Karthik Thyagarajan

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Education

Purdue University *August 2024 - May 2027*
B.S. of Computer Science & Artificial Intelligence - 4.0 GPA West Lafayette, Indiana
Relevant Coursework: Data Structures and Algorithms, Computer Architecture, Programming in C, Linear Algebra

Skills

- **Languages:** Python, Java, C++, C, JavaScript, TypeScript, SQL, HTML/CSS
- **Frameworks & Libraries:** React, Next.js, Flask, FastAPI, Node.js, LangChain, PyTorch, TensorFlow, NumPy, Pandas
- **Databases & Data Engineering:** PostgreSQL, NoSQL, Firebase, Vector Databases, Pinecone, ETL Pipelines, Data Modeling, Query Optimization
- **Cloud & DevOps:** AWS, S3, EC2, Lambda, GCP, Docker, Git, CI/CD, Linux, REST API, Vercel
- **AI/ML:** Machine Learning, Deep Learning, Computer Vision, Natural Language Processing, Large Language Models, LLM, RAG, Reinforcement Learning, Neural Networks, Graph Neural Networks, GAN
- **Quantum Computing:** Qiskit, VQE, QAOA, Quantum ML

Experience

- **Machine Learning Engineering Intern** *Jun 2025 - Present*
  Peraton Labs (Internship & Part-Time Co-op) Silver Spring, MD
  - Developed reinforcement learning agent for IoT malware detection using PyTorch and graph neural networks, reducing exploration latency by 35% and increasing detection coverage by 25% while processing 500K+ device events daily on distributed AWS EC2 infrastructure.
  - Designed heterogeneous graph neural network architecture with autoencoders to model device communication patterns, accelerating policy convergence by 40% and improving anomaly detection accuracy by 18%.
- **Computer Vision Software Engineer** *Feb 2025 - Aug 2025*
  Memories.ai (Part-Time) Remote
  - Architected production video memory framework processing 10K+ video streams for augmented reality applications using Python, Flask, and PostgreSQL, achieving 60% throughput improvement through frame sampling optimization and spatial data indexing.
  - Published Python SDK on PyPI with 2K+ downloads, implementing comprehensive API wrappers, asynchronous processing, and REST API integration for video analysis workflows.
- **Undergraduate Robotics Researcher** *Mar 2025 - Jun 2025*
  IDEAS Lab, Purdue University (Part-Time) West Lafayette, IN
  - Built real-time SLAM pipeline in C++ and Python integrating sensor fusion and Kalman filtering, improving 3D scene reconstruction accuracy by 25% and reducing mapping latency by 30% through multithreading optimization.
  - Implemented neural radiance fields for novel view synthesis, generating photorealistic scene reconstructions for autonomous navigation and robotic path planning.
- **Undergraduate Data Engineer** *Aug 2024 - Dec 2024*
  The Data Mine Corporate Partners, Purdue University (Part-Time) West Lafayette, IN
  - Built end-to-end weed detection data pipeline processing 200GB+ drone imagery using Python, TensorFlow, and PostgreSQL, optimizing ETL workflows and indexed queries for 40% faster data retrieval.
  - Engineered semantic segmentation models achieving 92% accuracy on 50K+ labeled images, reducing herbicide usage by 60% and operational costs by $150K annually through U-Net and DeepLabv3 architectures.
- **ML Science & Engineering Apprenticeship** *Jun 2023 - Aug 2023*
  Naval Research Laboratory (Full-Time) Washington, D.C.
  - Led 4-engineer team developing deep learning models using UNet, Transformers, and GANs for underwater acoustic modeling, improving transmission loss prediction accuracy by 20% over physics-based simulations.
  - Architected secure Retrieval-Augmented Generation system with LangChain and vector embeddings for classified document retrieval, implementing access controls and reducing query response time by 65%.

Projects

- **Frontera** *Ongoing*
  Tools: Next.js, TypeScript, FastAPI, Python, LangChain, Firebase, NoSQL, REST API https://frontera.app
  - Founding engineer building full-stack AI-powered project management platform serving 500+ users, architecting microservices backend with FastAPI, Firebase Authentication, NoSQL database, and WebSocket connections for real-time collaboration.
  - Engineered multi-agent LLM system using LangChain for automated roadmap generation, task decomposition, and intelligent issue resolution, reducing project planning time by 70%.
- **Caladrius** *Sep 2025*
  Tools: React Native, Python, LangGraph, GPT-4, AWS S3, REST API, Cryptography https://github.com/karthikcsq/Caladrius

- Architected cross-platform AI medical triage application with React Native implementing AES-256 encrypted QR-based data transfer and zero-knowledge architecture for HIPAA-compliant medical data handling; awarded 2nd Place at HackGT 12.
- Built multi-agent diagnostic system with LangGraph processing patient symptoms through specialized agents, achieving 85% triage accuracy and integrating REST API backend with AWS S3 for secure medical record storage.

- **Personal Portfolio & Blog Platform** *Ongoing*
  Tools: Next.js, TypeScript, React, Tailwind CSS, Pinecone, AWS S3, Python, Vercel https://github.com/karthikcsq/personalsite
  - Developed full-stack portfolio with Next.js, TypeScript, and AWS S3 CDN integration deployed on Vercel, achieving 95+ Lighthouse performance score and sub-1-second global load times with automated CI/CD pipeline.
  - Implemented RAG-powered semantic search using Pinecone vector database and GPT-4 embeddings, processing 100+ technical blog posts for intelligent content discovery.
- **Verbatim** *Feb 2025*
  Tools: Next.js, Python, OpenAI API, Google Cloud, Vercel, REST API https://github.com/karthikcsq/verbatim
  - Created production video processing platform integrating Whisper, GPT-4o, Eleven Labs, and Twelve Labs APIs for automated transcription, translation, voice cloning, and lip-sync generation, processing 500+ videos.
  - Architected serverless async processing pipeline on Vercel handling 2GB video files with job queues, webhook notifications, and API rate limiting, reducing user wait time by 85%.
- **In The Loop** *Ongoing*
  Tools: Next.js, React, TypeScript, LangGraph, Python, FastAPI, Vercel https://in-the-loop-ai.vercel.app/
  - Built streaming AI agent platform reducing LLM token usage by 40% through intent clarification using LangGraph for stateful multi-turn interactions with WebSocket-based streaming.
  - Implemented FastAPI backend supporting user interrupts and thread-level state management for 100+ concurrent sessions with conversation analytics dashboard.
- **Storytime.ai** *Ongoing*
  Tools: Next.js, React, TypeScript, GPT-4o, Pinecone, Python, Tailwind CSS https://storytime-sepia.vercel.app/
  - Developed AI news aggregation platform using GPT-4o for story clustering and summarization, processing 1K+ articles daily with Pinecone vector similarity search for duplicate detection.
  - Implemented content personalization engine with collaborative filtering and ETL pipeline scraping multiple news sources, increasing user engagement by 55%.
- **Photonic Implementation of Quantum Key Distribution** *Oct 2023 – May 2024*
  Tools: Python, NumPy, Oscilloscope, Optics Hardware https://arxiv.org/abs/2509.04389
  - Built polarization-based QKD prototype with laser systems, polarizers, and beamsplitters, achieving 95% photon detection rate and demonstrating secure key exchange over 5m fiber optic channel.
  - Automated signal processing pipeline with Python and NumPy for bit extraction, basis sifting, and quantum bit error rate analysis, processing 10K+ measurement samples; published research on arXiv.
- **Quantum Racer** *Aug 2022 – Dec 2022*
  Tools: Java, Android SDK, Gradle, XML https://github.com/karthikcsq/QuantumCarGame_Self
  - Designed educational Android game simulating quantum mechanics concepts with custom physics engine, MVC architecture, and touch-based controls using Java and Android SDK.
  - Packaged and distributed APK for educational outreach, reaching 100+ students in quantum computing workshops.