Mitchell Tyler Scott

Curriculum Vitae

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Contact Information

Department of Mathematics
Emory University
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Education

Emory University, Atlanta, Georgia, USA
Ph.D., Department of Mathematics, expected in May 2028
M.S., Department of Computer Science, expected in May 2028
Advisor: Professor Yuanzhe Xi
Tenative thesis title: Data-driven Preconditioners for Data Science Problems

Tufts University, Medford, Massachusetts, USA
M.S., Department of Mathematics, May 2023
Advisors: Professor Misha Kilmer, Professor Xiaozhe Hu
Thesis: A Tale of Two Tensors: Using Hierarchical and Block Low Rank Matrices to Make Preconditioners and Save Storage

Cornell University, Ithaca, New York, USA
B.S., Department of Biological Engineering, December 2020
Minors: Pure Mathematics, Applied Mathematics
Thesis: Designing and Optimizing a Protocol for Whole-Ovary Vitrification

Research Interests

Numerical Linear Algebra

High Performance Scientific Computing

Preconditioners for Data Science and Scientific Applications

Publications

Journal Papers:

1. M.T. Scott, T. Xu, Z. Tang, A. Pichette-Emmons, Q. Ye, Y. Saad, and Y. Xi, *Designing Preconditioners for SGD: Local Conditioning, Noise Floors, and Basin Stability* [arXiv]

Peer Reviewed Teaching Activities:

1. M.T. Scott (2025) *Markov Chains in Public Transportation*, Submitted October 7, 2025, Accepted October 26,2025, from https://serc.carleton.edu/309394

On-going research

Structured matrices, arising from the abstraction of real world physical systems modelled by discretized partial differential equations, are prevalent in fluid dynamics, computational finance, and image processing. Current ways to store and solve problems using these matrices can be slow. My current research is interested in expointing hidden structure so that we can construct robust and novel approximations of the Hessian to be used in nonlinear preconditioning for scientific and machine learning problems. More technical research topics include: iterative methods, multilinear algebra, tensor-based decomposition, fractional and nonlinear PDEs, and preconditioning.

Conferences, Workshops and Talks

Invited Talks:

1. *Learning LaTeXfor Homeworks and Presentations: An Introduction for REU Students*: Emory REU 2025, Atlanta, GA, June 18, 2025.
2. *Discovering Hierarchical Matrix Structure Through Recursive Tensor Decomposition*: Joint Mathematics Meeting, Boston, MA, January 4, 2023.

Contributed Talks:

1. *Preconditioning Stochastic Gradient Descent: Theoretical Guarantees & Novel Framework*, Southeast Applied and Computational Math Student Workshop, Auburn, AL, April 5, 2025.

2. *Preconditioning Stochastic Gradient Descent: Theoretical Guarantees & Novel Framework*, Atlanta SIAM Student Conference, Atlanta, GA, March 28, 2025.

3. *Constructing Hierarchical Matrices through Recursive Tensor Decomposition*, Conference on Fast Direct Solvers, West Lafayette, IN, November 4, 2023.

Contributed Posters:

1. *Accelerating and Stabilizing SGD via Preconditioning: A Unified Analysis.* Learning about Laney Showcase, Emory University, Laney Graduate School, Atlanta, GA, Sept 29, 2025.

2. *Accelerating Multigrid Prolongation via Bipartite Graph Attention Netowrks.* Summer Student Showcase, Lawrence Livermore National Lab, Livermore, CA, August 6, 2024

3. *Fisher-informed Nonlinear Truncated Generalized Conjugate Residual Optimizer.* Georgia Scientific Computing Symposium, GSCS 25, Atlanta, GA, February 8, 2025

4. *Acceleration Methods for Scientific and Data Science Applications.* SIAM Mathematics of Data Science, SIAM MDS 24, Atlanta, GA, October 25, 2024

5. *Quantized Tensor Trains for Solving Maxwell's Equations with Spectral Methods.* Computing Sciences Poster Session, Berkeley Lab, Berkeley, CA, August 6, 2024

Student Seminar Talks:

1. *All Aboard the Tensor Train: Using Spectral Methods in the Tensor Train Framework to solve Maxwell's Equation*, Emory University Discussions in Scientific Computing, Atlanta, GA, February 24, 2025.

2. *All Aboard the Tensor Train: Using Spectral Methods in the Tensor Train Framework to solve Maxwell's Equation*, Tufts University SIAM Seminar, Medford, MA, February 19, 2025.

3. *Integration over Lie Groups, with applications to random matrix theory*, Emory University Reseach in Algebra and Number Theory, Atlanta, GA, April 11, 2024.

4. *A Tale of Two Tensors: Using Hierarchical and Block Low Rank to Make Preconditioners and Save Storage*, Emory University Discussions in Scientific Computing, Atlanta, GA, October 6, 2023.

5. *It's Tensor Time!: A Computational Framework for Analyzing Structured Matrices*, Tufts University Monday Math Meeting, Medford, MA, September 12, 2022.

6. *Representation Schemas for Visualizing Quantum Algorithms*, Tufts University Quantum Computing Reading Group, Medford, MA, April 11, 2022.

7. *Special Families of Matrices used in Quantum Algorithms*, Tufts University Quantum Computing Reading Group, Medford, MA, February 28, 2022.

Workshops and Conferences Attended

1. Randomized Numerical Linear Algebra, ICERM, Brown University, Providence, RI, Feb. 2-6, 2026.

2. Teaching Computation with MATLAB (and GenAI), SERC, Carleton College, Northfield, MN, October 26-28, 2025.

3. Randomized Numerical Linear Algebra Research Collaboration Workshop, IPAM, Los Angeles, CA, August 10-16, 2025.

4. Southeast Applied and Computational Math Student Workshop '25, Auburn University, Auburn, AL, April 5-6, 2025.

5. Georgia Scientific Computing Symposium '25, Georgia Institute of Technology, Atlanta, GA, February 8, 2025.

6. SIAM Mathematics of Data Science, MDS 25, Atlanta, GA, October 21-25, 2024.

7. Georgia Scientific Computing Symposium '24, Emory University, Atlanta, GA, February 24, 2024.

8. Conference on Fast Direct Solvers, Purdue University, West Lafayette, IN, November 4-5, 2023.
9. Acceleration and Extrapolation Methods, ICERM, Providence, RI, July 24-28, 2023.
10. Qiskit Global Summer School 2023: Theory to Implementation, IBM, July 17-28, 2023.
11. Joint Mathematics Meetings, Boston, MA, January 4-7, 2023.
12. Geometry and Analysis Seminar for Boston Area Graduate Students, Massachusetts Institute of Technology, Cambridge, MA, October 29-30, 2022.
13. Qiskit Global Summer School 2022: Quantum Simulations, IBM, July 18-29, 2022.
14. Geometry and Analysis Seminar for Boston Area Graduate Students, Massachusetts Institute of Technology, Cambridge, MA, November 6-7, 2021.

Research Experience

Lawerence Livermore National Laboratory - Livermore, CA

Visiting Graduate Student Researcher: May 2025 - September 2025

Lawerence Berkeley National Laboratory - Berkeley, CA

Visiting Graduate Student Researcher: May 2024 - August 2024

Teaching Experience

Emory University

Instructor of Record

- Math 190 - Mathematics of Sustainability (Spring 2026)
- Math 111 - Calculus I (Fall 2025)

Teaching Assistant

- Math 210 - Advanced Calculus for Data Science (Spring 2025): **Head TA**
- Math 210 - Advanced Calculus for Data Science (Fall 2024)
- Math 315 - Numerical Analysis (Spring 2024)

Directed Reading Program Mentor

- Advanced Game Theory: Algorithms and Voting Systems (Fall 2025)
- Introduction to Stochastic Calculus (Spring 2025)
- Introduction to Functional Analysis and Finite Elements (Fall 2024)
- Introduction to Stochastic Processes (Spring 2024)
- Introduction to Iterative Methods for Inverse Problems (Fall 2023)
- Introduction to Stochastic Processes (Fall 2023)

Course Assistant

- Math 351 - Partial Differential Equations (Fall 2023)

Tufts University

Teaching Assistant

- Math 126 - Numerical Linear Algebra (Spring 2023)

Directed Reading Program Mentor

- Introduction to Mathematical Control Theory (Fall 2022)

Course Assistant

- Math 125 - Numerical Analysis (Fall 2022)
- Math 32 - Calculus I (Spring 2022)

Cornell University

Undergraduate Teaching Assistant

- BEE 2600 - Introduction to Biological Engineering (Fall 2018)

Honors and Awards	**Summer Student Showcase Top Presenter**, Lawrence Livermore National Laboratory, Data Science Institute, 2025.
	Summer Research Presentation Superlative, Sustainable Horizons Institute, 2024.
	Piedmont Teaching Fellowship in Sustainability and Curriculum Development, Emory University, $1,000 for AY 2024 - 2025, 2025 - 2026.
	Research Conference Presenter Grant, Tufts University, Graduate School of Arts and Science, $600 for AY 2022 - 2023
	Department of Mathematics Scholarship, Tufts University, $20,000 for AY 2022 - 2023
	The Fuertes Medal Memorial Prize for Public Speaking, Cornell University, College of Engineering, $3,000 for AY 2019 - 2020.
Memberships	American Mathematical Society (AMS)
	Society for Industrial and Applied Mathematics (SIAM)
	Spectra!
Departmental Service	Officer: Directed Reading Program Steering Committee, Emory University, 2023 - Present
	Risk Manager: SIAM Chapter, Emory University, 2025 - Present
STEM Outreach	American Mathematics Competition (AMC-8) Site Coordinator
	Mary STEAM
Language Skills	English: native speaker
	Programming: Matlab, Julia, Python, C/C++
	Computer: LaTeX, Microsoft Office, HTML, CSS