NOAH J. BERGAM

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EDUCATION

COLUMBIA UNIVERSITY   **New York, NY**

Ph.D. in Computer Science. Advisors: Andrew Blumberg and Daniel Hsu.   2024 - present

M.S. in Computer Science, en route to PhD.   2024 - 2025

B.A. in Mathematics, with honors, summa cum laude.   2021 - 2024

PUBLICATIONS

Interests: foundations of machine learning; automated structure discovery (clustering, dimension reduction).

1. A k-means Approach to Trajectory Inference.
   N. Bergam, A. Blumberg, and D. Hsu.
   In Progress, 2025.

2. t-SNE Exaggerates Cluster Structure, Provably.
   N. Bergam, S. Snoeck, and N. Verma.
   In Submission, 2025.

3. Compressibility Barriers to Neighborhood-Preserving Data Visualizations.
   S. Snoeck, **N. Bergam**, and N. Verma.
   In Submission, 2025.

4. clusterSC: Advancing Synthetic Control with Donor Clustering for Disaggregate-Level Data.
   S. Rho, A. Tang, **N. Bergam**, R. Cummings, and V. Misra.
   AISTATS 2025.

5. On Manifold Dimension Estimation.
   N. Bergam and A. Blumberg.
   Columbia Journal of Undergraduate Mathematics (CJUM) 2025.

6. Legal and Political Stance Detection of SCOTUS language.
   N. Bergam, E. Allaway, and K. McKeown.
   Natural Legal Language Processing Workshop EMNLP 2022.

7. Designing and Simulating a Smart Air Purifier to Combat HVAC-induced COVID-19 Transmission.
   N. Bergam, L. Chen, S. Lende, S. Snow, J. Zhang, M. DiBuono, and N. Calzaretto.
   MIT IEEE Undergraduate Research in Technology Conference 2020. [Won Best Lightning Talk]

HONORS

- Passed Exam P (Probability) and Exam FM (Financial Mathematics), 2025 (towards an SOA ASA actuary certification).
- John Dash van Buren Mathematics Prize (2024), i.e. top senior thesis in Columbia graduating class.
- Phi Beta Kappa (2024).
- Van Amringe Mathematical Prize (2023), i.e. top-four scorer on Columbia Math Prize Exam.
- Two-time NSF REU participant (2021, 2023).
- Best in Data Science and Society at Columbia Undergrad CS and Data Science Fair (2022).
- National Merit Scholarship Finalist (2021). National AP Scholar (2021).
- High school valedictorian (2021).

GRANT & RESEARCH EXPERIENCE

[Mathematics Honors Thesis] Manifold Dimension Estimation .   New York, NY

Columbia Mathematics Department. Advisor: Andrew Blumberg.   Fall 2023 - Spring 2024

- Wrote a detailed review of algorithms, complexity results, and data science applications for intrinsic dimension estimation of point cloud data sampled i.i.d. from a smooth manifold.

[NSF REU Project] Adaptive Triangulation for Geostatistics   Medford, MA

Tufts Mathematics Department, Data Intensive Studies Center. Advisor: Abani Patra.   Summer 2023 - Present

- Tested and analyzed a new "adaptive triangulation" scheme for altimetry modeling of the Greenland ice sheet.
- Published lecture notes on the mathematics of regression, in collaboration with NSF-funded Glaciology Hub.

[Pritzker-Pucker Fund] Robustness of t-SNE and Graph Visualization   New York, NY

Columbia Computer Science. Advisor: Nakul Verma.   Spring 2023 - Present

- Robustness and computational complexity of finding optimal t-distributed stochastic neighbor embeddings (t-SNE).
- Establishing dimension lower bounds for data visualization procedures.

[Funding: Laidlaw Fellowship] NLP-driven Analysis of SCOTUS Oral Arguments   New York, NY

Columbia Computer Science. Advisor: Kathleen McKeown.   Summer 2022

- Used transformer-based language models to track the political stance expressed in Supreme Court transcripts.
- Using SCOTUS written opinions, created and trained models on a *legal stance detection* dataset, the first of its kind.

[NSF REU Project] Topological Data Analysis for NLP   New York, NY

Yeshiva University Mathematics Department. Advisor: Marian Gidea.   Summer 2021

- Used persistent homology on Word2Vec word embeddings to construct an author classification model.
- Took mini-courses in change point detection and stochastic interacting particle systems.

WORK EXPERIENCE

Teaching Assistant   New York, NY

Columbia CS Department   Fall 2022 - Present

- Hold office hours, run review sessions, and grade assignments for 10 graduate-level computer science courses.
- Past Courses (+ some student feedback): COMS4232 Analysis of Algorithms, MATH2500 Analysis and Optimization, COMS4771 Machine Learning, COMS4774 Unsupervised Machine Learning, COMS4705 Natural Language Processing, MATH4115 Probability Theory, MATH4041 Modern Algebra I, MATH4041 Modern Algebra II.

Residential Advisor   New York, NY

Columbia Residential Life   Fall 2022 - Spring 2024

- Residential community leader for around 40 undergraduate residents. Regularly on-duty to help handle emergencies and other concerns from residents. Trained to connect students with various campus resources.

NLP Research Engineering Intern   New York, NY

NLMatics Co.   Summer 2022

- Improved state-of-the-art passage retrieval benchmarks using confidence calibration and ensembling. Published results on ArXiv.

ACTIVITIES & SERVICE

Volunteer, Columbia Directed Reading Program   Fall 2024, 2025

Copy Editor, *Introduction to Manifolds* (Third Edition) by Loring Tu.   2023 - 24

Content Editor, Columbia Journal of Undergraduate Mathematics (Volume 1).   2023 - 24

President, Columbia Men's Club Water Polo Team   2022 - 24

Presenter and Member, Columbia Undergraduate Mathematics Society   2021 - 24

- Past talks include: *The Duality of Determinant and Trace* (Summer 2023); *Coins, Partitions, and Generating Functions* (Summer 2022); *Statistical Mechanics Helps Us Count Alternating Sign Matrices* (Fall 2022).