EMILY SAUNDERS

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EDUCATION

Columbia University — New York, NY
PhD in Mathematics — *September 2019 - May 2025*

Completed a PhD in persistent homology, a subfield of topological data analysis. Research focused on constructing a generalization of persistent homology methodology to zig-zag bifiltrations.

Harvard University — Cambridge, MA
BA in Mathematics — *September 2015 - June 2019*

Graduated *magna cum laude* with highest honors in mathematics. GPA 3.89. Recipient of the Herb Alexander Award for an outstanding undergraduate in the Department of Mathematics.

Relevant Courses

Web Programming with Python and JavaScript, User Interface Design, Artificial Intelligence, Machine Learning, Graduate Analysis & Probability I, Graduate Probability II, Analysis of Algorithms.

PROJECTS

Shoe Tracker
Independent — *May 2025 - June 2025*

· Developed a web application where users keep track of their preferred running shoes. Implemented with a React frontend, Django REST framework API backend, and PostgreSQL database.

Colorpedia
Columbia University — *April 2024 - May 2024*

· Developed a web application for learning color theory terminology as part of a final project for the User Interface Design course at Columbia University. Implemented with a React frontend, Flask backend, and SQLite database. Designed a responsive user-friendly interface with Bootstrap framework. Deployed at colorpedia.net.

PhD Dissertation
Columbia University — *September 2021 - April 2025*

· Wrote a PhD dissertation on a generalization of multi-parameter persistent homology indexed over the product poset $\mathcal{Z} \times \mathbb{R}$. Main contributions included defining a metric on the space of $\mathcal{Z} \times \mathbb{R}$ persistence modules, proving stability with respect to the Gromov-Hausdorff distance on compact metric spaces, proving convergence of $\mathcal{Z} \times \mathbb{R}$ persistence modules obtained via bootstrap resampling, constructing invariants on the space of $\mathcal{Z} \times \mathbb{R}$ persistence modules, and adapting Gromov-Prokhorov stability results for density-sensitive bifiltrations to the zig-zag setting.

Undergraduate Thesis
Harvard University — *June 2018 - March 2019*

· Wrote an undergraduate thesis advised by Professor Michael J. Hopkins on the Smale-Hirsch theorem in differential topology, based primarily on *Immersion Theory for Homotopy Theorists* by Michael Weiss.

WORK EXPERIENCE

MetLife Legal Plans — Remote
Full Stack Web Development Intern — *November 2023 – May 2024*

- Contributed to the development and maintenance of internal tools built with React and Django in a production-scale web application.
- Fixed UI and backend bugs in collaboration with senior developers, gaining hands-on experience with issue tracking, Git workflows, and code review processes.

Columbia University New York, NY
PhD Candidate - Advisor: Andrew J. Blumberg *September 2019 - May 2025*

- Developed expertise in probability theory and persistent homology through 2 years of coursework and preparation for qualifying exams.
- Researched generalizations of persistent homology methods used in topological data analysis.
- Presented in seminars on topics including ∞-category theory, stable homotopy theory, and persistent homology.

Columbia University New York, NY
Instructor *September 2020 - May 2025*

- Taught the following courses: Calculus III (Summer 2023), Calculus II (Summer 2022), College Algebra and Analytic Geometry (pre-calculus) (Fall 2021).
- Led 3 undergraduate seminar courses on Combinatorics (Spring 2022), *The Probabilistic Method* by Alon and Spencer (Spring 2021) and Category Theory (Fall 2020). Responsibilities included developing curriculum, preparing students for their talks and lecturing.
- Served as teaching assistant for Modern Analysis (Spring 2025), Calculus III (Fall 2024), Analysis and Optimization (Spring 2024), Linear Algebra (Fall 2023, Spring 2023, Fall 2022, Summer 2021), and Calculus I (Summer 2021).

TECHNICAL SKILLS

Programming Languages	Python, JavaScript
Web Development	HTML5, CSS3, React, Django, Flask, Bootstrap
Tools & Frameworks	Git, GitHub