

Debangshu Banerjee

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Education

University of Illinois Urbana-Champaign

2022–Current

Ph.D. student in Computer Science.

Research advisor: Dr. Gagandeep Singh.

GPA: 4.0/4.0.

Indian Institute of Technology Guwahati

2016–2020

B.Tech in Computer Science & Engineering With Minor in Mathematics.

Undergrad research advisor: Dr. R. Inkulu.

GPA: 9.69/10 (Rank 2 out of 88).

Research Interests

LLM for verified code, LLM expressivity and reasoning, Formally Verified Foundational Agents.

Publications (reverse chronological order)

1. **DINGO: Constrained Inference for Diffusion LLMs** [\[arxiv\]](#)
T. Suresh*, D. Banerjee*, S. Ugare, S. Misailovic, G. Singh.
Preprint
Workshop on Reliable and Responsible Foundation Models @ICML, 2025.
2. **CRANE: Reasoning with constrained LLM generation** [\[arxiv\]](#)
D. Banerjee*, T. Suresh*, S. Ugare, S. Misailovic, G. Singh.
International Conference on Machine Learning (ICML), 2025.
The VerifAI Workshop @ ICLR, 2025.
3. **Support is All You Need for Certified VAE Training** [\[openreview\]](#)
C. Xu, D. Banerjee, D. Vasisht, G. Singh.
International Conference on Learning Representations (ICLR), 2025.
4. **Relational Verification Leaps Forward with RABBit** [\[openreview\]](#) [\[code\]](#)
T. Suresh*, D. Banerjee*, G. Singh.
Annual Conference on Neural Information Processing Systems (NeurIPS), 2024.
5. **Relational DNN Verification With Cross Executorial Bound Refinement** [\[paper\]](#) [\[code\]](#)
D. Banerjee, G. Singh.
International Conference on Machine Learning (ICML), 2024.
6. **Input-Relational Verification of Deep Neural Networks** [\[paper\]](#) [\[code\]](#)
D. Banerjee, C. Xu, G. Singh.
Programming Language Design and Implementation (PLDI), 2024.
7. **Interpreting Robustness Proofs of Deep Neural Networks** [\[openreview\]](#) [\[code\]](#) [\[slides\]](#)
D. Banerjee, A. Singh, G. Singh.
International Conference on Learning Representations (ICLR), 2024.
Workshop on Formal Verification of Machine Learning @ ICML, 2023 (**Outstanding paper award**).
8. **Incremental Randomized Smoothing Certification** [\[openreview\]](#) [\[code\]](#)
S. Ugare, T. Suresh, D. Banerjee, G. Singh, and S. Misailovic.
International Conference on Learning Representations (ICLR), 2024.

9. **Incremental Verification of Neural Networks** [\[paper\]](#) [\[arxiv\]](#) [\[code\]](#)
S. Ugare, D. Banerjee, S. Misailovic, and G. Singh.
Programming Language Design and Implementation (PLDI), 2023.
10. **Vertex Guarding for Dynamic Orthogonal Art Galleries** [\[paper\]](#)[\[arxiv\]](#)
D. Banerjee, R. Inkulu.
International Journal of Computational Geometry & Applications(IJCGA) Volume 31, 2021.

* indicates equal contribution

Invited Talks

Interpreting Robustness Proofs of Deep Neural Networks [\[slides\]](#)

Invited talk at 2nd Workshop on Formal Verification of Machine Learning @ ICML, 2023.

Reviewing

Served as a reviewer for multiple top ML/PL conferences - ICML, NeurIPS, ICLR, AISTATS, POPL.

Research Projects

Verified Agent Synthesis with Formal Contracts

Working on a framework that combines automatic agent synthesis with formal verification, ensuring provable safety and compliance with user requirements such as access control and resource bounds, while maintaining high performance.

Expressive Constrained Generation for LLMs

This project improves LLMs' ability to generate syntactically valid and functionally correct outputs in tasks like code generation and symbolic reasoning. It explains why strict grammatical constraints harm reasoning and introduces CRANE, a decoding algorithm that balances syntactic correctness with reasoning capabilities.

Relational Verification of Neural Networks

Worked on developing the first GPU-accelerated scalable relational verification algorithms for hyperproperties such as monotonicity, fairness, etc. defined over multiple executions of Deep Neural Networks. The goal of this project is to enable trustworthy deployment of Neural Networks in financial and scientific applications.

Work Experience

Research Intern, Automated Reasoning, Amazon Science

Summer 2025

Worked on automated program verification of Dafny programs using annotations (loop invariants, assertions) generated by LLMs. Designed an inference-time strategy based on RAG that improved SOTA performance by 20 percentage points with Claude 3.7 Sonnet on the largest Dafny program verification benchmark, DafnyBench. Finetuned smaller Qwen3 models (4B, 8B, and 14B) using auto-informalized error messages generated by the Dafny verifier, achieving up to 15% gains over similarly sized models.

Software Engineer III (L4), Google

2022–2022

Worked with the search quality improvement team for google apps to improve the quality and coverage of search suggestions shown in Gmail and Drive. Improved suggestion CTR in Gmail by +1.5% and in Drive by +8%.

Software Engineering Intern, Google

Summer 2019

Mentor: *Hrishikesh Amur, Staff Software Engineer*

- Implemented the search flow(document retrieval, scoring and sorting) for Gmail using Google's own distributed system framework named plaque.

Honours & Awards

- Received **Bloomberg Infrastructure & Security Research Ph.D. Fellowship (2025)** for *Verified Agent Synthesis with Formal Contracts*.
- **Outstanding paper award** at Workshop on Formal Verification of Machine Learning at ICML, 2023.
- Obtained **2nd highest GPA** among all 600 B.Tech students of the batch of 2020 (IIT Guwahati).
- **Institute Merit Scholarship** awarded twice(2017, 2018) for securing the highest yearly GPA among all students in the Computer Science department (IIT Guwahati).
- One of 30 students from the state qualified for **Regional Mathematics Olympiad (RMO)** and selected to participate in Indian National Mathematics Olympiad (INMO).