SEAN GRATE

Address:	Department of Mathematics 221 Parker Hall Auburn University, AL 36849 USA	Office: Email: Website: GitHub:	122H Parker Hall sean.grate@auburn.edu seangrate.com https://github.com/TheGrateSalmon

EDUCATION

Auburn University, Auburn August 2020 –Present
Ph.D. candidate, Mathematics
Advisor: Hal Schenck
Dissertation Title: *Problems in Computational Algebraic Geometry: Lefschetz Properties and Toric Varieties*

University of Kentucky, Lexington August 2016 –May 2020
B.S. in Mathematics with minors in History and Classics, *cum laude*

PROFESSIONAL EXPERIENCE

Auburn University Department of Mathematics and Statistics August 2020–Present
Graduate Teaching Assistant

University of Kentucky Department of Computer Science May 2019–August 2020
Undergraduate Research Assistant
Researched topics in computer vision under the guidance of Dr. Nathan Jacobs at the University of Kentucky. Used traditional machine learning techniques to estimate flight paths of planes capturing LiDAR data across all of Kentucky, and used deep learning to obtain arbitrary resolutions of point cloud data.

PUBLICATIONS

[4] Ayah Almousa, Shiliang Gao, Sean Grate, Daoji Huang, Patricia Klein, Adam LaClair, Yuyuan Luo, and Joseph McDonough. "The MatrixSchubert package for Macaulay2". *Journal of Software for Algebra and Geometry* (2025), to appear. arXiv: 2312.07393 [math.AG].

[3] Nasrin Altafi, Roberta Di Gennaro, Federico Galetto, Sean Grate, Rosa M. Miró-Roig, Uwe Nagel, Alexandra Seceleanu, and Junzo Watanabe. "Betti numbers for connected sums of graded Gorenstein Artinian algebras". *Trans. Amer. Math. Soc.* 378.2 (2025), pp. 1055–1080. ISSN: 0002-9947,1088-6850. DOI: 10.1090/tran/9286. URL: https://doi.org/10.1090/tran/9286.

[2] Sean Grate and Hal Schenck. "Betti tables forcing failure of the weak Lefschetz property". *Lefschetz properties—current and new directions*. Vol. 59. Springer INdAM Ser. Springer, Singapore, [2024] ©2024, pp. 155–164. ISBN: 978-981-97-3885-4; 978-981-97-3886-1. DOI: 10.1007/978-981-97-3886-1_8. URL: https://doi.org/10.1007/978-981-97-3886-1_8.

[1] Hunter Blanton, Sean Grate, and Nathan Jacobs. "Surface Modeling for Airborne Lidar". *IGARSS 2020 - 2020 IEEE International Geoscience and Remote Sensing Symposium*. 2020, pp. 1110–1113. DOI: 10.1109/IGARSS39084.2020.9323522.

PREPRINTS

[4] Haile Gilroy, Sean Grate, and Melinda Lanius. "Graph Theoretic Reflection to Foster Alignment in Coordinated Courses". *International Journal of Mathematical Education in Science and Technology* (2024). Positive referee reports, now in revision.

[3] Nicholas Gaubatz, Sean Grate, and Haile Gilroy. "Minimal Out-Neighborhoods in the F-Lattice". In preparation.

[2] Sean Grate. "Castelnuovo-Mumford Regularity of Toric Surfaces". In preparation.

[1] Herman Chau, Spencer Daugherty, Sean Grate, J. Carlos Martínez Mori, and Anna Pun. "The combinatorics of stable Tamari posets". In preparation.

AWARDS AND HONORS

- Auburn University DMS Baskervill Endowed Mathematics Fellowship 2024
- Auburn University DMS Teaching Citation Award 2022, 2024
- Auburn University DMS Bennett Fellowship 2023
- Auburn University DMS Research Citation Award 2021, 2022
- Auburn University COSAM Outstanding GTA Award 2022
- Best Presentation at UK Computer Science Summer Research Program August 9th, 2019
- University of Kentucky Dean's List Multiple semesters 2016-2020
- Kentucky Educational Excellence Scholarship (KEES) ($2,225 per year) 2016-2020
- University of Kentucky Provost Scholarship ($1,500 per year) 2016-2020

TEACHING EXPERIENCE

- Instructor of Record
  - MATH 1610 Calculus I Spring 2022
  - MATH 1120 Precalculus Algebra Fall 2021
- Recitation Leader
  - MATH 1610 Calculus I Fall 2022, Spring 2023, Fall 2023
  - MATH 1620 Calculus II Spring 2024, Fall 2024
- Tutor
  - MATH 1120 Precalculus Algebra
  - MATH 1610 Calculus I
  - MATH 1620 Calculus II
  - MATH 1680 Business Calculus I

CONFERENCE TALKS

- "Combinatorial bounds on the Castelnuovo-Mumford regularity of toric surfaces", Mathematical Conference of the Americas, July 2025
- "Castelnuovo-Mumford regularity of toric surfaces", SIAM Conference on Applied Algebraic Geometry, July 2025

- "Combinatorial bounds on the Castelnuovo-Mumford regularity of toric surfaces", AWM Research Symposium, May 2025
- "Castelnuovo-Mumford regularity of toric surfaces", Joint Mathematics Meeting, January 2025
- "Castelnuovo-Mumford regularity of toric surfaces", AMS Fall Central Sectional, September 2024
- "Betti tables forcing failure of the Weak Lefschetz Property", Combinatorial Algebra meets Algebraic Combinatorics (CAAC), January 2024
- "Betti tables forcing failure of the Weak Lefschetz Property", Workshop on Lefschetz Properties in Algebra, Geometry, Topology and Combinatorics, May 2023

SEMINAR TALKS

- "Combinatorial bounds on the Castelnuovo-Mumford regularity of toric surfaces", Virtual, Syzygies and Mirror Symmetry Seminar, February 2025
- "Betti tables forcing failure of the weak Lefschetz property", University of Nebraska-Lincoln, Commutative Algebra Seminar, October 2024
- "Betti tables and Lefschetz properties, University of Nebraska-Lincoln, Commutative Algebra Reading Seminar, October 2024
- "Betti numbers of connected sums of graded Artinian Gorenstein algebras", Purdue University, Commutative Algebra Seminar, October 2024
- "Betti tables forcing failure of the weak Lefschetz property", Purdue University, Student Commutative Algebra Seminar, October 2024
- "Betti tables and Lefschetz properties", University of Kentucky Algebra Seminar, November 2023
- "Lefschetz properties and Artinian rings", McNeese State University Math Seminar, November 2023
- Auburn University
  - "The stable Tamari lattice", Discrete Math Seminar, November 2024
  - "Betti numbers of connected sums of graded Artinian Gorenstein algebras", Algebra Seminar, September 2024
  - "How-To: Making a website", Graduate Student Seminar, August 2024
  - "Betti tables and Lefschetz properties", Algebra Seminar, February 2024
  - "Suturing the severed didactic tetrahedron: Graph-Theoretic reflection to foster alignment in coordinated courses", Auburn University DBER Seminar, February 2024
  - "Leveraging software for mathematics and graduate school", Graduate Student Seminar, September 2023
  - "A brief introduction to tropical geometry", Graduate Student Seminar, August 2022
  - "An overview of topological data analysis", Math Club, February 2022
  - "A brief introduction to tropical geometry", Algebra Seminar, November 2021
  - "Computations in topological data analysis", Graduate Algebra Seminar, August 2021
  - "Tropical algebra", Graduate Algebra Seminar, July 2021
  - "Geometry in noncommutative algebra", First Year Graduate Student Seminar, January 2021
  - "What/Why/How of neural networks", First Year Graduate Student Seminar, November 2020

POSTER PRESENTATIONS

- "Castelnuovo-Mumford regularity of toric surfaces", Mid-Atlantic Algebra, Geometry, and Combinatorics (MAAGC) Workshop, March 2025
- "Castelnuovo-Mumford regularity of toric surfaces", Combinatorial Algebra meets Algebraic Combinatorics (CAAC), January 2025
- "Betti numbers of connected sums of graded Artinian Gorenstein algebras", UweFest, August 2024
- "Betti tables forcing failure of the weak Lefschetz property", BrianFest, August 2023

CONFERENCES AND WORKSHOPS ATTENDED

- Mathematical Congress of the Americas — July 2025
- SIAM Conference on Applied Algebraic Geometry — July 2025
- Collaborate@ICERM — June 2025
- Workshop on Weak and Strong Lefschetz Properties Across Mathematics — June 2025
- AWM Research Symposium — May 2025
- Meetings in Applied Algebraic Geometry (MAAG) — April 2025
- Macaulay2 Workshop — April 2025
- Commutative Algebra in the South (CATS) — April 2025
- Mid-Atlantic Algebra, Geometry, Combinatorics (MAAGC) — March 2025
- CA+ — March 2025
- Combinatorial Algebra meets Algebraic Combinatorics (CAAC) — January 2025
- Apprenticeship Program in Commutative Algebra — January 2025
- Joint Mathematics Meetings — January 2025
- AMS Fall Central Sectional Meeting — September 2024
- UweFest — August 2024
- AMS MRC on Algebraic Combinatorics — June 2024
- Computational Algebraic Geometry and String Theory — June 2024
- JM Invariant at 60 — May 2024
- Combinatorial Algebra meets Algebraic Combinatorics (CAAC) — January 2024
- SIAM Texas-Lousiana Sectional Meeting — November 2023
- BrianFest — August 2023
- Macaulay2 Week — June 2023
- SLMath Commutative Algebra Summer School — May 2023
- Workshop on Lefschetz Properties in Algebra, Geometry, Topology and Combinatorics — May 2023
- Commutative Algebra in the South (CATS) — April 2023
- SLMath Tropical Geometry Summer School — August 2022

SERVICE

- President of the Mathematics Club at Auburn University — 2021-2024
- Secretary for the Auburn University DMS Graduate Student Council — August 2022-August 2023
- Graduate Student Representative on the Auburn University DMS Graduate Student Council — August 2021-August 2023

OUTREACH

- Destination STEM — October 2022, October 2023
- Auburn Mathematical Puzzle Challenge (AMP'd) — November 2022
- University of Kentucky Math Club — 2016-2020
- Expanding Your Horizons workshop mentor — 2019
- Julia Robinson Math Festival volunteer — 2019

TECHNICAL STRENGTHS

Software & Tools	Python, Macaulay2, PyTorch, SageMath
Macaulay2 Packages	MatrixSchubert, Permutations