

Curriculum Vitae: Joe Kileel

09/01/2026

Office

PMA 12.154, Department of Mathematics
POB 3.434, Oden Institute of Computational Engineering and Sciences
University of Texas at Austin
Austin, TX 78712-1199
phone: (510) 944-7317
website: <https://web.ma.utexas.edu/users/jkileel/>
e-mail address: jkileel@math.utexas.edu

Education

Ph.D. in Mathematics, University of California, Berkeley, 2012-2017
M.Math. and B.A. in Mathematics, University of Cambridge, 2008-2012

Professional Experience

Tenured Associate Professor, Department of Mathematics and Oden Institute, University of Texas at Austin, 2026-present

Assistant Professor, Department of Mathematics and Oden Institute, University of Texas at Austin, 2020-2026

Postdoctoral Fellow, Program in Applied and Computational Mathematics, Princeton University, 2017-2020 (with support from Simons Collaboration on Algorithms and Geometry)

Title of Dissertation

Algebraic Geometry for Computer Vision

Dissertation Advisor

Bernd Sturmfels

Postdoctoral Research Topic

Applied and Computational Mathematics (specific topics: inverse imaging; method of moments; tensor decomposition; data analysis and data compression)

Postdoctoral Advisor

Amit Singer

Current Research Interests

Applied Mathematics and Computational Algebra (specific topics: data analysis and compression; tensor decomposition; 3-D reconstruction in cryo-electron microscopy and computer vision; method of moments; nonconvex optimization landscapes; applied algebraic geometry; scientific machine learning; digital twins; AI for math)

Professional Societies

membership in American Mathematical Society

membership in Society for Industrial and Applied Mathematics

Research Funding

1. Sponsored Research Funding
 - a. Current Funding
 - sponsor: National Science Foundation
 - my role: PI
 - project title: NSF-BSF: Computational Methods for Shape Space Analysis in Structural Biology (DMS 2309782)
 - funding period: June 15, 2023 – May 31, 2027 (expected after no-cost extension)
 - co-PIs: none, though Amit Moscovich (Tel Aviv University) is PI on a corresponding BSF grant in Israel
 - funding amounts by year: \$144,314 in Y1; \$69,081 in Y2; \$61,605 in Y3
 - amounts under my supervision: all of above
 - b. Current Funding
 - sponsor: National Science Foundation
 - my role: PI
 - project title: Collaborative Research: RI: Medium: Bridging the Semantic-Metric Gap via Multinocular Image Integration (CISE/IIS 2312746)

- funding period: September 1, 2023 – August 31, 2027 (expected)
 - co-PIs: none, though Benjamin Kimia (Brown University) and Ahmad Abdelfattah (University of Tennessee) are PIs on corresponding collaborative research grants
 - funding amounts by year: \$0 in Y1; \$29,704 in Y2; \$30,711 in Y3; \$30,256 in Y4
 - amounts under my supervision: all of above
- c. Current Funding
 - sponsor: Department of Energy
 - my role: PI
 - project title: Adaptive, Efficient, and Safe: General Tools for Streaming Large-Scale Tensors (DE SC2309782)
 - funding period: September 1, 2024 – August 31, 2027 (expected)
 - co-PIs: Gunnar Martinsson (University of Texas at Austin)
 - funding amounts by year: \$64,585 in Y1; \$212,584 in Y2; \$217,831 in Y3
 - amounts under my supervision: \$49,063 in Y1; \$196,533 in Y2; \$201,233 in Y3
- d. Current Funding
 - sponsor: National Science Foundation
 - my role: co-PI
 - project title: FDT-BioTech: A Digital Twin Framework for Developing and Analyzing Virtual Patient Cohorts to Enable Virtual Clinical Trials (DMS 2436499)
 - funding period: December 15, 2024 – November 30, 2027 (expected)
 - co-PIs: Karen Willcox (University of Texas at Austin), Thomas Yankeeolov (University of Texas at Austin), Joe Kileel (University of Texas at Austin), Anirban Chaudhuri (University of Texas at Austin), with David Hormuth (University of Texas at Austin) as PI
 - funding amounts by year: \$303,143 in Y1; \$312,124 in Y2; \$337,600 in Y3
 - amounts under my supervision: \$14,878 in Y1; \$15,324 in Y2; \$44,646 in Y3
- e. Current Funding
 - sponsor: Alfred P. Sloan Foundation
 - my role: PI
 - project title: Sloan Research Fellowship in Mathematics
 - funding period: September 15, 2025 – September 14, 2027 (expected)
 - co-PIs: none
 - funding amounts per year: \$37,500 in Y1; \$37,500 in Y2
 - amounts under my supervision: all of above

Publications

- Total citations: >1200 [as of 09/01/26]

- H-index: 19 [as of 09/01/26]
- Total number of refereed papers: 37 [as of 09/01/26]
- Google Scholar: <https://scholar.google.com/citations?user=brZD504AAAAJ&hl=en>
- arXiv preprint server; all my papers can be found here:
<https://arxiv.org/search/?query=joe+kileel&searchtype=all&source=header>

Peer-reviewed papers

1. “First proof”, Mohammed Abouzaid, Andrew Blumberg, Martin Hairer, Joe Kileel, Tamara Kolda, Paul Nelson, Daniel Spielman, Nikhil Srivastava, Rachel Ward, Shmuel Weinberger, Lauren William, *Bulletin of the American Mathematical Society*, accepted, pp. 1-73 [journal paper]
2. “Efficient tensor decomposition via moment matrix extension”, Bobby Shi, Julia Lindberg, Joe Kileel, *Journal of Symbolic Computation*, **139** 102612 (2027), pp. 1-56 [journal paper]
3. “Two datasets are better than one: Method of double moments for 3-D reconstruction in cryo-EM”, Joe Kileel, Oscar Mickelin, Amit Singer, Sheng Xu, *Inverse Problems*, **42** 075016 (2026), pp. 1-36 [journal paper]
4. “QuadSync: Quadrifocal tensor synchronization via Tucker decomposition”, Daniel Miao, Gilad Lerman, Joe Kileel, *IEEE Conference on Computer Vision and Pattern Recognition* (2026), 30 pages counting supplement [peer-reviewed conference paper; oral]
5. “Higher-order group synchronization”, Adriana Duncan, Joe Kileel, *Research in the Mathematical Sciences* **13** 48 (2026), pp. 1-40 [journal paper]
6. “SO(3)-invariant PCA with application to molecular data”, Michael Fraiman, Paulina Hoyos, Tamir Bendory, Joe Kileel, Oscar Mickelin, Nir Sharon, Amit Singer, *IEEE International Symposium on Biomedical Imaging* (2026), 5 pages [peer-reviewed conference paper; oral]
7. “Geometry and optimization of shallow polynomial networks”, Yossi Arjevani, Joan Bruna, Joe Kileel, Elzbieta Polak, Matthew Trager, *SIAM Journal on Applied Algebra and Geometry* **10** 2 (2026), pp. 174-209 [journal paper]
8. “Condition numbers in multiview geometry, instability in relative pose estimation, and RANSAC”, Hongyi Fan, Joe Kileel, Benjamin Kimia, *IEEE Transactions on Pattern Analysis and Machine Intelligence* **48** (2026), pp. 2855-2869 [journal paper]
9. “Covering number of real algebraic varieties and beyond: Improved bounds and applications”, Yifan Zhang, Joe Kileel, *Foundations of Computational Mathematics* (2025), pp. 1-48 [journal paper]
10. “Snapshot of algebraic vision”, Joe Kileel, Kathlen Kohn, *Combinatorial, Computational, and Applied Algebraic Geometry: A Tribute to Bernd Sturmfels*, AMS Proceedings of Symposia in Pure Mathematics **111** (2025), pp. 323-363 [peer-reviewed book chapter]
11. “Subspace power method for symmetric tensor decomposition,” Joe Kileel, João Pereira, *Numerical Algorithms* (2025), pp. 1-38 [journal paper]

12. “Fast expansion into harmonics on the ball”, [Joe Kileel](#), Nicholas Marshall, Oscar Mickelin, Amit Singer, *SIAM Journal on Scientific Computing* **47** 2 (2025), pp. A1117-A1144 [journal paper]
13. “The effect of smooth parametrizations on nonconvex optimization landscapes”, Eitan Levin, [Joe Kileel](#), Nicolas Boumal, *Mathematical Programming* **209** 1 (2025), pp. 63-111 [journal paper]
14. “Tensor-based synchronization and the low-rankness of the block trifocal tensor”, Daniel Miao, Gilad Lerman, [Joe Kileel](#), *Advances in Neural Information Processing Systems* (2024), pp. 1-28 [peer-reviewed conference paper]
15. “Scalable symmetric Tucker tensor decomposition”, Ruhui Jin, [Joe Kileel](#), Tamara Kolda, Rachel Ward, *SIAM Journal on Matrix Analysis and Applications* **45** 4 (2024), pp. 1746-1781 [journal paper]
16. “Algebraic constraints and algorithms for common lines in cryo-EM”, Tommi Muller, Adriana Duncan, Eric Verbeke, [Joe Kileel](#), *Biological Imaging* **4** E9 (2024), pp. 1-30 [journal paper]
17. “The G-invariant graph Laplacian Part I: Convergence rate and eigendecomposition”, Eitan Rosen, Paulina Hoyos, Xiuyuan Cheng, [Joe Kileel](#), Yoel Shkolnisky, *Applied and Computational Harmonic Analysis* **71** (2024), pp. 1-35 [journal paper]
18. “Moment-based metrics for molecules computable from cryo-EM images”, Andy Zhang, Oscar Mickelin, [Joe Kileel](#), Eric Verbeke, Nicholas Marshall, Marc Aurele Gilles, Amit Singer, *Biological Imaging* **4** E3 (2024), pp. 1-22 [journal paper]
19. “Moment estimation for nonparametric mixture models through implicit tensor decomposition”, Yifan Zhang, [Joe Kileel](#), *SIAM Journal on Mathematics of Data Science* **5** 4 (2023), pp. 1130-1159 [journal paper]
20. “Moment varieties for mixtures of products”, Yulia Alexandr, [Joe Kileel](#), Bernd Sturmfels, *ACM International Symposium on Symbolic and Algebraic Computation* (2023), pp. 53-60 [peer-reviewed conference paper]
21. “Autocorrelation analysis for cryo-EM with sparsity constraints: Improved sample complexity and projection-based algorithms” Tamir Bendory, Yuehaw Khoo, [Joe Kileel](#), Oscar Mickelin, Amit Singer, *Proceedings of the National Academy of Sciences* **120** 18 (2023), e2216507120 [journal paper; 18 pages counting supplement]
22. “Estimation under group actions: Recovering orbits from invariants”, Afonso Bandeira, Ben Blum-Smith, [Joe Kileel](#), Amelia Perry, Jonathan Niles-Weed, Alexander Wein, *Applied and Computational Harmonic Analysis* **66** (2023), pp. 236-319 [journal paper]
23. “Finding stationary points on bounded-rank matrices: A geometric hurdle and a smooth remedy”, Eitan Levin, [Joe Kileel](#), Nicolas Boumal, *Mathematical Programming* **199** 1 (2023), pp. 831-864 [journal paper]
24. “On the instability of relative pose estimation and RANSAC's role”, Hongyi Fan, [Joe Kileel](#), Benjamin Kimia, *IEEE Conference on Computer Vision and Pattern Recognition* (2022), pp. 8935-8943 [peer-reviewed conference paper]

25. “Landscape analysis of an improved power method for tensor decomposition”, [Joe Kileel](#), Timo Klock, João Pereira, *Advances in Neural Information Processing Systems* (2021), pp. 6253-6265 [peer-reviewed conference paper]
26. “Manifold learning with arbitrary norms”, [Joe Kileel](#), Amit Moscovich, Nathan Zelesko, Amit Singer, *Journal of Fourier Analysis and Applications* **27** 82 (2021), pp. 1-56 [journal paper]
27. “Earthmover-based manifold learning for analyzing molecular conformation spaces”, Nathan Zelesko, Amit Moscovich, [Joe Kileel](#), Amit Singer, *IEEE International Symposium on Biomedical Imaging* (2020), pp. 1715-1719 [peer-reviewed conference paper]
28. “Method of moments for 3-D single particle ab initio modeling with non-uniform distribution of viewing angles”, Nir Sharon, [Joe Kileel](#), Yuehaw Khoo, Boris Landa, Amit Singer, *Inverse Problems* **36** 4 (2020), pp. 1-40 [journal paper]
29. “On the expressive power of deep polynomial neural networks”, [Joe Kileel](#), Matthew Trager, Joan Bruna, *Advances in Neural Information Processing Systems* (2019), pp. 10310-10319 [peer-reviewed conference paper]
30. “Numerical implicitization”, Justin Chen, [Joe Kileel](#), *Journal of Software for Algebra and Geometry* **9** 1 (2019), pp. 55-63 [journal paper]
31. “3D ab initio modeling in cryo-EM by autocorrelation analysis”, Eitan Levin, Tamir Bendory, Nicolas Boumal, [Joe Kileel](#), Amit Singer, *IEEE International Symposium on Biomedical Imaging* (2018), pp. 1569-1573 [peer-reviewed conference paper; oral]
32. “Distortion varieties”, [Joe Kileel](#), Zuzana Kukelova, Tomas Pajdla, Bernd Sturmfels, *Foundations of Computational Mathematics* **18** (2018), pp. 1043-1071 [journal paper]
33. “The Chow form of the essential variety in computer vision”, Gunnar Floystad, [Joe Kileel](#), Giorgio Ottaviani, *Journal of Symbolic Computation* **86** (2018), pp. 97-119 [journal paper]
34. “Minimal problems for the calibrated trifocal variety”, [Joe Kileel](#), *SIAM Journal on Applied Algebra and Geometry* **1** (2017), pp. 575-598 [journal paper]
35. “A clever elimination strategy for efficient minimal solvers”, Zuzana Kukelova, [Joe Kileel](#), Bernd Sturmfels, Tomas Pajdla, *IEEE Conference on Computer Vision and Pattern Recognition* (2017), pp. 3605-3614 [peer-reviewed conference paper]
36. “Rigid multiview varieties”, Michael Joswig, [Joe Kileel](#), Bernd Sturmfels, André Wagner, *International Journal of Algebra and Computation* **26** (2016), pp. 775-788 [journal paper]
37. “Hadamard products of linear spaces”, Cristiano Bocci, Enrico Carlini, [Joe Kileel](#), *Journal of Algebra* **448** (2016), pp. 595-617 [journal paper]

Preprint papers

38. “Group invariant spectral embedding”, Yeari Vidger, Paulina Hoyos, David Thong, Joakim Andén, [Joe Kileel](#), Amit Moscovich, arXiv:2607.08987, pp. 1-28

39. “Testing the mixture model hypothesis via spectral gap”, March Boedihardjo, [Joe Kileel](#), Vandy Tombs, arXiv:2603.03245, pp. 1-29
40. “Multi-context principal component analysis”, Kexin Wang, Salil Bhate, João Pereira, [Joe Kileel](#), Matylda Figlerowicz, Anna Seigal, arXiv:2601.15239, pp. 1-47
41. “Multi-subspace power method for decomposing partially symmetric tensors”, Kexin Wang, João Pereira, [Joe Kileel](#), Anna Seigal, arXiv:2510.18627, pp. 1-36
42. “Norming sets for tensor and polynomial sketching”, Yifan Zhang, [Joe Kileel](#), arXiv:2506.05174, pp. 1-16
43. “The fascinating world of $2 \times 2 \times 2$ tensors: Its geometry and optimization challenges”, Gabriel Brown, [Joe Kileel](#), Tamara Kolda, arXiv:2504.03937, pp. 1-33
44. “Tensor moments of Gaussian mixture models: Theory and applications”, João Pereira, [Joe Kileel](#), Tamara Kolda, arXiv:2202.06930, pp. 1-42

Patents

1. “Method of moments for 3-D reconstruction in cryo-electron microscopy from multiple datasets with different viewing angle distributions”, Amit Singer, [Joe Kileel](#), Oscar Mickelin, Sheng Xu
 - USA Patent Application, Appl. No.: 63/816,313. Application Date: June 2, 2025
2. “Trifocal block tensor-based synchronization and applications to computer vision systems”, Gilad Lerman, [Joe Kileel](#), Daniel Miao
 - USA Patent Application, Appl. No.: 19/328,427. Application Date: September 15, 2025
3. “Fully automatic, template-free particle picking for electron microscopy”, Amit Singer, Ayelet Heimowitz, Joakim Anden, Yuehaw Khoo, [Joe Kileel](#)
 - USA Patent, No.: 11,557,034 B2. Patent Date: January 17, 2023
 - China Patent, No.: ZL201880046702.X. Patent Date: April 28, 2023

Awards and Honors

- Moncrief Grand Challenge Faculty Award, University of Texas at Austin, 2026-2027
- Peter O’Donnell Distinguished Researcher Award, University of Texas at Austin, 2025-2029
- Alfred P. Sloan Research Fellow in Mathematics, 2025-2027
- ACHA Charles Chui Young Researcher Best Paper Award, 2023 (for paper #19 above)
- Simons Collaboration on Algorithms and Geometry Postdoctoral Fellowship, 2017-2020
- Bernard Friedman Memorial Prize for Best Thesis in Applied Mathematics, University of California, Berkeley, 2017
- Chateaubriand Fellowship, Embassy of France in the United States, Summer 2016

- Blyth Cambridge Commonwealth Scholarship, 2008-2011 (two scholarships in Canada)

Service

Departmental

- Committee Member for Statistics/Probability Courses Reform Committee for Department of Mathematics (AY 26-27)
- Committee Member for Scientific Machine Learning Faculty Search Committee for Departments of Mathematics and Computer Science and Oden Institute (AY 25-26)
- Co-Organizer of “Computational and Applied Mathematics Seminar” for Department of Mathematics (starting Fall 25)
- Co-Organizer of “Oden Institute Seminar” for Oden Institute (starting Spring 25)
- Committee Member for Scientific Machine Learning Faculty Search Committee for Department of Mathematics and Oden Institute (AY 24-25)
- Committee Member for Bing Instructor (Postdoc) Search Committee for Department of Mathematics (AY 24-25, AY 25-26)
- Co-Chair of Ph.D. Admissions Committee for Oden Institute (AY 25-26)
- Committee Member for Ph.D. Admissions Committee for Department of Mathematics (AY 21-22, AY 24-25) and Oden Institute (AY 21-22, AY 23-24, AY 24-25)
- Project Member for “CALC_x: UT Math/STEM_x Initiative” to Redesign First-Year Calculus Sequences (AY 24-25)
- Committee Member for Mathematics Website Development Committee (AY 24-25)
- Committee Member for Professional-Track Faculty Chair's Committee for Department of Mathematics (AYs 23-25)
- Committee Member for Professional-Track Faculty Annual Review Committee for Department of Mathematics (AY 23-24)
- Committee Member for CSEM Graduate Studies Subcommittee for Oden Institute (AYs 24-27)
- Committee Member for Ph.D. Dissertation Award Committee for Oden Institute (Spring 23)
- Committee Member for Ph.D. Dissertation Writing Fellowship Committee for Oden Institute (Spring 24)

- Committee Member for Prelim Exam Committee for Oden Institute: Data Science test (Spring 23, Spring 24) and Data Science retest (Summer 21, Summer 24)
- Non-Advisor Committee Member of Ph.D. Thesis and/or Proposal Committees: Youguang Chen (advisor: Biros), Jeffrey Cochran (expected, upcoming; advisors: Hughes and Bui-Thanh), Yijung Dong (advisors: Martinsson and Ward), Patrícia Muñoz Ewald (advisor: Chen), Zhou Fang (advisors: Israel and Xu), Rodrigo González Hernandez (advisor: Gamba), Lewis Liu (advisor: Tsai), Andrew Moore (advisor: Chen), Minh Nguyen (advisor: Bajaj), Tiffany Phan (advisor: Jah), Will Ruys (advisor: Biros), Bobby Shi (advisor: Ward), Zachary Stoeber (expected, upcoming; advisor: Tamir), Casey Stowers (advisor: Yankeelov), Xin Tang (advisor: Baldea), Lukas Taus (advisor: Tsai), Zheyu Wen (advisor: Biros), Yuege Xie (advisor: Ward), Yi Wang (advisor: Bajaj), Jinpai Zhao (advisor: Dawson) [for my roles as advisor, please see the section “Mentoring” below]
- Leader of Reading Courses (topics: computational algebraic geometry; Gröbner bases; group synchronization; manifold learning; data compression; low-rank tensor and matrix optimization; 3-D reconstruction; and others)

College

- Committee Member for Calculus/AI Education Committee for College of Natural Sciences and Cockrell School of Engineering (AY 25-26)
- Served as Marshal at UT's CNS Undergraduate Commencement (2023)
- QR Flag Proposer for M 348 “Scientific Computation in Numerical Analysis” (2023)

University

- Undergraduate Outreach Presentation for UT Dean’s Scholars (2023)

Community

- Non-Advisor Committee Member of Ph.D. Thesis Committee for Alessandro Tamai (Scuola Internazionale Superiore di Studi Avanzati, Italy)
- Non-Advisor Committee Member of Ph.D. Thesis and Proposal Committee for Daniel Miao (University of Minnesota, Twin Cities)

Seminars/Lectures

(back to 2018)

- Workshop on Extended Systems and Boundary Conditions in Numerical Algebraic Geometry and Correlated Electrons Program, Institute for Pure and Applied Mathematics, University of California, Los Angeles, April 2027 (expected; upcoming), Invited

- Workshop on Algebraic Geometry: A Window into Machine Learning, Institute for Pure and Applied Mathematics, University of California, Los Angeles, February 2027 (expected; upcoming), Invited
- Joint Mathematics Meeting, Special Session on Mathematics of Data Science and Machine Learning, Chicago, January 2027 (expected; upcoming), Invited
- Joint Mathematics Meeting, Special Session on Algebraic, Topological and Geometric Methods in Machine Learning, Chicago, January 2027 (expected; upcoming), Invited
- Joint Mathematics Meeting, Special Session on Algebra and Geometry in Computations, Chicago, January 2027, Invited
- Workshop on Matrix Optimization, Institute for Mathematical Sciences, National University of Singapore, December 2026 (expected; upcoming), Invited
- SIAM Mathematics of Data Science Conference, Minisymposium on Algebraic Approaches to Generalization in Machine Learning, Salt Lake City, November 2026 (expected; upcoming), Invited
- Seminar on AI/Mathematics/Statistics, Harvard University, Fall 2026 (expected; upcoming), Invited
- Applied Mathematics Seminar, Texas Tech University, November 2026 (virtual; expected; upcoming), Invited
- Annual Meeting of SIAM TX-LA Section, Minisymposium on Applications of Algebraic Geometry, Southern Methodist University, October 2026 (expected; upcoming), Invited
- Annual Meeting of SIAM TX-LA Section, Minisymposium on Tensor Computations, Data Science and Applications, Southern Methodist University, October 2026 (expected; upcoming), Invited
- Wallenberg Advanced Scientific Forum on Symmetries in Neural Networks, Stockholm, Sweden, October 2026 (expected; upcoming), Invited
- Conference of Italian Network for Applied and Birational Algebraic Geometry, Siena, Italy, September 2026 (virtual; expected; upcoming), Invited
- Workshop on Rigidity Theory and Geometric Data Science, Institute for Computational and Experimental Research in Mathematics, Brown University, July 2026, Invited
- Workshop on Metric Algebraic Geometry, Institut Mittag-Leffler, Sweden, June 2026, Invited
- Kolloquium, Osnabrück University, Germany, June 2026, Invited
- Conference of International Linear Algebra Society, Virginia Tech, May 2026, Invited
- Texas Algebraic Geometry Symposium, Texas A&M, April 2026, Invited
- Young Mathematician Lecture Series, National University of Singapore, Spring 2026, Invited
- Joint Mathematics Meeting, Special Session on Algebraic Methods in Machine Learning and Optimization, Washington, D.C., January 2026, Invited

- Applied Mathematics Seminar, University of California, Berkeley / Lawrence Berkeley Laboratory, November 2025, Invited
- Workshop on Randomness, Invariants and Complexity, Simons Institute, University of California, Berkeley, November 2025, Invited
- Annual Meeting of SIAM TX-LA Section, Minisymposium on Geometric Data Analysis, University of Texas at Austin, September 2025, Invited
- Annual Meeting of SIAM TX-LA Section, Minisymposium on Scientific Machine Learning, University of Texas at Austin, September 2025, Invited
- International Conference on Continuous Optimization, Minisymposium on Optimization on Stratified Sets, University of Southern California, July 2025, Invited
- SIAM Conference on Applied Algebraic Geometry, Minisymposium on Algebraic Approaches to Machine Learning, University of Wisconsin-Madison, July 2025, Invited
- SIAM Conference on Applied Algebraic Geometry, Minisymposium on Algebraic Approaches to Computational Optimization, University of Wisconsin-Madison, July 2025, Substitute Speaker
- Conference of International Linear Algebra Society 2025, Minisymposium on Numerical Multilinear Algebra, Kaohsiung, Taiwan, June 2025, Invited
- Colloquium, Department of Mathematics, University of Texas at San Antonio, April 2025, Invited
- Sophex Seminar, Department of Mathematics, University of Texas at Austin, March 2025, Invited
- DOE Advanced Scientific Computing Research CS PI Meeting, Lightning Talk, Frisco, TX, March 2025, Invited
- Babuška Forum, Oden Institute for Computational Engineering and Sciences, University of Texas at Austin, March 2025, Invited
- SIAM Conference on Computational Science and Engineering, Minisymposium on Tensors, Fort Worth, March 2025, Co-Organizer and Speaker
- Mathematics of Machine Learning Seminar, Max Planck Institute for Mathematics in the Sciences and University of California, Los Angeles, February 2025 (virtual), Invited
- One World Mathematics of INformation, Data, and Signals (1W-MINDS) Seminar, January 2025 (virtual), Invited
- Joint Mathematics Meeting, Special Session on Algebraic Statistics, Seattle, January 2025, Invited
- Joint Mathematics Meeting, Special Session on Nonlinear Algebra for Machine Learning, Seattle, January 2025, Invited
- Joint Mathematics Meeting, Special Session on Geometric Methods in Deep Learning, Seattle, January 2025, Invited

- IMS International Conference on Statistics and Data Science, Session on Tensor Methods, Nice, France, December 2024, Invited
- Colloquium, Department of Mathematics, Michigan State University, November 2024, Invited
- SIAM Conference on Mathematics of Data Science, Minisymposium on Algebraic Geometry and Machine Learning, Atlanta, October 2024, Invited
- BIRS-CMO Workshop on Computational Harmonic Analysis in Data Science and Machine Learning, Casa Matemática Oaxaca, Mexico, September 2024, Invited
- AMS Central Sectional Meeting, Special Session on Applications of Algebraic Geometry, University of Texas at San Antonio, September 2024, Invited
- International Symposium on Mathematical Programming, Special Session on Moment, Polynomial and Tensor Optimization, Montreal, Canada, July 2024, Invited
- NSF CompMath PI meeting, Special Session on Data Science, University of Washington, July 2024, Contributed
- Joint Mathematics of Data & Decisions (MADDD) and Algebraic Geometry Seminar, University of California, Davis, March 2024, Invited
- Codes and Expansions (CodEx) Seminar, March 2024 (virtual), Invited
- Winter Program in ML, Minicourse on Tensor Methods in Data Science, Department of Mathematics, University of Texas at Austin, January 2024, Co-Organizer and Instructor
- Topical Workshop on Higher-Order Statistics and Symmetric Tensors, Institute for Computational and Experimental Research in Mathematics, Brown University, January 2024, Co-Organizer and Speaker
- Joint Mathematics Meeting, Special Session on Mathematics of Computer Vision, San Francisco, January 2024 (virtual), Invited
- Bayesian Statistics and Statistical Learning Workshop, Institute for Mathematical and Statistical Innovation, University of Chicago, December 2023, Invited
- PSU-Purdue-UMD Joint Seminar on Mathematical Data Science, November 2023 (virtual), Invited
- Annual Meeting of SIAM TX-LA Section, University of Louisiana at Lafayette, November 2023, Invited
- FFT Conference, Norbert Wiener Center for Harmonic Analysis and Applications, Charles Chui Prize Lecture, University of Maryland, College Park, October 2023, Invited
- Workshop on Invitation to Algebraic Statistics and Applications, Tutorial Lecture, Institute for Mathematical and Statistical Innovation, University of Chicago, September 2023, Invited
- Workshop on Mathematical Methods for Exploring and Analyzing Morphological Shapes Across Biological Scales, Banff International Research Station, Canada, September 2023 (virtual), Invited

- International Council for Industrial and Applied Mathematics, Minisymposium on Randomized Numerical Linear Algebra, Tokyo, Japan, August 2023, Invited
- SIAM Conference on Applied Algebraic Geometry, Minisymposium on Applications of Tensors, Eindhoven, Netherlands, July 2023, Invited
- SIAM Conference on Optimization, Minisymposium on Nonconvex Landscapes, Seattle, June 2023, Co-Organizer and Speaker
- Oden Institute Seminar, Oden Institute for Computational Engineering and Sciences, University of Texas at Austin, May 2023, Invited
- SIAM Conference on Computational Science and Engineering, Minisymposium on 3D Reconstruction, Amsterdam, Netherlands, February 2023, Invited
- Topics in Algebra, Topology, Etc., Research Seminar (TATERS), Boise State University, February 2023 (virtual), Invited
- Alan Turing-Oden Institutes Workshop, Short Talk, London, United Kingdom, January 2023, Invited
- Colloquium, Department of Mathematics, University of Missouri, January 2023, Invited
- Joint Mathematics Meeting, Special Session on Data Science, Boston, January 2023, Invited
- Joint Mathematics Meeting, Special Session on Numerical Homotopy Continuation, Boston, January 2023, Invited
- Joint Mathematics Meeting, Special Session on Tensors, Boston, January 2023, Invited
- Colloquium, Department of Mathematics, University of Texas at Austin, December 2022, Invited
- Colloquium, Program in Applied and Computational Mathematics, Princeton University, November 2022, Invited
- Cryo-Electron Microscopy and Beyond Workshop, Institute for Pure and Applied Mathematics, University of California, Los Angeles, November 2022, Invited
- Data and Learning Seminar, Instituto de Matemática Pure e Aplicada, Rio de Janeiro, Brazil, November 2022, Invited
- Mathematical Machine Learning Seminar, Max Planck Institute for Mathematics in the Sciences and University of California, Los Angeles, October 2022 (virtual), Invited
- SIAM Conference on Mathematics of Data Science, Minisymposium on Optimal Transport, San Diego, September 2022 (virtual), Invited
- ML+X Seminar, Institute for Foundations of Machine Learning, University of Texas at Austin, September 2022, Invited
- Combinatorial, Computational, and Applied Algebraic Geometry Conference, University of Washington, June 2022, Invited

- Workshop on Mathematical and Computational Challenges in Cryogenic Electron Microscopy, University of British Columbia, Vancouver, Canada, May 2022, Invited
- AMS Special Session on Data Science, Tufts University, March 2022 (virtual), Invited
- IMA Data Science Seminar, University of Minnesota, February 2022, Invited
- Algebraic Geometry Seminar, University of California, Davis, January 2021 (virtual), Invited
- Applied Mathematics Seminar, Yale University, November 2021 (virtual), Invited
- SIAM Texas-Louisiana Sectional Meeting, Minisymposium on Algorithmic Algebra and Geometry, University of Texas at Rio Grande Valley, November 2021 (virtual), Invited
- BIRS-CMO Workshop on Geometry & Learning from Data, Casa Matemática Oaxaca, Mexico, October 2021 (virtual), Invited
- Computational and Applied Mathematics Colloquium, University of Chicago, October 2021, Invited
- SIAM Conference on Applied Algebraic Geometry, Minisymposium on Algebraic Geometry and Machine Learning, Texas A&M University, August 2021 (virtual), Invited
- Data Science Seminar, University of Oxford, June 2021 (virtual), Invited
- Tensors Seminar Series, Institute for Pure and Applied Mathematics, University of California, Los Angeles, May 2021 (virtual), Invited
- Applied and Computational Mathematics Seminar, National University of Singapore, March 2021 (virtual), Invited
- Tsinghua Sanya International Mathematics Forum, Workshop on Algebraic Geometry and Machine Learning, January 2021 (virtual), Invited
- Geometry Seminar, Texas A&M University, November 2020 (virtual), Invited
- Babuška Forum, Oden Institute for Computational Engineering and Sciences, University of Texas at Austin, November 2020 (virtual), Invited
- SIAM Texas-Louisiana Section, Minisymposium on Applications of Algebraic Geometry, Texas A&M University, October 2020 (virtual), Invited
- SIAM Texas-Louisiana Section, Minisymposium on Algebraic, Geometric, and Combinatorial Methods in Mathematical Biology, Texas A&M University, October 2020 (virtual), Invited
- Algebraic Statistics Online Seminar, September 2020 (virtual), Invited
- SIAM Conference on Mathematics of Data Science, Special Session on Algebraic Geometry and Machine Learning, Cincinnati, June 2020 (virtual), Invited
- Colloquium, School of Mathematics, Georgia Institute of Technology, March 2020, Invited
- Colloquium, Division of Applied Mathematics, Brown University, February 2020, Invited

- Colloquium, Courant Institute of Mathematical Sciences, New York University, February 2020, Invited
- Colloquium, Department of Mathematics, University of Wisconsin-Madison, February 2020, Invited
- Colloquium, Department of Mathematics, Duke University, January 2020, Invited
- Colloquium, Department of Mathematics, Rutgers University-New Brunswick, January 2020, Invited
- Analysis Seminar, Department of Mathematics, University of Texas at Austin, January 2020, Invited
- Colloquium, Oden Institute for Computational Engineering and Sciences, University of Texas at Austin, January 2020, Invited
- Colloquium, Department of Mathematics, University of Toronto, Canada, January 2020, Invited
- Joint Applied Mathematics / Statistics & Data Science Seminar, Yale University, December 2019, Invited
- Novel Medical Imaging Workshop, Texas A&M University, November 2019, Invited
- Linear Algebra Seminar, Auburn University, November 2019, Invited
- Algebra Seminar, University of Washington, October 2019, Invited
- SIAM Pacific Northwest Section, Special Session on Algebra, Geometry and Applications, Seattle University, October 2019, Invited
- AMS Sectional Meeting, University of Wisconsin-Madison, Special Session on Applications of Algebra and Geometry, September 2019, Invited
- Big Data Conference, Center of Mathematical Sciences and Applications, Harvard University, August 2019, Invited
- NYC Computational Cryo-EM Summer Workshop, Center for Computational Mathematics, Flatiron Institute, August 2019, Invited
- SIAM Conference on Applied Algebraic Geometry, Universität Bern, Switzerland, Minisymposium on Algebraic Vision, July 2019, Invited
- Computational and Applied Mathematics Colloquium, University of Chicago, May 2019, Invited
- Applied Algebra Seminar, University of Wisconsin-Wisconsin, May 2019, Invited
- Algebra Seminar, Georgia Institute of Technology, April 2019, Invited
- AMS Sectional Meeting, Auburn University, Special Session on Applications of Algebraic Geometry, March 2019, Invited
- Algebraic Vision Research Cluster, Institute for Computational and Experimental Research in Mathematics, Brown University, January 2019, Invited

- Joint CUNY Graduate Center-Courant Seminar, Symbolic-Numeric Computing, City University of New York, December 2018, Invited
- Mathematics, Information and Computation Seminar, Center for Data Science, New York University, November 2018, Invited
- Nonlinear Algebra Seminar, Institute for Computational and Experimental Research in Mathematics, Brown University, November 2018, Invited
- Math and Data Working Group at Center for Data Science, New York University, October 2018, Invited
- AMS Sectional Meeting, Special Session on Extensions-Interpolation-Shape Matching in $\mathbb{R}^d$, Symmetry-Invariance, Algorithms and Related Topics, University of Michigan, Ann Arbor, October 2018, Invited
- Dagstuhl Seminar, Shape Analysis: Euclidean, Discrete and Algebraic Geometric Methods, Leibniz-Zentrum für Informatik, Germany, October 2018, Invited
- Joint KMS-DMV Mathematics Conference, Special Session on Algebraic Geometry and Computer Vision, Seoul, South Korea, October 2018, Invited
- Simons Collaboration on Algorithms and Geometry, Simons Foundation, New York, March 2018, Invited
- SIAM Southeastern Atlantic Sectional Conference, Special Session on Topics in the Mathematics of Data Analysis, University of North Carolina at Chapel Hill, March 2018, Invited

Professional Services

Major Conference Program Committees

- Co-Organizing Approved Semester-Long Program “Metric Algebraic Geometry”, Institute for Computational and Experimental Research in Mathematics, Brown University, Spring 2027

Workshops and Specialized Conference Program Committees

- Co-Organizing Approved Weeklong Workshop “Extended Systems and Boundary Conditions” apart of “Numerical Algebraic Geometry and Correlated Electrons” Program, Institute for Pure and Applied Mathematics, University of California, Los Angeles, April 2027
- Co-organizing Approved Workshop “Algebraic Distance Optimization” apart of “Metric Algebraic Geometry”, Institute for Computational and Experimental Research in Mathematics, Brown University, February 2027
- Co-organizing Approved Minisymposium “Tensor Methods in Data Science”, SIAM Conference on Mathematics of Data Science, November 2026

- Co-Organizing Weeklong Workshop “Mathematics of 3D Reconstruction”, Institute for Computational and Experimental Research in Mathematics, Brown University, July 2026
- Lead Organizer of SQuaRE “Randomized Numerical Linear Algebra for Tensor Applications”, American Institute of Mathematics, California Institute of Technology, First Session in March 2026
- Co-Organized Minisymposium “Tensors in Scientific Computing and Engineering”, SIAM Conference on Computational Science and Engineering, Fort Worth, March 2025
- Co-Organized 2-Day Workshop “Mathematics of Deep Learning”, Institute for Foundations of Machine Learning, University of Texas at Austin, February 2025
- Co-Organized Minisymposium “Processing Data with Geometric Structure”, SIAM Conference on Mathematics of Data Science, Atlanta, October 2024
- Co-organized Minisymposium “Algebraic Methods for Data Science”, SIAM Annual Meeting of SIAM TX-LA Section, Baylor University, October 2024
- Co-Organized Weeklong School “Winter Program in ML”, Department of Mathematics, University of Texas at Austin, January 2024
- Co-Organized Weeklong Workshop “Connecting Higher-Order Statistics and Symmetric Tensors”, Institute for Computational and Experimental Research in Mathematics, Brown University, January 2024
- Co-Organized Minisymposium “Parameterizations and Nonconvex Landscapes”, SIAM Conference on Optimization, University of Washington, June 2023
- Co-Organized Minisymposium “Data-Driven Scientific Computing”, SIAM Conference on Computational Science and Engineering, Fort Worth, Texas, March 2021 (virtual)
- Co-Organized Minisymposium “Theoretical and Computational Aspects of the Method of Moments”, SIAM Conference on Mathematics of Data Science, Cincinnati, June 2020 (virtual)

Journal, Conference, and Book Reviewing

- Referee for journals, including: SIAM Journal on Mathematics of Data Science, SIAM Journal on Applied Algebra and Geometry, SIAM Journal on Matrix Analysis and Applications, SIAM Journal on Imaging Science, Mathematical Programming, Advances in Mathematics, Advances in Computational Mathematics, Experimental Mathematics, Journal of Machine Learning Research, Nature Communications, Linear Algebra and its Applications, Foundations of Computational Mathematics, Applied and Computational Harmonic Analysis, Journal of Fourier Analysis and Applications, Algebraic Statistics, Acta Crystallographica Section D, Journal of Mathematical Imaging and Vision, Annals of Statistics, Journal of Algebra, International Journal of Computer Vision, Courant Journal of Pure and Applied Mathematics, Communications on

Pure and Applied Mathematics (quick opinion), Memoirs of AMS (quick opinion), Journal of AMS (quick opinion)

- Referee for conferences, including: NeurIPS, ICML, ICLR, CVPR, STOC, COLT, MEGA, FOCS, EECV, ACCV, BMVC, MLSB
- Referee for books: Springer's Applied and Numerical Harmonic Analysis

Grant Proposal Reviewing

- panel service: NSF Computational Mathematics (2025), NSF Mathematical Biology (2025), NSF Computational Mathematics (2024)
- ad hoc reviews: German Research Foundation (2026), NSF Computational Mathematics (2025), United States-Israel BSF (2025), National Science Centre Poland (2025), Czech Science Foundation (2025), NSF Computational Mathematics (2024)

Service for Prizes

- invited nominator: Shaw Prize in Mathematical Sciences (2026, 2027)

Teaching

- “Foundational Techniques of Machine Learning and Data Sciences”, graduate prelim course (Spring 26, Spring 24, Fall 23)
- “Tensor Methods”, graduate topics course (Fall 25)
- “Differential and Integral Calculus”, undergraduate lower-division course (Spring 25, Fall 24)
- “Scientific Computation in Numerical Analysis”, undergraduate upper-division course (Fall 26, Fall 23, Spring 22)
- “Geometric Methods in Data Science”, graduate topics course (Fall 21)
- “Real Analysis I”, undergraduate upper-division course (Spring 21)

Mentoring

Postdocs

- Paul Beckman (New York University Ph.D.). Co-mentored by Gunnar Martinsson. Peter O'Donnell Jr. Postdoctoral Fellow in Oden Institute. September 2025-present.
- Julia Lindberg (University of Wisconsin-Madison Ph.D.). Bing Instructor in Department of Mathematics. January 2023-July 2025. *First placement: Tenure-*

Track Assistant Professor in Department of Mathematics, Georgia Institute of Technology.

- João Pereira (Princeton University Ph.D.). Co-mentored by Rachel Ward. Postdoctoral Fellow in Oden Institute. January 2021-May 2022. *First placement: Tenure-Track Assistant Professor at Instituto de Matemática Pure e Aplicada, Brazil.*

Graduate Students

- Mina Parast, Math Ph.D. student. Sole advisor. Start of 4th year. Topics: multimarginal optimal transport, low-rank methods, representation learning.
- Michael Liu, Oden Ph.D. student. Sole advisor. Start of 3rd year. Topics: equivariant machine learning, applications of invariant theory to constitutive modeling.
- Gabriel Brown, Oden Ph.D. student. Sole advisor. Has passed candidacy talk and is filing official paperwork for candidacy. Start of 5th year. Topics: tensor decomposition, ill-posedness, data compression for scientific simulations.
- Paulina Hoyos, Math Ph.D. candidate. Sole advisor. Start of 6th year. Won UT Continuing Fellowship AY 24-25. Topics: manifold learning under group actions, tensor-structured linear systems, t-product, applications to cryo-ET.
- Adriana Duncan, Math Ph.D. student. Sole advisor. Graduated in 5 years. Topics: higher-order group synchronization, applications to computer vision and cryo-EM. Won Frank Gerth III Outstanding Dissertation Award. *First placement: Data Scientist at Samsung Austin Semiconductor.*
- Yifan Zhang, Oden Ph.D. candidate. Sole advisor. Graduated in 6 years. Won UT Continuing Fellowship AY 24-25. Topics: tensor decomposition, method of moments, randomized dimension reduction of real algebraic varieties. *First placement: Quantitative Researcher at Citadel Securities company.*
- Elzbieta Polak, Math Ph.D. graduate. Sole advisor. Graduated in 6 years. Topics: discriminants in polynomial optimization, applications to image processing and training neural networks. *First placement: Data Scientist at Travelers company.*
- George Torres, Math Ph.D. graduate. Co-advised by Ngoc Tran (main advisor). Graduated in 6 years. Topics: tropical geometry to model ReLU neural networks and optimization of polytopes. *First placement: Research Scientist at Striveworks company.*

Undergraduate Students

- Lohit Jagarapu. Second reader on senior thesis in Department of Mathematics. Topics: generative modeling over functional maps. *First placement: Ph.D. Student in Computer Science at Courant Institute, New York University.*

- John Breedis. Second reader on scientific computing certificate at Oden Institute. Topics: approximation theory and neural networks. *First placement: M.Eng. Student in Computational Science and Engineering at Harvard University.*
- Bryan Doan. Advisor on scientific computation and data sciences certificate at Department of Statistics and Data Science. Topics: 3-D steerable principal component analysis. *First placement: Industry.*
- Bronson Zhou. Advisor of summer research at Department of Mathematics. Won Babuška scholarship. Topics: fast transforms, computing with molecules. *First placement: Ph.D. Student in Statistics and Data Science at Yale University.*
- Eitan Levin. Co-advisor on undergraduate thesis at Princeton University. Topics: numerical optimization on varieties. Won thesis prize (Princeton). *First placement: Ph.D. Student in Applied and Computational Mathematics at California Institute of Technology.*
- Changshuo Liu. Co-advisor on undergraduate thesis at Princeton University. Topics: method of moments, cryo-EM. Won thesis prize (Princeton). *First placement: Quantitative Financial Researcher at GTS company.*