J Vijayavallabh

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Summary

Pre-final year **B.Tech (Biological Engineering), IIT Madras**; focused on **AI for biotech** and **multimodal/agentic systems**.

Education

2027 **B.Tech Biological Engineering**, **IIT Madras** (CGPA: 8.64/10)
2023 Class XII (CBSE), **Sri Chaitanya Techno School** (95.4%)
2021 Class X (CBSE), **Sri Chaitanya Techno School** (99.4%)

Publications and Patent

- **Enhancing Financial RAG with Agentic AI and Multi-HyDE** (Proceedings of **EMNLP** 2025 FinNLP) [Inter-IIT].
- **Sparse Hyperbolic Convolutional Networks with Enhanced Object Localization via GradCAM** (Proceedings of International Conference on Computer Vision **ICCV** Beyond Euclidean Workshop **BEW** 2025) [SENAI IITM].
- **Patent: SECure RAG** - Semantically Enhanced Contextualization for Unified Reasoning with Explainability in RAG.

Professional Experience

AI Research and Development Intern, Photios Apr 2025 - May 2025

- Fine-tuned state-of-the-art Automatic Speech Recognition (**ASR**) models using Deep Learning techniques for transcribing sales interactions in retail environments, by extensive literature review and comparative analysis of ASR architectures.
- Architected an automated data cleaning pipeline with the **FastText** model to filter Sanskrit words from Hindi datasets, then fine-tuned custom **N-Gram language model** integrated with **AI4Bharat Conformer**, reducing Word Error Rate (**WER**).

Research Experience

Research Intern, Kansas State University [Paper under review] May - Jul 2025

- Developed **Position-Aware Inductive Graph Transformer (PAIGT)** for single-cell RNA-seq (under Prof. Bala Natarajan) by developing GraphSAGE layers with spatial, positional, and path encoders on gold-standard datasets [Glioma and other standard].
- Implemented trajectory inference using **scTEP** method and validated gains in generalisation and clustering on benchmarks.

Student Researcher, SENAI IITM Dec 2024 - Present

- Worked on **geometric representation learning** (Prof. Raghunathan Rengaswamy): Hyperbolic Grad-CAM, activation sparsity in Hyperbolic/hybrid CNNs for interpretability in non-Euclidean spaces, revealing hierarchical/part-whole structure in images.
- Delivered **technical talks**: geometric deep learning, disentanglement via topology, topology of DNNs, and PCA in ML research.

Student Researcher, RBCDSAI Sep 2024 - Dec 2024

- Modelled **gene-protein relationships** for reaction prediction (Prof. Karthik Raman) by building a **seq2seq** pipeline with **ESM**-encoded proteins and a **BART**-style cross-attention decoder to generate all SMILES sequences for a given reaction sequence.
- Optimized the model capabilities through tokenization and data partitioning experiments to maximize chemically valid SMILES.

Personal Projects

Inter IIT Tech Meet 14.0 (ISRO GeoNLI) Nov - Dec 2025

- Led a 6-member team representing IIT Madras in a **Mid Prep PS** over a span of 15 days to build ***GeoNLI***, an offline/on-prem remote-sensing Vision Language Model [**VLM**] system for **captioning**, semantic/binary/numeric **VQA**, and visual **grounding**.
- Curated **multi-resolution RS** datasets (VRSBench, RSVLM-QA, XLRS) and synthesized adversarial + counting/area VQA.
- Finetuned **Ovis2.5-9B** using **LoRA** on captioning and VQA, and implemented a **hybrid grounding** stack [also in similar fashion for VQA] (Ovis intent routing → **SAM-3** segmentation → OpenCV mask-metadata → OBB + tool-based geometry).

Inter IIT Tech Meet 13.0 (Pathway) Oct - Dec 2024

- Represented IIT Madras in a **High Prep PS** to build a novel dynamic agentic Retrieval Augmented Generation [**RAG**] pipeline for financial documents like **SEC-10K** filings with **adaptive, secure, explainable** workflows using Pathway's vector store.
- Engineered **Multi-HyDE** hybrid retrieval mechanism combining multi-query and hypothetical document embeddings, robust **PDF parsing**, Llama Guard-based **safety guardrails**, and **explainable** AI source attribution; deployed on **Azure** (Docker + FastAPI) and evaluated on **GPT-4o/Gemini-1.5** using semantic similarity, recall, factual correctness, faithfulness, and ROUGE.

Scholastic Achievements

- **Top 0.5%** in JEE Main 2023
- **Top 1%** in JEE Advanced 2023
- **Top 6/23** – Inter IIT Tech Meet 13.0 (High Prep)
  Dynamic Agentic RAG for SEC-10K filings
- **Top 8/23** – Inter IIT Tech Meet 14.0 (Mid Prep)
  ISRO GeoNLI
- **ABRSM Grade 8 Piano Practical** – Merit (Nov 2024)

Skills

Technical **Python**, Matlab, **PyTorch**, TensorFlow, Pandas, NumPy, RDKit, DGL, NetworkX, **LangChain**, Unsloth, Pathway, Optuna, NLTK, Matplotlib, Git/GitHub, Docker, FastAPI, Bash, Azure, Knowledge Graph, LaTeX

Courses/Certs Computational Neuroscience, Microbiology and Biochemistry, Principles of Neuroscience, DSA for Biology, Molecular Biology and Genetic Engineering, Advanced Topics in AI [Large Scale Cloud Computing and Federated Learning], Signals and Systems, Linear Algebra, Probability and Statistics, Deep Learning [Coursera].