Vidhata Jayaraman

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Education

University of Illinois Urbana-Champaign (UIUC) Anticipated Graduation: May 2026
B.S. in Computer Engineering (Highest Honors)| B.S. in Mathematics Distinction: Highest Honors
GPA: *3.97/4.0 | 4.0/4.0* Dean's List (Top 20% of Student Body)
Thesis: "Information-theoretic limits of Knowledge Distillation"

Research Interests

Machine Learning, Probability Theory & Statistics, Information Theory, Optimization, Control Theory, Quantum Information, Uncertainty Quantification

Relevant Coursework

Pure Math: Real Analysis, Linear Algebra, Abstract Algebra, Ordinary & Partial Differential Equations, Complex Analysis, Graph Theory, Probability & Measure, Algebraic Topology

Applied Math/CS: Optimization, Machine Learning, Quantum Information Theory, Deep Generative Models, Random Processes, Information Theory, Analog Signal Processing, Digital Signal Processing, Algorithms & Models of Computation

Research Experience

Research with Professor Rayadurgam Srikant September 2025 – Present

- **Senior Thesis (Co-advised with Prof. Lav Varshney)**: *Limits of Knowledge Distillation* (Primary researcher). Analyzing knowledge distillation and model compression to characterize fundamental limits, particularly in LLMs.

Research with Professor Lav Varshney February 2024 – Present

Current Projects

- **Senior Thesis (Co-advised with Prof. Rayadurgam Srikant)**: *Information-theoretic bounds for Knowledge Distillation in LLMs* (Primary researcher). Developing information-theoretic formulations for knowledge distillation to characterize fundamental performance limits, particularly in LLMs.
- *2-stage retrieval in Transformers*: Analyzing an Associative Memory model to explain 2-stage retrieval in Transformers.
- *Visual redundancies in VLMs*: Found redundancy in visual token representations in VLMs and justified their existence rigorously (Publications: 1, 2).
- (Jan. 2026) *Multimodal Federated Learning*: Will be working with Argonne National Laboratory to improve learning with multimodal data in a federated learning paradigm (i.e., learning from decentralized private data)

Past Projects

- *Extending Community Detection/Graph Clustering to Quantum Networks* (Primary researcher). Extending "No Free Lunch" theorems and community detection algorithms from classical graphs to quantum network structures.
- *Emergent Capabilities in Transformers*: Investigated Modern Hopfield Networks and neural associative memories to analyze emergent capabilities as model scale increases and their connection to Transformer architectures.
- *Mitigating Catastrophic Forgetting in LLMs*: Identified layer-level clustering patterns in LLMs post-continual learning and designed a switch network to mitigate catastrophic forgetting (Publication 4).

Research with Professor Xu Chen March 2023 – February 2024

- Developed a Physics-Informed Neural Network (PINN) using the Deep Galerkin Method (DGM) to model voltage and electric field from a charged circle/sphere inside a grounded box (code available upon request).
- Work was adapted by Samsung engineers for use in internal modeling applications.

Publications & Presentations

(Citations in chronological order)

1. Hartman, M.†, **Jayaraman V.A.**†, Choraria, M., Bhimaraju, A., & Varshney, L.R. (2025). Skip-It? Theoretical Conditions for Layer Skipping in Vision-Language Models. Preprint arXiv:2509.25584 *(Under review for ICLR 2026)*
2. Hartman, M.†, **Jayaraman, V.A.**†, Choraria, M., Bhimaraju, A., & Varshney, L. R. (2025). Unmasking the functionality of early layers in VLMs *(Presented: eXCV Workshop @ ICCV 2025)*
3. **Jayaraman, V.A.**, Dagommer, M. (2025). pADME Explainability and Uncertainty Quantification, Poster available upon request.

4. Wu, X., Hartman, M.*, **Jayaraman, V.A.***, & Varshney, L. R. (2024). SwitchCIT: Switching for Continual Instruction Tuning of Large Language Models. Preprint arXiv:2407.11780. *(Undergoing revision for JSTSP 2025)*
5. Bernstein, H.C., Bindel, S.R., McKibben, M.A., & **Jayaraman, V.A.** (2024). Planning Model based on Projection Methodology Bayesian Discrete Extended (PM2-BDE) *(Under internal review)*, Manuscript available upon request

† denotes joint-first author and * denotes equal contribution.

Industry Experience

Argonne National Laboratory | *(Incoming) Research Intern* January 2026 – August 2026
- Will research on improving multimodal learning from decentralized private data (i.e. Federated Learning).

AbbVie | *Machine Learning Research Intern* May 2025 – August 2025
- Implemented the SubgraphX method for GNN explainability, modified for multi-target regression and for 3D inputs.
- Method identified important areas in molecules for property prediction, strengthening internal site-of-metabolism tools.
- Research on Uncertainty Quantification using metric learning and distribution parameter estimation (Poster 3).

Johns Hopkins University Applied Physics Laboratory | *Data Science Intern* June 2024 – August 2024
- Created a chat-bot with Retrieval Augmented Generation (RAG) for retrieving information in technical documents.
- Implemented a Bayesian approach towards reliability growth planning (RGP) for system reliability estimation.
- Manuscript in preparation (Publication 5). Available upon request.

National Institute of Standards and Technology (NIST) | *Research Intern* June 2023 – August 2023
- Created a small GPT-2 model which utilized Cloze Probabilities to identify abnormal sentences in text data.
- Demonstrated that analysis of outliers in dimensionally reduced text embeddings can provide similar results.

Brunswick i-JET Research Lab | *Autonomous Simulation Intern* January 2023 – May 2023
- Utilized Robotic Operating System (ROS) to create maps using Simultaneous Localization and Mapping (SLAM).
- Utilized fluid dynamics to build an autonomous wake generator and used ROS to visualize and analyze data.

Teaching and Mentorship

Algorithms & Models of Computation Classroom Assistant
August 2025 – Present
- Assist weekly in quiz and exam grading and hold 2-hour-long office hours weekly.
- Writing lecture notes on the connection between the WL graph isomorphism test and the expressivity of Graph Neural Networks.

Analog Signal Processing (ECE 210) Tutor (IEEE-HKN)
August 2023 – May 2024
- Provided 1-on-1 tutoring, created review slideshows/worksheets, and gave review lectures before midterms.

Skills & Expertise

Deep Learning: PyTorch, TensorFlow
Natural Language: NLTK, spaCy, LangChain
Software: Python, C/C++, Java
Web/API: Flask, Django, HTML/CSS, Javascript
DevOps: Git, Docker
Low-Level: x86 assembly, SystemVerilog
Robotics: ROS, OpenCV
Research/Math: LaTeX

Grants & Awards

- Awarded grant for undergraduate research from the Office of Undergraduate Research (OUR) 2025
- Accepted to AI Startup School by YCombinator for gifted researchers. 2025
- Awarded James Scholar at University of Illinois Urbana-Champaign 2023 - 2025
- Inducted into Eta Kappa Nu (IEEE-HKN), an ECE Honors Society 2023
- Inducted into Tau Beta Pi, the Engineering Honor Society 2023