Ashmi SN

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Education

Indian Institute of Information Technology, Kottayam *Aug 2023 – Ongoing*
B.Tech in Computer Science

- **Coursework:** Compiler Design, Theory of Computation, Computer Architecture, Design and Analysis of Algorithms, Python, Java, PHP, Data Structure and Algorithms

Publications & Presentations

Transformer-Based Approaches for Malayalam Handwritten Text Recognition Using Custom Tokenization
Presented at **SPELLL 2025**, IIIT Kottayam, India.

Experience

Machine Learning Intern May 2025 – Aug 2025
National Institute of Technology (NIT), Calicut

- Conducted research and model development on transformer-based **OCR systems** using Hugging Face, focusing on handwritten **Malayalam script recognition**.
- Designed and fine-tuned the **Microsoft TrOCR** architecture with a custom tokenizer, achieving high character recognition accuracy on regional datasets.
- Developed and evaluated a **cyberbullying detection model** for Malayalam text using **IndicBERT** and a manually curated social media dataset.
- Implemented extensive **data preprocessing, augmentation, and normalization** pipelines to improve model robustness and generalization.
- Converted the internship work into a **research project** accepted on low-resource language Conference .

Skills

Technical: Python, JavaScript, C++, SQL, PyTorch, TensorFlow, Hugging Face Transformers, OpenCV, MediaPipe, Scikit-learn, FastAPI, Streamlit, React.js, Node.js, Express.js, MySQL, MongoDB, PostgreSQL, Git, Render Cloud
AI & ML: Transformer-based Models (ViT, GPT-2, BERT)**IBM Watson**, Retrieval-Augmented Generation (RAG), OCR Systems, NLP Text Classification, CNNs (U-Net++), Data Preprocessing & Augmentation, Model Optimization
Soft Skills: Analytical Thinking, Research Orientation, Problem Solving, Collaboration, Adaptability, Effective Communication

Projects

REBOUND: AI-Powered Exercise Monitoring and Chatbot System *Oct 2025 – Nov 2025*
Code

- **Overview:** Developed an AI-driven fitness platform integrating computer vision and conversational intelligence for personalized exercise feedback.
- Implemented pose estimation and repetition tracking using **MediaPipe** and **TensorFlow** to evaluate posture and movement accuracy in real time.
- Integrated an interactive **OpenAI LLM chatbot** for instant feedback, fitness guidance, and motivational coaching.
- Built a full-stack web application using **Streamlit** and **PostgreSQL**, deployed on **Render Cloud**.
- Added user progress analytics and adaptive feedback loops for tailored improvement recommendations.

- **Impact:** Created an engaging virtual trainer bridging physical fitness with conversational AI for enhanced user performance.
- **Tech Stack:** Python, OpenCV, MediaPipe, TensorFlow, OpenAI API, Streamlit, PostgreSQL, Render.

Sarathī: Advanced RAG Pipeline Optimization *Aug 2025 – Oct 2025*
Code

- **Overview:** Designed an intelligent RAG-based chatbot for civil engineering and road safety, providing precise, clause-level answers from Indian Road Congress (IRC) standards.
- **Goal:** Enable engineers to query dense technical documents (e.g., IRC PDFs) in natural language and receive accurate, citation-backed answers.

Core Architecture (RAG Pipeline):

- **Data Ingestion:** Parsed and chunked IRC standards into semantically coherent sections.
- **Vector Store:** Embedded text chunks using `mxbai-embed-large-v1` and stored them in **ChromaDB** for semantic retrieval.
- **Planner Agent:** Analyzed the user query and formulated optimal multi-step retrieval plans.
- **Retriever:** Queried ChromaDB to extract the most contextually relevant document chunks.
- **Generator (LLM):** Used **Llama 3.1** to synthesize precise, context-grounded responses in natural language.
- **Interface:** Developed a **Streamlit** web front-end (`app.py`) for interactive querying.

Outcome:

- Achieved over **90% reduction in factual errors** on complex, multi-topic technical queries.
- Transformed Sarathī-Chariot into a robust RAG system capable of precise retrieval and context-grounded reasoning across large technical standards.

Malayalam Cyberbullying Detection using Deep Learning *May 2025 – Jul 2025*
Code

- **Overview:** Developed an NLP-based model to automatically detect cyberbullying in Malayalam social media text.
- Collected and preprocessed a labeled dataset containing abusive and non-abusive Malayalam comments.
- Implemented text classification using **INDIC BERT**, achieving **95% accuracy**.
- Applied text cleaning, tokenization, and word embedding for efficient model training.
- Designed an interactive evaluation interface using **Streamlit** for real-time text classification.
- **Impact:** Contributed to regional language AI safety by building one of the first Malayalam-specific cyberbullying detectors.
- **Tech Stack:** Python, TensorFlow, BERT, Pandas, Streamlit, scikit-learn.

Malayalam Handwritten OCR using Microsoft TrOCR *May 2025-Aug 2025*

- Developed an OCR system for handwritten Malayalam text using **Microsoft's TrOCR** (Vision Transformer + GPT-2).
- Designed a **custom syllable-level tokenizer** to handle Malayalam conjuncts and diacritics effectively.
- Integrated tokenizer into a custom **TrOCRProcessor** and trained using Hugging Face's VisionEncoderDecoderModel.
- Reduced **Character Error Rate (CER)** from 59% to 10%, outperforming baseline models.
- Evaluated performance using CER/WER metrics and built scripts for visualization and error analysis.

GREENQUEST: Gamified Rural Waste Management Solution *Feb 2025 – Apr 2025*
Code

- **Overview:** Developed an interactive full-stack platform that gamifies rural waste management through

community engagement, rewards, and digital incentives.

- Built a **MERN stack** web application featuring household, volunteer, and NGO modules for waste tracking and management.
- Implemented a **marketplace system** where users redeem eco-points for sustainable products and utility benefits.
- Integrated **leaderboards**, quizzes, and mini-games like **eco-themed maze challenges** to promote environmental awareness.
- Added **email notifications** and automated alerts for pickups, leaderboard updates, and event reminders.
- Designed an analytics dashboard to visualize waste collection data, user rankings, and progress metrics.
- Deployed the platform on cloud infrastructure with **MongoDB Atlas** for scalable data handling and real-time updates.
- **Impact:** Encouraged eco-friendly behavior by merging technology, gamification, and community-driven sustainability.
- **Tech Stack:** MongoDB, Express.js, React.js, Node.js, Chart.js, Nodemailer.

DARSHAN: CNN Model for Road and Building Classification *Aug 2024 – Present*
Code

- Developed a deep learning model using **U-Net++** for road and building segmentation from drone imagery.
- Applied advanced **image augmentation, tiling, and preprocessing** techniques for efficient handling of large datasets.
- Trained and evaluated models using **TensorFlow, Keras, and PyTorch**, optimizing with F1-score and precision-recall metrics.
- Improved urban infrastructure mapping accuracy, aiding disaster management and smart city planning.
- **Tech Stack:** TensorFlow, Keras, PyTorch, U-Net++, OpenCV.

AutoRAG: Language-Driven Automation using RAG and FAISS *Jul 2024 – Sep 2024*
Code

- Engineered a **FastAPI-based automation system** integrating Retrieval-Augmented Generation (RAG) and FAISS for semantic matching.
- Used **all-MiniLM-L6-v2** embeddings to map natural language commands to Python function execution.
- Implemented modular APIs and cross-platform support through **PowerShell** and REST interfaces.
- Reduced manual execution time for automation tasks by enabling human-like interaction through text prompts.
- **Tech Stack:** Python, FastAPI, FAISS, Sentence-Transformers, Uvicorn, PowerShell.

Sahyog: Disaster Resource Tracking System *Sep 2024 – Present*
Code

- Developed a full-stack system for real-time **disaster resource tracking** and NGO coordination.
- Designed an **interactive React.js** frontend with dynamic dashboards and analytics visualization.
- Built a scalable backend using **Node.js, Express.js, and MySQL** with structured data models.
- Integrated **Socket.io** for instant notifications and live updates on resource and volunteer status.
- **Impact:** Enhances efficiency and transparency in relief operations by connecting NGOs and authorities.
- **Tech Stack:** React.js, Node.js, Express.js, Socket.io, MySQL, Chart.js.

Achievements

- **Attended IBM Student Maitrayee Program**:Shortlisted from pool of candidates for attending Annual outreach program Online at Bangalore.
- **Qualified, Smart India Hackathon Internals:** Proposed a disaster management solution in 2023 and developed a CNN-based Mask R-CNN for building classification in 2024.
- **Gen AI 60-Day Challenge:** Successfully completed the Gen AI 60-Day Challenge, gaining hands-on experience in building AI solutions. Received winning swags from Google for outstanding participation in AI-based tasks.

Extracurricular Activities

Lead *IITK*

Mind Quest Mental Wellness Club

- Coordinated outreach programs promoting mental wellness, focusing on stress management and resilience during academic exams.
- Organized workshops and sessions in collaboration with local schools and mental health professionals.
- Raised awareness and provided support for mental well-being through structured events and initiatives.

Ex-Robotics Sub-Lead *IITK*

Beta Labs

- Organized and executed technical events to introduce first-year students to robotics.
- Led the development of a line-following robot with speed control, overseeing both simulation and real-time implementation.
- Facilitated teamwork and hands-on learning through a technical treasure hunt and practical projects.