and S. Har-Peled. Geometric packing under nonuniform constraints. *SIAM Journal on Computing*, 46(6):1745–1784, 2017.
- [J6] with C. Seshadhri. Avoiding the global sort: A faster contour tree algorithm. *Discrete & Computational Geometry*, 58(4):946–985, 2017. SOCG special issue. Erratum on my website.
- [J7] with S. Har-Peled, N. Kumar, and D. Mount. Space exploration via proximity search. *Discrete & Computational Geometry*, 56(2):357–376, 2016.

- [J8] with H. Chang and S. Har-Peled. From proximity to utility: A Voronoi partition of pareto optima. *Discrete & Computational Geometry*, 56(3):631–656, 2016.
- [J9] with A. Driemel and S. Har-Peled. On the expected complexity of Voronoi diagrams on terrains. *ACM Transactions on Algorithms*, 12(3):37, 2016.
- [J10] with S. Har-Peled. Net and prune: A linear time algorithm for euclidean distance problems. *Journal of the ACM*, 62(6):44, 2015.
- [J11] with S. Har-Peled. On the complexity of randomly weighted multiplicative Voronoi diagrams. *Discrete & Computational Geometry*, 53(3):547–568, 2015. SOCG 2014 special issue.
- [J12] with S. Har-Peled. The Fréchet distance revisited and extended. *ACM Transactions on Algorithms*, 10(1):3:1–3:22, 2014.

Manuscripts

- [S1] with A. Ene and S. Har-Peled. Fast clustering with lower bounds: No customer too far, no shop too small. *CoRR*, abs/1304.7318, 2013.

Grants

- National Science Foundation, Awarded in 2018, Amount: \$497,046, \$8,000 REU supplement awarded in 2020.
 - CAREER: AF: Giving Form to Data with a Geometric Scaffold
- National Science Foundation, Awarded in 2016, Amount: \$161,277
 - CRII: AF: Breaking Barriers for Geometric Data

Experience

Instructor, University of Texas at Dallas, Fall 2015-present

- Spring 2019/21 CS 6319, Computational Geometry
- Spring 2017/18/20 CS 4349, Advance Algorithm Design and Analysis
- Fall 2015-21, Spring 22 CS 6363, Design and Analysis of Computer Algorithms
- Spring 2016 CS/SE 7301, Frontiers in Algorithms

Intern at Sandia National Labs, Seshadhri Comandur and Janine Bennett, Livermore CA, Summer 2013/2014.

- Designed algorithms for computing compressed distributed merge trees, for applications in high performance computing and combustion research. Also, developed an output structure sensitive algorithm for computing contour trees.

Teaching Assistant for CS 473 / CS 573, Univeristy of Illinois, Fall 2010/2012/2013.

- Assisted in teaching undergraduate and graduate algorithms courses, including the following: giving lectures, leading discussion sections, holding office hours, writing homework solutions, and grading.

Geometric Approximation Algorithms Book Editor, Sariel Har-Peled, University of Illinois, Fall 2009 / Spring 2010.

- Assisted in the editing of Professor Har-Peled’s book on geometric approximation algorithms, which was published in 2011 by AMS.

Image Spatial Data Analysis Group, National Center for Supercomputing Applications, Fall 2008 / Spring and Summer 2009.

- Designed and prototyped automatic generation and organization of metadata about a collection of multimedia files from a decision support environment.

Workshops

Geometric Computing on Uncertain Data, Co-organizer

- Held at the Symposium on Computational Geometry (SOCG) 2016.

Dagstuhl seminar on Computational Geometry, Germany, 2017, 2019, and 2021.

- Week long workshop on Computational Geometry.

A New Era of Discrete and Computational Geometry, Ascona Switzerland

- Workshop for 30th anniversary of DCG, 2016.

International Workshop on Interactive and Spatial Computing (IWISC),

Richardson TX, Fall 2015, Spring 2017, Spring 2018.

- Gave a talk: *Approximating the Convex Hull in High Dimensions*, presented a poster, program committee member, registration/publication chair.

China Theory Week, Tsinghua University, Beijing China, Fall 2014.

- Workshop for rising stars in CS theory with the most accomplished PhD students from institutions worldwide presenting and discussing their research.

Computational Geometry MRC, Snowbird Utah, Summer 2012.

- Week long workshop on Discrete and Computational Geometry.

Presentations

- *Generalized Metric Repair*. Workshop on Computational Aspects of Learning and Processing Metrical Data. SOCG, 2020.
- *Metric Violation Distance*. Dagstuhl, Germany, 2019.
- *Viewing the Rings of a Tree: Minimum Distortion Embeddings into Trees*. SODA, 2019.
- *A Treehouse with Custom Windows: Minimum Distortion Embeddings into Bounded Treewidth Graphs*. Dagstuhl, Germany, 2017.
- *A Treehouse with Custom Windows: Minimum Distortion Embeddings into Bounded Treewidth Graphs*. SODA, 2017.
- *Avoiding the Global Sort: A Faster Contour Tree Algorithm*. A New Era of Discrete and Computational Geometry, Workshop for 30th anniversary of DCG, Ascona Switzerland, 2016.
- *Avoiding the Global Sort: A Faster Contour Tree Algorithm*. SOCG, 2016.
- *Sparse Approximation via Generating Point Sets*. SODA, 2016.
- *Reality Distortion: Exact and Approximate Algorithms for Embedding into the Line*. FOCS, 2015.
- *Space exploration via proximity search*. SOCG, 2015.
- *On the expected complexity of randomly weighted Voronoi diagrams*. SOCG, 2014.
- *Net and Prune: A linear time algorithm for Euclidean distance problems*. Seminar at IBM Almaden CA, 2013.
- *Net and prune: A linear time algorithm for euclidean distance problems*. STOC, 2013.
- *Fault tolerant clustering revisited*. CCCG, 2013.
- *Fast clustering with lower bounds – No customer too far, no shop too small*. Young Researchers Forum at SOCG, 2012.
- *Geometric packing under non-uniform constraints*. SOCG, 2012.
- *The Fréchet distance revisited and extended*. SOCG, 2011.

Program Committees

- National Science Foundation (NSF) panel member.
- Symposium on Computational Geometry (SOCG) 2018

- Scandinavian Symposium and Workshop on Algorithm Theory (SWAT) 2018
- International Workshop on Interactive and Spatial Computing (IWISC) 2018
(Registration/Publication Chair)

Other Committees

- Founding member of UT Dallas Institute for Interactive and Spatial Computing (UT-DIISC).
- UTD Computer Science Academic Affairs Committee
- UTD Computer Science Graduate Admissions Committee
- UTD Computer Science Algorithms Qualifying Exam Committee
- UTD Computer Science Graduate Curriculum Committee
- UIUC Computer Science Graduate Student Academic Council member.
- UIUC Reviewed graduate applications for the Department of Computer Science Fellowship, Assistantship, and Admissions Committee.
- UIUC Mathematics Undergraduate Affairs Committee (2009).
- UIUC Mathematics Graduate Teaching Awards Committee (2008).

Awards and Honors

- Best Teacher in CS Award, Erik Jonsson School of Engineering and Computer Science, 2021.
- Recognized for Excellence in Teaching and Service, UTD CS Department, 2018 and 2019.
- Dissertation Completion Fellowship (awarded for the 2014-2015 academic year).
- Andrew and Shana Laursen Fellowship for recruitment of top graduate students.
- Graduated with B.S. degree with highest distinction in Math and Physics.
- Bronze Tablet Award Recipient – 2009 (top 3% of graduating class).
- Dean's List every semester at both UIUC and Indiana University.
- Mal S. Klugman Scholarship (Fall 2008).

Reviewed papers for the following:

(Subreviewer for more than 70 distinct papers in total.)

Conferences:

- CCCG
- COCOA
- ESA
- FOCS
- FSTTCS
- ICALP
- IPCO
- ISAAC
- SOCG
- SODA
- STACS
- STOC
- SWAT
- WADS

Journals:

- Algorithmica
- CGTA
- DCG
- IJCGA
- IPL
- JOCG
- SICOMP
- TALG
- TKDE
- TOCS
- VLDBJ