YUVVAN TALREJA

WEBSITE | EMAIL | LINKEDIN | GITHUB

Education

Carnegie Mellon University — **Aug 2024 – Present**
B.S. in Electrical and Computer Engineering + AI — *Pittsburgh, PA*

Experience

AirLab @ Carnegie Mellon University — **February 2025 – Present**
Undergraduate Research Assistant — *Pittsburgh, PA*

- Contributed to the Unified Spherical Frontend project at CMU's AirLAB, developing a generic strategy for visual perception tasks in spherical space that abstracts away hardware-related artifacts like lens distortion
- Designed and trained deep learning models for spherical image classification and object detection using **PyTorch**, integrating MNIST, PANDORA, 2D3DS, SUN360, and Tartan Air datasets with **WanDB** for experiment tracking
- Developed tools for lens normal map generation and spherical projection visualization, creating interactive visualization capabilities for spherical image data using **Open3D**
- Collaborated with PhD students to create a lens normal map generation pipeline that transformed standard camera configurations to spherical projections, enabling consistent visual processing across heterogeneous camera systems with varying optical properties

Respirer Living Sciences — **May 2024 – Jul 2024**
Software Engineering Intern — *Hybrid*

- Implemented a dual **REST/GraphQL API** system to expose real-time and historical air quality data from **2,500+** IoT sensors, incorporating **OAuth 2.0** authentication and role-based access control
- Engineered a high-performance API gateway using **Kong** to handle request routing, rate limiting, response caching, and analytics, resulting in **99.9%** uptime and average response times under **80ms**
- Developed client SDKs in **Python** and **JavaScript** with comprehensive data validation, error handling, and automatic retry mechanisms to facilitate third-party integration
- Created a developer portal with **Swagger** documentation, interactive testing console, and analytics dashboard using **React** and **Node.js**, reducing integration time for partners by **60%**

Projects

Flowify — **React | Flask | NLTK**

- Developed an algorithmic video content analysis system using Python that automatically generates mind maps from video transcripts, leveraging **TF-IDF vectorization** and cosine similarity matrices for topic segmentation.
- Implemented a novel **sliding submatrix** window algorithm for dynamic topic boundary detection, with configurable parameters for window size, similarity thresholds, and minimum segment sizes.
- Built a text preprocessing pipeline using **NLTK** for sentence tokenization, lemmatization, and n-gram generation, incorporating **KeyBERT** for keyword extraction and topic fingerprinting.
- Created an end-to-end web application that processes videos client-side for transcription and visualizes hierarchical content structure using **JSMind**, making complex video content more digestible.

Ellie-ai — **RAG | VectorDB | Prompt Engineering**

- Developed an AI Teaching Assistant platform using **Flask**, integrating **Groq's** LLM API with a **RAG** (Retrieval-Augmented Generation) system to provide context-aware responses from course materials including PDFs, PPTs, and text documents
- Implemented a robust feedback system with data analytics capabilities, utilizing **Pandas** and **Matplotlib** to generate visual reports tracking student engagement metrics and response quality over time
- Built a document processing pipeline using **PyMuPDF** and python-pptx libraries to extract and index educational content with metadata, enabling granular context retrieval at the page/slide level
- Created both web-based and CLI interfaces with real-time conversation management, supporting persistent user sessions and conversation history tracking through a **JSON**-based storage system

Optical Character Recognition using CRNN and BiGRU — **Python | PyTorch**

- Implemented a hybrid Convolutional Recurrent Neural Network (CRNN) with Bidirectional Gated Recurrent Units (BiGRU) for end-to-end CAPTCHA recognition, achieving **94%** character-level accuracy without requiring explicit character segmentation
- Engineered an advanced image preprocessing pipeline using **OpenCV** that normalized distorted and rotated text, enhanced contrast, and reduced noise, improving model performance by **15%** on challenging CAPTCHA datasets
- Developed and optimized a custom **Connectionist Temporal Classification** (CTC) loss function to train the network on sequence data without aligned labels, reducing training time by **30%** compared to traditional approaches

Dynamic Memory Allocator — **C | Data Structures | Memory Management**

- Designed and implemented a custom dynamic memory allocator in C, managing heap memory efficiently through a combination of explicit free lists and segregated storage techniques.
- Optimized memory allocation and deallocation by leveraging block coalescing, splitting, and boundary tags, improving fragmentation and reducing allocation time.
- Developed a suite of test cases and benchmarking tools to evaluate performance against standard allocators like malloc, achieving competitive execution times and memory efficiency.
- Integrated debugging features such as heap consistency checks to detect memory leaks and invalid accesses, enhancing reliability.

Technical Skills

Languages: Python, Java, JavaScript, Flutter, C++, SQL
Frameworks: Tensorflow, PyTorch, ReactJS, NodeJS, Django
Developer Tools: Git, VSCode, Docker, IntelliJ
Libraries: Pandas, Numpy, Scikit-Learn, Matplotlib, OpenCV, NLTK