Ruthu V Rao

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Education

- **Purdue University**   **Aug 2024 – May 2026**
  Master of Science in Computer Science
- **Nitte Meenakshi Institute of Technology**   **Aug 2019 – Aug 2023**
  Bachelors in Technology in Information Science

Skills

- **Languages**: Python (primary), JavaScript/TypeScript, C++, Go, Java, Solidity, HDL, Circom, Assembly
- **Frontend**: React, Next.js, Angular, Vue
- **Backend**: Node.js, NestJS, Express, FastAPI, Python microservices, REST/GraphQL APIs, Kafka, Redis, Docker, Kubernetes
- **Data & Pipelines**: PySpark, Pandas, NumPy, data preprocessing, distributed workloads
- **Cloud**: AWS (Lambda, S3, SNS), Azure, GCP
- **ML/AI**: TensorFlow, PyTorch, Transformers, XGBoost, RAG, LangChain, LlamaIndex, Agents, LLM fine-tuning (PEFT/LoRA/QLoRA), embeddings, evaluation
- **Databases**: PostgreSQL, MySQL, MongoDB
- **Tools**: Git, Jira, Terraform, CI/CD, IPFS, Subgraphs, Kubernetes

Experience

- **Numerikal Labs**   **Aug 2024 – Present**
  Software Engineer Intern   *DE, United States*
  - Engineered computational models of **neuronal fluctuations** inspired by recent theoretical work **https://arxiv.org/abs/2511.10435**, improving stability and fidelity in large-scale neural simulations.
  - Developed a **Statistically Aware Backpropagation (SA-BP)** framework that integrates variance and uncertainty into gradient updates, extending traditional backpropagation for noisy biological regimes.
  - Implemented a neural network **from scratch in Python**, covering forward propagation, activation functions, and cross-entropy loss, enabling fine-grained experimentation.
  - Built high-performance Go RPC services and Python FastAPI pipelines for real-time data processing, visualization, and scalable deployment.
  - Integrated computational neuroscience insights with engineering abstractions to design more resilient learning dynamics.
- **StationX Network**   **Mar 2022 – Dec 2022**
  Full-Stack Developer   *Bangalore, India*
  - Developed and maintained 15+ production-grade **REST APIs** in Node.js/NestJS, improving backend–frontend throughput by 20%.
  - Built 20+ **Next.js dashboards and React components** with reusable state patterns (Redux), accelerating UI delivery.
  - Implemented 20+ **Subgraphs** supporting 1000+ investor clubs, handling large-scale data ingestion, indexing, and real-time querying.
  - Containerized services with Docker and automated deployments via CI/CD pipelines, increasing release velocity.
  - Integrated **Gnosis Safe** and multi-step workflows, while improving filtering logic and frontend performance.
- **Graduate Teaching Assistant**   **Aug 2024 – Present**
  CS16100 — Intro to CS II   *Purdue University*
  - Instructed 40+ students in Java, covering Object-Oriented Programming and Data Structures & Algorithms.
  - Led lab sessions and guided students in implementing efficient Java-based solutions.
  - Mentored students in problem-solving, debugging, and coding best practices.
- **Teaching Assistant**   **Aug 2023 – Aug 2024**
  Operating Systems (Prof. David Liu)   *Purdue University*
  - Assisted 35 students with process scheduling and memory management algorithms.
  - Graded and assisted assignments focusing on multi-threading and scheduling algorithms.
- **Push Protocol**   **Nov 2023 – Apr 2024**
  Software Engineering Intern   *Belize*
  - Refactored backend from Node.js to NestJS (10K+ LOC), improving modularity and microservice readiness.
  - Designed and shipped the Metamask Snap product, implementing RPC-based task scheduling for 100K+ asynchronous requests.
  - Built real-time notification + chat services, reducing latency by 35% via optimized WebSocket and queue patterns.
- **Nethermind**   **Mar 2023 – Jun 2023**
  Software Engineering Intern   *United Kingdom*
  - Developed 11+ MEV-resistant automation bots in TypeScript, improving request success rates in distributed systems.
  - Audited and fixed 15+ smart contract vulnerabilities, improving reliability across financial microservices.
  - Delivered features rapidly in a high-throughput environment with strong attention to testing and correctness.
- **ETH India**   **Dec 2022 – Mar 2023**
  Fellowship   *Bangalore, India*
  - Built Threshold Signature Schemes and Shamir's Secret Sharing for secure key recovery.
  - Improved Zero-Knowledge Proof performance by 40% using Lagrange Interpolation in Circom.
  - Developed 15+ cryptographic circuits to enhance security. **https://eif3.devfolio.co/fellows/**

Projects

- **Drug-Induced Liver Injury (DILI) Prediction App — github.com/route-2/dili-backend**
  - Built a hybrid DILI engine combining a **rule-based expert system** (Hy's Law, R-ratio) with **ML models** (Logistic Regression, LSTM, Transformer) on longitudinal labs for early risk detection.
  - Engineered time-series pipelines for labs, drug exposures, and comorbidities (normalization, imputation, feature aggregation) and served models via APIs.
- **MealPal Telegram Bot — github.com/route-2/transend-be**
  - Developed a plug-in bot that generates personalized meal plans using OpenAI APIs with a **RAG** layer over recipes/nutrition.
  - Implemented **Kroger OAuth + cart** integration to order selected items automatically; backend with Node.js/NestJS and Redis caching; **Next.js UI** with geolocation.
  - Added **OCR** so users can upload ingredient photos to get meal suggestions and implemented MCP.
- **Computer from Scratch — github.com/route-2/nand2tetris**
  - Implemented a 16-bit CPU from logic gates: registers, ALU/control, memory interface (**HDL**).
  - Built an **assembler** and **virtual machine** translating high-level commands to machine code, forming a complete toolchain.
- **Sharelock — devfolio.co/projects/sharelock-a43e**
  - Built lost-key recovery using **Shamir's Secret Sharing**; published NPM package **mpc-zksnap**.