NOAH J. BERGAM

njb2154@columbia.edu • (973) 908-4503 • Website

EDUCATION

COLUMBIA UNIVERSITY   **New York, NY**

Ph.D. in Computer Science. Advised by Andrew Blumberg and Daniel Hsu.   2024 - present

B.A. in Mathematics (with Honors). Summa Cum Laude. Phi Beta Kappa. GPA: 4.14/4.33.   2021 - 2024

THE PINGRY SCHOOL   **Basking Ridge, NJ**

Valedictorian. Senior Class President. Cum Laude. SAT: 1590.   2017 - 2021

PUBLICATIONS
(*) indicates publication in progress

Interests: foundations of machine learning, algorithms for massive data, computational geometry.

(*) **N. Bergam** and A. Ozcan. Second-Order Bounds for Sleeping Experts. 2024.

(*) **N. Bergam**, B. Ottlik, and A. Ozcan. A Sequential Lightbulb Problem. 2024.

N. Bergam and A. Blumberg. On Manifold Dimension Estimation. Columbia Mathematics Senior Thesis. 2024.

(*) **N. Bergam** and N. Verma. On Optimal t-distributed Stochastic Neighbor Embeddings. University of Maryland, College Park, Fall Fourier Talks. Poster Presentation. 2023.

N. Bergam and A. Patra. A Graph-theoretic Approach to Altimetry-based Surface Modeling of the Greenland Ice Sheet. Joint Math Meeting. Poster Presentation. 2024.

N. Bergam. Regression on Ice: Function Approximation for the Mathematically-inclined Glaciologist. The GHub, 2024.

W. Yang, **N. Bergam**, A. Jain, and N. Sheikhoslami. Confidence-Calibrated Ensemble Dense Phrase Retrieval. arXiv:2306.15917. 2023.

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

N. Bergam and T. Kolarov. The Black-Scholes Model in the Context of Econophysics. Parabola Math Journal, University of New South Wales. 2021.

N. Bergam, L. Chen, S. Lende, S. Snow, J. Zhang, M. DiBuono, and N. Calzaretto. Designing and Simulating a Smart Air Purifier to Combat HVAC-induced COVID-19 Transmission. MIT IEEE URTC, IEEE Xplore. 2020.

RESEARCH EXPERIENCE

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

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

- Wrote review of algorithms for intrinsic dimension estimation of point cloud data sampled from a smooth manifold.
- Won the John Dash van Buren Prize ($5000) for Best Senior Thesis in the Mathematics Department.

[NSF REU, Tufts] 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. This algorithm is more efficient and lower-error than the grid-based schemes usually deployed in this setting.
- Published lecture notes on the mathematics of regression, in collaboration with NSF-funded Glaciology Hub.

[Pritzker-Pucker Scholar] Theoretical Analysis of t-SNE.   New York, NY

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

- Researching the complexity of finding optimal t-distributed stochastic neighbor embeddings (t-SNE).
- Established necessary and sufficient conditions for the existence of optimal embeddings. Provided a new proof of t-SNE's agreement with spectral clustering for low-diameter embeddings.

[Laidlaw Scholar] NLP-driven Analysis of SCOTUS Oral Arguments. New York, NY

Columbia Computer Science. Advisor: Kathleen McKeown. Summer 2021

- 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, Yeshiva] Topological Data Analysis for NLP. New York, NY

Yeshiva University Mathematics Department. Advisor: Marian Gidea. Summer 2020

- 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 Computer Science Department Fall 2022 - Present

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

Residential Advisor New York, NY

Columbia Residential Life Fall 2022 - Spring 2024

- 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. Host fun events regularly.

NLP Research Engineering Intern New York, NY

NLMatics Co. Summer 2022

- Improved state-of-the-art passage retrieval benchmarks using confidence calibration and ensembling. Also explored improvements using meta-learning. Wrote paper.

ACTIVITIES AND SERVICE

Mathematics Textbook and Journal Editing Fall 2023 - Present

- Content Editor for the Columbia Journal of Undergraduate Mathematics Expository Journal.
- Providing line-by-line edits for Dr. Loring Tu as he edits his third edition of *Introduction to Manifolds*.

President of Columbia Men's Club Water Polo Team Fall 2022 - Spring 2024

Presenter for the Columbia Undergraduate Mathematics Society Spring 2021 - Present

- Past talks include: *The Duality of Determinant and Trace* (Summer 2023); *On t-SNE's spectral regime* (Spring 2023); *Coins, Partitions, and Generating Functions* (Summer 2022); *Statistical Mechanics Helps Us Count Alternating Sign Matrices* (Fall 2022); *Topological Insights on Vector-Embedded Language* (Spring 2022).

FELLOWSHIPS AND AWARDS

- John Dash van Buren Mathematics Prize (2024), i.e. top senior thesis in Columbia graduating class. ($5000).
- Van Amringe Mathematical Prize (2023), i.e. top-four scorer on Columbia Math Prize Exam. ($1875).
- Laidlaw Leadership and Research Scholar (2022-23).
- Two-time NSF REU participant (2021, 2023).
- Pritzker-Pucker Summer Funding Awardee (2023). ($4000).
- Best in Data Science and Society at Columbia Undergrad CS and Data Science Fair (2022).
- National Merit Scholarship Finalist (2021). National AP Scholar (2021).
- Brown University Book Award; The Physics Award; Casmir A. France Award for Excellence in English (2021).
- Winner (2019) and Finalist (2020) in the LeBow Oratorical Competition.
- Congressional App Challenge Winner (2020). Submission: The Digital Humanities Lab.
- People's Choice Lightning Talk Award at the MIT IEEE Undergrad Research in Technology Conference (2020). Title: DROVER: Drone-Rover Communication for Pathfinding.