Avi Bagchi

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Education

University of Pennsylvania Philadelphia, PA
School of Engineering and Applied Science: BSE in Computer Science, GPA: 3.87 *Aug. 2022 – May 2026*
Senior Thesis Title: "Towards Efficient and Trustworthy Discrete Diffusion Models"

Papers

"Watermarking Discrete Diffusion Language Models" | *arXiv:2511.02083 (2025)*
Avi Bagchi, Akhil Bhimaraju, Moulik Choraria, Daniel Alabi, Lav R. Varshney

"Doppler Invariant CNN for Signal Classification" | *arXiv:2511.14640 (2025)*
Avi Bagchi, Dwight Hutchenson

"Edge-Intelligent Mosquito Threat Prediction using IoT-Enabled Hardware System" | *Sensors (2022)* (cited 14)
S. Polineni†, O. Shastri†, **A. Bagchi**†, G. Gnanakumar†, S. Rasamsetti†, P. Sundaravadivel (†=equal contribution)

"The South Sea Bubble" | The Concord Review (2021)
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Experience

Research Intern May 2025 – Present
MIT Lincoln Laboratory: Group 64 (Tactical Satellite Communications) *Lexington, MA*
- Built complex-valued convolutional neural net invariant to Doppler shifts for interference signal classification.

Undergraduate Researcher June 2024 – Present
University of Illinois Urbana-Champaign (advised by Professors Lav Varshney & Daniel Alabi) *Remote*
- Created first watermark for discrete diffusion. Used distribution-preserving gumbel-max trick for diffusion sampling. Theoretical proofs of distortion-freeness and soundness. Benchmark analysis with SEDD & LLaDA.
- Designing polynomial-based flow matching framework modeling curved transport paths to accelerate inference.

Quantitative Research Intern Oct. 2023 – Aug. 2024
Nebula Research and Development *New York, NY*
- Developed LLM fine-tuning library for the hedge fund, predicting returns from earnings call transcript sentiment.

Undergraduate Researcher Aug. 2022 – May 2024
The Wharton School: Operations, Information, and Decisions (OID) *Philadelphia, PA*
- Acknowledged contributor, "Auditing the Use of Language Models to Guide Hiring Decisions" (Gaebler et al. 2024)

Small Projects

Diffusion Factor Models (experimental evaluation of Chen et al. (2025))
- Extracting latent factor structure via diffusion-based model for realistic synthetic financial return generation.

Elliptic Curve Cryptography
- Presentation to Penn Mathematics Dpt on attacks to the discrete log problem; Pollard's Rho, Shor's Algorithm.

Computational Ecology & Policy Advocacy
- Built IoT device for real-time malaria tracking. Created model predicting invasive species niches in future climate change scenarios (international recognition). Traveled to Mongolia, documenting regional water insecurity.

Awards

Grand Prize Winner | *Regeneron International Science and Engineering Fair, 2nd in category (7 million participants)*
Borlaug Scholar | *Selected as New York State Youth Representative at World Food Prize Conference*

Interests

Research Interests: AI safety, diffusion models, cryptography, quantitative finance, signal processing, ecology

Course Electives: Real Analysis, Machine Learning, Deep Learning, Computational Learning Theory, Mathematical Statistics, Computer Security, Convex Optimization, Linguistics, Russian Literature