

# 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, <b>IIT Madras</b>	(CGPA: 8.64/10)
2023	Class XII (CBSE), <b>Sri Chaitanya Techno School</b>	(95.4%)
2021	Class X (CBSE), <b>Sri Chaitanya Techno School</b>	(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 to model cell-cell relationships on gold-standard datasets.
- Implemented trajectory inference using scTEP method and validated gains in generalisation and clustering on standard benchmarks.

#### Student Researcher, SENA IITM

Dec 2024 - Present

- Worked on geometric representation learning (Prof. Raghunathan Rengaswamy): Hyperbolic Grad-CAM + activation sparsity in Hyperbolic CNNs/hybrids 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 text-driven 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 Mains 2023; Top 1% in JEE Advanced 2023.
- Top 6/23, Inter IIT Tech Meet 13.0 High Prep (Dynamic Agentic RAG for SEC-10K).
- 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, Unslloth, Pathway, Optuna, NLTK, Matplotlib, Git/GitHub, Docker, FastAPI, Bash, Azure, Knowledge Graph, L <sup>A</sup> T <sub>E</sub> X
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 Specialisation [Coursera], LLM Agents MOOC by UC Berkeley.