R. Amzi Jeffs
Curriculum Vitae

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Affiliation: Carnegie Mellon University, Department of Mathematics
Citizenship: United States and Canada, dual citizen

Research Interests

Combinatorics, discrete and convex geometry. Applications of geometric and topological techniques to combinatorial problems. Combinatorics of polytopes, matroids, and simplicial complexes.

Education

PhD Mathematics, University of Washington. 2021.
Thesis "Morphisms, Minors, and Minimal Obstructions to Convexity of Neural Codes" advised by Isabella Novik.

BA Mathematics, Harvey Mudd College, with high distinction and honors. 2016.
Thesis "Convexity of Neural Codes" advised by Mohamed Omar and Nora Youngs.

Employment

2021-present **NSF Postdoctoral Fellow**, Carnegie Mellon University.

Honors and Grants

2021-24 **NSF Postdoctoral Fellowship**
2021 **NSERC Postdoctoral Fellowship**
(Declined in order to accept NSF fellowship.)
2018-21 **NSF Graduate Research Fellowship**
2020 **Phelps Award for Research Excellence**
University of Washington Mathematics Department award.
2019 **SIAM Travel Award**
2019 **FPSAC Travel Funding Award**
2016 **Chavin Prize for Outstanding Mathematics Thesis**
Harvey Mudd College Mathematics Department award.

Papers (* indicates undergraduate coauthor)

20. **Embedding dimension gaps in sparse codes**
with Henry Siegel*, David Staudinger*, and Yiqing Wang*. Preprint. Available at
https://arxiv.org/abs/2309.14862. 2023.

19. **Quantitative upper bounds on the Gromov–Hausdorff distance between spheres**
with Michael Harrison. Preprint. Available at https://arxiv.org/abs/2309.11237. 2023.

18. **Distances between realizations of order types**
with Boris Bukh. Submitted. Available at https://arxiv.org/abs/2309.02588. 2023.

17. **Gromov-Hausdorff distances, Borsuk-Ulam theorems, and Vietoris-Rips complexes**
with Henry Adams, Johnathan Bush, Nate Clause, Florian Frick, Mario Gómez, Michael Harrison, Evgeniya Lagoda, Sunhyuk Lim, Facundo Mémoli, Michael Moy, Nikola Sadovek, Matt Superdock, Daniel Vargas, Qingsong Wang, and Ling Zhou.
Submitted. Available at https://arxiv.org/abs/2301.00246. 2023.

16. **Realizing convex codes with axis-parallel boxes**
    with Miguel Benitez*, Siran Chen*, Tianhui Han*, Kinapal Paguyo*, and Kevin A. Zhou*.
    Involve, a Journal of Mathematics (accepted). 2023.

15. **Planar convex codes are decidable**
    with Boris Bukh.
    SIAM Journal on Discrete Mathematics. 2023.

14. **Recognizing and realizing inductively pierced codes**
    with Ryan Curry*, Nora Youngs, and Ziyu Zhao*.
    Journal of Computational Geometry. 2022.

13. **Colorful words and d-Tverberg complexes**
    with Florian Frick.
    Combinatorial Theory (accepted). 2023.

12. **Decompositions of augmented Bergman complexes**
    Electronic Journal of Combinatorics. 2022.

11. **Enumeration of interval graphs and d-representable complexes**
    with Boris Bukh.
    Israel Journal of Mathematics (accepted). 2023.

10. **Open, closed, and non-degenerate embedding dimensions of neural codes**
    Discrete & Computational Geometry. 2022.

9. **Order-forcing in neural codes**
    with Caitlin Lienkaemper and Nora Youngs. Submitted.
    Available at `https://arxiv.org/abs/2011.03572`. 2020.

8. **Non-monotonicity of closed convexity in neural codes**
    with Brianna Gambacini*, Sam MacDonald*, and Anne Shiu.
    Vietnam Journal of Mathematics (issue dedicated for B. Sturmfels' 60th birthday). 2021.

7. **Embedding dimension phenomena in intersection complete codes**
    Selecta Mathematica, Vol 28(1). 2021.

6. **Sunflowers of convex open sets**
    Advances in Applied Mathematics, Vol 111, Article 101935. 2019.

5. **Convex union representability and convex codes**
    with Isabella Novik.
    International Mathematics Research Notices. 2019.

4. **Morphisms of neural codes**
    SIAM Journal on Applied Algebra and Geometry, Vol 4(1), 99–122. 2020.

3. **Homomorphisms preserving neural ideals**
    with Mohamed Omar and Nora Youngs.
    Journal of Pure and Applied Algebra, Vol 222(11), 3470-3482. 2018.

2. **Sparse neural codes and convexity**
    with Mohamed Omar, Natchanon Suaysom, Aleina Wachtel, and Nora Youngs.
    Involve, a Journal of Mathematics, Vol 12(5), 737-754. 2019.

1. **Characterizing the cryptographic properties of reactive 2-party functionalities**
    with Mike Rosulek.
    Theory of Cryptography Conference, 2013.

Teaching (Courses as instructor of record)

2023   **Discrete Mathematics** at Carnegie Mellon University.
Introductory course in enumerative combinatorics and graph theory. 40 students.

2023   **Integration and Approximation** at Carnegie Mellon University.
Second course in calculus sequence. Managed a team of three teaching assistants and one grader, and coordinated course with two other lecture sections. 90 students.

2022   **Differential and Integral Calculus** at Carnegie Mellon University.
Introductory calculus course. Managed and trained four first-time teaching assistants, and one first-time grader. 150 students.

2020   **Matrix Algebra** at University of Washington, Seattle.
A first course in linear algebra. Met regularly with fellow instructors and faculty to coordinate, develop materials, and discuss teaching practices. 50 students.

2019   **Math in Society** at Cornish College of the Arts.
Developed math curriculum from scratch for undergraduate art students highlighting connections between math and society. 22 students.

2018   **Math in Society** at Washington Corrections Center for Women.
Co-taught with a fellow graduate student through Freedom Education Project Puget Sound, a program that provides accredited college courses for incarcerated students at the Washington Corrections Center for Women. 8 students.

Advising and Mentoring

2023   **Project advisor: Summer Experiences in Mathematical Sciences (SEMS)**
Led team of three undergraduate students in eight week research project on discrete geometry at Carnegie Mellon University. Project culminated in a paper "Embedding dimension gaps in sparse codes" currently in preparation.

2022-23   **Masters thesis advisor**
Advised student Kevin Zhou at Carnegie Mellon University for masters thesis component of honors mathematics degree.

2022   **Project advisor: Summer Experiences in Mathematical Sciences (SEMS)**
Led team of five undergraduates in eight week research project on convex codes at Carnegie Mellon University. Project culminated with a paper "Realizing convex codes with axis-parallel boxes," now accepted to *Involve*. Students presented results at JMM 2023 and at CMU's "Meeting of the Minds," where they received the runner-up prize for best poster.

2022   **Teaching assistant: Geometry and Topology in a Discrete Setting**
Graduate student summer school at Freie Universität, Berlin.

2019   **Mentor: Washington Experimental Mathematics Lab (WXML)**
Assisted undergraduate research project on "higher nerves" and combinatorial geometry. Met twice per week with three students during Spring quarter.

2017-19   **Mentor: Advanced high school student**
Met biweekly to tutor an advanced high school student in mathematics. Covered the basics of combinatorics, abstract algebra, algebraic geometry, and topology.

2018   **Mentor: University of Washington Math Circle**

Talks

Conferences:

2024   **JMM 2024** (upcoming)
Special session on bridging applied and quantitative topology

2024   **JMM 2024** (upcoming)
Special session on extremal and probabilistic combinatorics

2023   **AMS Fall Central Sectional Meeting** (upcoming)
Special session on discrete, algebraic, and topological methods in mathematical biology.
Creighton University.

2023   **Random Structures and Algorithms (RS&A)**
Geometry session. Carnegie Mellon University.

2023   **Canadian Discrete and Algorithmic Mathematics Conference (CanaDAM)**
Minisymposium on Geometric Combinatorics. University of Manitoba and
University of Winnipeg.

2023   **AMS Spring Central Sectional Meeting**
Special session on topological and geometric methods in combinatorics.
University of Cincinnati.

2023   **Algorithms, Combinatorics and Optimization Research Network (ACORN)**
Lightning talks session. Georgia Institute of Technology.

2023   **JMM 2023** contributed session on geometry.

2022   **SIAM Conference on Discrete Mathematics**
Contributed session on discrete geometry. Carnegie Mellon University.

2022   **AMS Spring Eastern Sectional Meeting**
Special session on discrete and convex geometry (virtual).

2021   **AMS Fall Southeastern Sectional Meeting**
Special session on topological methods in discrete mathematics (virtual).

2021   **AMS Fall Central Sectional Meeting**
Special session on geometric and topological combinatorics and their applications (virtual).

2021   **SIAM Conference on Applied Algebraic Geometry**
Minisymposium on algebraic and combinatorial methods in neural coding.
University of Bern, Switzerland.

2019   **AMS Spring Central and Western Joint Sectional Meeting**
Special session on algebraic and geometric combinatorics. University of Hawaii at Manoa.

2019   **AMS Spring Southeastern Sectional Meeting**
Special session on algebraic and discrete methods in mathematical biology.
Auburn University, Alabama.

Seminars and Colloquia:

2023   **Institute for Basic Science & Korea Advanced Institute of Science and Technology (IBS / KAIST).** Discrete Math Seminar.

2023   **Carnegie Mellon University.** Summer Undergraduate Mathematics Seminar.

2023   **Rutgers University.** Discrete Math Seminar.

2023   **Carnegie Mellon University.** Math Club.

2022   **University of Washington, Seattle.** Combinatorics Seminar.

2022   **Freie Universität, Berlin.** Discrete Geometry and Topological Combinatorics Seminar.

2021   **Pennsylvania State University.** Invited talk (virtual).

2021   **Colby College.** Mathematics Department Colloquium.

2021   **Carnegie Mellon University.** Graduate Student and Postdoc Seminar.

2021	**Carnegie Mellon University.** Algebra, Combinatorics, and Optimization Seminar.
2021	**University of Minnesota.** Graduate Student Combinatorics Conference (virtual).
2021	**University of Kentucky.** Discrete Math Seminar (virtual).
2021	**Graduate Online Combinatorics Colloquium.** (virtual).
2020	**Simon Fraser University.** Operations Research Seminar (virtual).
2020	**Pennsylvania State University.** Invited talk (virtual).
2020	**University of British Columbia.** Discrete Math Seminar (virtual).
2020	**Iowa State University.** Combinatorial Structures and Processes Seminar on Topological Combinatorics (virtual).
2020	**University of Minnesota.** Applied Algebraic Topology Research Network Seminar AATRN (virtual).
2020	**University of California, Davis.** Algebra & Discrete Mathematics Seminar (virtual).
2020	**University of Washington, Seattle.** Combinatorics Seminar.
2019	**Carnegie Mellon University.** Algorithms, Combinatorics, and Optimization Seminar.
2018	**University of Washington, Seattle.** Combinatorics Seminar.
2018	**University of Miami.** Combinatorics Seminar.
2018	**Pennsylvania State University.** Invited talk.

Organizing

2022-24	**Algorithms, Combinatorics, and Optimization Seminar** Carnegie Mellon Unversity.
2023	**Minisymposium on Geometric Combinatorics** Canadian Discrete and Algorithmic Mathematics Conference (CanaDAM). University of Manitoba and University of Winnipeg.
2023	**Special Session on Topological and Geometric Methods in Combinatorics** AMS Spring Central Sectional, University of Cincinnati.
2021	**Minisymposium on Algebraic and Geometric Methods in Combinatorial Neural Coding** SIAM Conference on Applied Algebraic Geometry (SIAM AG21).

Service

	Referee for: *Combinatorial Theory, Combinatorics, Probability and Computing, La Matematica, SIAM Journal on Applied Algebra and Geometry, and SIAM Journal on Discrete Mathematics.*
2022	**Panelist: SIAM Postdoc Panel at CMU**
2021	**Panelist: Graduate Student Labor Organizing** ParaDIGMS Conference on Diversity in Graduate Mathematical Sciences.
2018-21	**UAW4121 Union Steward and Head Steward** Organized and facilitated regular union meetings and actions to build a stronger UW community and improve campus for all students, workers, and faculty. Participated on a weekly basis in our union's Organizing Committee, Housing Justice Workgroup, Bargaining Team, and Joint Council.
2018	**Judge: University of Washington Math Hour Olympiad**

Professional Development

Year	
2023	**Teaching in Practice Seminar** at Carnegie Mellon University
2021	**"Designing Inclusive Undergraduate Research at Scale"** Four-week workshop facilitated by the Eberly Center for Teaching Excellence and Educational Innovation at Carnegie Mellon College.
2019	**Cornish College of the Arts Faculty Development Workshops** Three days of intensive faculty trainings on curriculum design and pedagogy.
2019	**"Teaching and Learning in Higher Education"** University of Washington graduate course.
2019	**Conference on Formal Power Series and Combinatorics** University of Ljubljana, Slovenia.
2019	**Summer School on Algebraic and Geometric Combinatorics** Sorbonne Université, Paris.
2019	**"Breaching Borders: Intersectional Pathways Towards Equity and Justice"** University of Washington graduate course on equity in higher education.