Mukund Raj

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Education

Indian Institute of Technology Bombay 2023–2027
BTech: Major in Environmental Science and Engg. | Minor in Machine Intelligence and Data Science (C-MInDS)

Experience

AI Intern, Manya Fintech Pvt. Ltd. Oct 2025 – Dec 2025
Mumbai, India (Hybrid)

- Engineered a real-time **multi-person tracking** pipeline combining **YOLOv8**, **DeepSORT**, and **MoveNet pose estimation**, with gesture-based binding and **ReID**-driven re-acquisition across occlusion.
- Built a cross-platform **React Native** computer-vision app with native **Camera API** and JS-bridge integration and circular video recording, optimized end-to-end for low-latency on-device inference.
- Benchmarked **ONNX Runtime**, **TensorFlow Lite**, **TensorFlow.js**, and **MediaPipe** to select the optimal **edge-AI** deployment route for real-time inference on Snapdragon hardware.
- Developed a **Flask** wake-word service with 7+ **OpenWakeWord** models and **VAD**, and built testing instrumentation for latency and reliability evaluation.

Defense AI Research Intern, College of Military Engineering, Pune Dec 2025 – Jan 2026
Remote

- Architected **PRISM**, an autonomous **LLM**-orchestrated search intelligence engine powering an incremental **web crawler** that filters stale links and ranks sources by military relevancy.
- Engineered a contextual document-integration pipeline that auto-maps retrieved intelligence to structured report sections.
- Designed a human-in-the-loop expert **validation dashboard** delivering full decision traceability for defense-grade review.
- Built a **NoSQL**-backed feedback engine using rule-based learning to continuously refine relevance scoring.

Projects

Multimodal Hybrid RAG for Personalized Learning | Code Jan 2026–Feb 2026

- Engineered a production-ready **Multimodal Hybrid RAG** system unifying text documents and YouTube transcripts with semantic retrieval, achieving **89.1% Recall@5** and **35.5ms** avg. retrieval latency for personalized learning.
- Built a **Hybrid Retrieval** pipeline combining **Dense Vector Search** (**Qdrant**) with **BM25** to reduce hallucinations.
- Designed scalable **FastAPI** microservices with Gradio frontend, **Dockerized** deployment, and modular RAG architecture.
- Implemented persistent conversational memory using **MongoDB** with session-based context tracking for multi-turn QA.
- Optimized document ingestion using sentence-based chunking, **SHA-256** duplicate detection, and metadata indexing.

Algorithmic Trading Application (Contributor) | Live Demo May 2026–Aug 2026

- Developed and deployed a modular **Python** backtesting engine with **FastAPI** and **Docker**, processing **274K+** 1-minute NIFTY50 candles with configurable risk management, tradebook generation, and performance analytics.
- Engineered a scalable data pipeline consolidating **738** days of market data from raw JSON into **Apache Parquet**, with feature engineering and **7+ technical indicators**.
- Built a strategy optimization engine performing automated parameter sweeps for large-scale backtesting, with the initial EMA crossover generating **4,320 trades**.
- Integrated the **OpenAI API** to generate AI-driven strategy reports and optimization insights.
- Delivered a production-grade trading platform for interactive strategy backtesting, optimization, and performance analysis.

Hand Gesture Recognition System | Live Demo May 2025–Jun 2025

- Built a real-time, dual-hand gesture recognition system using **MediaPipe**, **OpenCV**, and **TensorFlow**, mapping gestures to live commands for hands-free control through the browser webcam feed.
- Implemented a normalization pipeline ensuring scale and orientation-invariant landmark preprocessing.
- Designed a custom **DNN** with Dense and Dropout layers across 8 classes, achieving 93% accuracy and 0.93 F1-score.
- Built an end-to-end data collection pipeline with keypress-triggered logging and live landmark visualization.

Technical Skills

Languages	C++, Python, C, JavaScript, TypeScript, SQL, LaTeX
AI/ML & GenAI	PyTorch, TensorFlow, Scikit-Learn, NumPy, Pandas, Spark, NLTK, OpenCV, Matplotlib, RAG, Sentence Transformers, Ollama, Prompt Engineering
Backend	FastAPI, Node.js, Express.js, Fastify, REST APIs, Microservices, System Design (HLD/LLD)
Databases	PostgreSQL, MySQL, MongoDB, Redis, Qdrant
DevOps/Cloud	Docker, Docker Compose, Kubernetes, AWS, GCP, Terraform, Nginx, CI/CD
Tools	Git, Postman, Swagger, Linux, GitHub Actions, WebSockets, gRPC, Kafka, JWT

Relevant Coursework

Computer Science	Computer Programming and Utilization, Data Structures and Algorithms, Computer Networks, Advanced Image Processing, Logic for Computer Science, Computation Lab, System Dynamics & Simulation
AI & Data Science	Theoretical Machine Learning, Optimization in Machine Learning, Deep Learning for Sequences, Language Models, Natural Language Processing and Knowledge Graphs
Mathematics	Calculus I, Calculus II, Linear Algebra, Differential Equations, Numerical Methods

Achievements

- Scored a perfect **AA grade** in **CS101**, a **C/C++** course offered in the 2nd semester in IIT Bombay [2023]
- Secured a **SPI of 9.58** in the 3rd semester, demonstrating strong academic excellence [2024]
- Qualified Stage 1 of the **National Talent Search Examination (NTSE)** conducted by NCERT [2021]
- Led a team of 3 in Code Wars, developing a Python script to solve complex algorithmic problems [2024]