Idhant Gulati

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EDUCATION

The Pennsylvania State University — University Park, PA
Bachelor of Science in Computer Science — *Aug. 2023 – May 2027*

EXPERIENCE

Research — August 2024 – Present
Independent

- Analyzing expert activation patterns in mixture of experts language models (MoEs)
- Exploring input noise impact on model performance
- Developing methods to quantify expert specialization
- Contributing to interpretability of advanced language models

Undergraduate Research Assistant — July 2024 – Present
CAIS Lab, The Pennsylvania State University — *University Park, PA*

- Implementing a data collection system to gather various parameters from multiple 3D printers over an extended period.
- Designing machine learning model using collected data to predict to optimize the 3D printing process.
- Creating a Unity-based simulation dashbaord to visualize and interact with the optimization model.
- Developed a comprehensive dashboard for real-time monitoring and analysis of 3D printing performance metrics.

Research Project — June 2024 – August 2024
Buildspace S5 — *(Remote) San Fransisco, CA*

- Developed DenseTEX, a deep learning model to convert mathematical equation images into LaTeX code.
- Implemented CNN encoder using DenseNet-169 architecture and integrated GPT-style decoder for accurate transcription.
- Incorporated 2D Positional Encoding to preserve spatial relationships in mathematical notation.
- Utilized UniMER-1M dataset for training, achieving improved validation loss over time.
- Collaborated on model architecture design, including custom positional encoding formulas.

Computer Vision Leader — August 2023 – Present
RoboX Club, The Pennsylvania State University — *University Park, PA*

- Implemented perception, object detection, and tracking algorithms for robots.
- Developed kinematic modeling and auto-aim features.
- Integrated vision algorithms with hardware components.
- Applied machine learning and computer vision techniques to overcome robotics challenges.

RESEARCH & PUBLICATIONS

MoE Lens - An Expert is All You Need | *Under review at ICLR 2025 (SLLM Workshop)* — Feb 2025

- Analyzed expert specialization behavior across distinct domains in Mixture-of-Experts (MoE) language models
- Developed novel methodology to track expert contributions to output representations
- Demonstrated that a single top-weighted expert closely approximates full ensemble predictions
- Identified potential for inference optimization through targeted expert pruning

PROJECTS

IdeaStruct | *Python, Flask, OpenAI API, Neo4j, Cytoscape.js*   Sepxtember 2024
- Developed an AI-powered Flask web app for generating and querying dynamic knowledge graphs
- Integrated OpenAI's GPT for NLP and implemented a flexible backend with Neo4j and in-memory databases
- Created an interactive frontend using Cytoscape.js for complex data visualization
- Engineered features like conditional data addition, URL scraping, and custom integration management
- Collaborated in a team of four to complete the project within HackMIT time constraints

Textify: Convolutional Neural Network (CNN) from Scratch | *Python, NumPy*   May 2024
- Implemented a Convolutional Neural Network (CNN) from scratch to convert handwritten text into digital format
- Utilized Python and NumPy to build the entire CNN architecture without relying on deep learning libraries
- Developed model capable of predicting and digitizing handwritten text.
- Gained in-depth understanding of CNN internals, including convolution operations, pooling layers, and backpropagation

Others: Glucoma Prediction Model, Vaccine Management System