Nihar Sanda

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EDUCATION

Northeastern University - Khoury College of Computer Sciences **2023 - 2024**
MS in Computer Science — GPA: 4/4 *Boston, MA, USA*

- Master's Thesis: *"Cross-Domain Knowledge Retrieval Using LLM-Enhanced Graphs"*

Indian Institute of Information Technology, Dharwad **2019 - 2023**
Bachelor of Technology, Computer Science and Engineering *Karnataka, India*

EXPERIENCE

Northeastern University, Institute for Experiential AI **Jan 2025 - Present**
Machine Learning Engineer *Boston, MA*

- Architecting **PRISM (Precision Research and Information Systems for bioMedicine)**, a unified AI-augmented knowledge aggregation platform for life sciences, integrating **Neo4j knowledge graphs**, **FastAPI backends**, and **multi-agent RAG systems** to enable cross-domain scientific reasoning.
- Developed **eGoT (enhanced Graph-of-Thoughts)**, a novel graph-based reasoning algorithm achieving **98.8% win rates** against competing GraphRAG methods including KAG, with superior performance on **MultiHopRAG and HotPotQA benchmarks**, advancing multi-hop question answering capabilities.
- Engineered **Cypher query generation pipelines** and **knowledge graph construction workflows** leveraging **GPT-4, DeepSeek-V3**, and advanced embedding systems, processing biomedical literature and climate science data for cross-domain knowledge retrieval.

Northeastern University, TEA Lab **Jan 2024 - Dec 2024**
Research Assistant *Boston, MA*

- Developed an advanced AI-powered Miro plugin utilizing unsupervised ML **clustering algorithms**, implementing **HCI** and **Gestalt principles** to enhance **accessibility** for low vision users in digital collaboration spaces.
- Engineered custom **ML models** that analyze and restructure visual information in **real-time**, leveraging **computer vision** techniques to transform complex ideation workspaces into accessible, navigable interfaces.
- Led an **interdisciplinary team** to **first-place victory** in Papers2Products hackathon by Northeastern University, developing architecture for an innovative solution that seamlessly integrates **psychological principles** with cutting-edge **AI** to solve complex accessibility challenges in digital whiteboarding.

Institute for Software Integrated Systems, Vanderbilt University **May 2024 - Dec 2024**
Machine Learning Engineer Intern *Nashville, Tennessee*

- Architected **scalable real-time inference endpoints** for **Livekit Agents** to process **100 requests/second** for Emotion Recognition and YOLO models on a 20-node Kubernetes cluster, reducing latency by 40% and maintaining 99.9% uptime.
- Developed a **Human Activity Tracking** system for collaborative learning environments, integrating state-of-the-art **Kalman filters** and **triplet loss-based ReID models**, achieving 92% mAP across 10+ hours of video data from 10 classrooms.
- Engineered a **multimodal fusion technique for emotion recognition**, attaining 87% accuracy in affect mapping for the NSF AI Engage Institute's project, impacting 1000+ students across 5 universities.

Indian Institute of Technology, Bombay **May 2023 – Dec 2023**
Research Associate *Mumbai, India*

- Scaling the **"Affect Aware Tutoring System Using Video Bots"** to learn **student engagement with adaptive feedback**, **improving accessibility** and **enhancing learning outcomes**.
- Demonstrating **leadership and project management skills** by overseeing the development of a high-performance production application, designed to handle concurrent usage by over **10,000 users**.
- Engaged in extensive research on **"Privacy Protection of Student Video Data through Stylegan-Based Deidentification in Diverse Learning Environments"** exploring innovative approaches to **safeguard student privacy** and confidentiality within various educational settings.

Patenti Technology Solutions **Mar 2023 - May 2023**
ML Intern *Bangalore, India*

- Created a comprehensive IP infringement search tool by **utilizing OCR models** and employing **Django's Model-View-Template (MVT) architecture** to develop the application.
- Deployed and maintained multiple **production and testing environments** on **AWS EC2, S3, and Redis**, utilizing **Github Actions** for **CI/CD automation**.

- Developed numerous backend modules and executed an NLP pipeline to **employ LLMs** and **construct a corpus** for **topic modeling** and **scientific term retrieval** in patent documents.

Indian Institute of Information Technology, Dharwad **Oct 2022 - Jan 2023**

Undergraduate Research Assistant (Under Prof. Kavi Mahesh and Dr. Abhilash C B) *Dharwad, India*

- Led research efforts to **explore semantic interestingness** and conduct **analysis of interesting patterns** in various types of healthcare data, aiming to **enhance rule representation**.
- Additionally, facilitated the **integration and utilization of transformer-based models** for **ontology-based associated rule mining**, enabling advanced data analysis techniques in the **healthcare domain**.
- Engaged in **building ontologies** for diverse datasets, including **US birth data** and **Karnataka Covid Patients data**, to enhance **data interoperability, semantic integration, and facilitate meaningful insights** and analysis in these specific domains.

Google Summer of Code, PEcAn Project **Jun 2022 – Nov 2022 & Jun 2023 – Oct 2023**

Contributor *Mumbai, India*

- Developing the **various PEcAn packages** of **data assimilation and meta-analysis** for Carbon and Land data.
- Leveraged **R Shiny** to create a **robust and user-friendly dashboard**, empowering users to generate dynamic **SDA (State Data Assimilation) and forecasting graphs** for various researchers around the world.
- Enhanced the **authentication of the existing REST APIs** by incorporating robust **API Key authentication** and implementing efficient **rate-limiting features**.

Indian Institute of Technology, Bombay **Jul 2022 – Nov 2022**

Research Intern *Mumbai, India*

- Worked on a novel idea in the field of education technology, named **"Affect Aware Tutoring System Using Video Bots"**.
- Built a learning management system that collects the click-stream log data of the student, simultaneously captures video and then predicts the user's affect state for real-time feedback.
- Developed an optimized transformer-based deep learning model **Vision Transformers** to predict the user's affect state. The model was trained on the huge DAiSEE dataset for approximately **300 hours**.

Camplus App, Varopro Private Limited **Feb 2021 – Oct 2022**

Founder and CEO *Mumbai, India*

- Led a team of more than **10 people** in the development of a **campus management application** catering to a user base exceeding **800 individuals**, receiving **grants and funding** of more than **$13000**.
- The startup was incubated by **New Gen IEDC IIIT Allahabad**, **Government of India**, under the **Startup India initiative**, secured funding and garnered significant **media attention**.
- Engineered the application's **multi-tenant backend** leveraging a robust tech stack including **AWS Lambda**, **DynamoDB**, **S3**, **SES**, **API Gateway**, and the **MEN (MongoDB, Express, Node) stack**.

PROJECTS

GeoSAFE - Geospatial Artificial Intelligence Safety Assurance Framework | *NLP, AI-Safety* **Dec 2025**

- Designed a novel **safety assurance framework GeoSAFE**, for geospatial AI, introducing a taxonomy encompassing **six critical hazard categories** and addressing domain-specific safety concerns.
- Curated a dataset of **12,078** LLM-human interaction **prompts and responses**, annotated for **safety evaluation**, leveraging data-centric AI principles to remove bias and improve fairness in the prompts.
- Improved AI-safety classification accuracy by **fine-tuning** large language models like LlamaGuard and NeMo Guardrails, achieving a **97% F1 score** and significantly reducing false safe rates in geospatial AI prompts.

Realtime Person Tracking and Reidentification in Embodied Learning Environment | *Computer Vision* **Jan 2024**

- Engineered a **high-performance person re-identification (Re-ID)** system using a custom dataset and deep learning pipeline in **PyTorch**, designed for **real-time tracking** in closed-room classroom settings.
- Achieved **92% mAP accuracy** by fine-tuning pre-trained models **(TriNet, OSNet)** and applying **ensemble learning**.
- Integrated **YOLOv8** with **DeepSORT** for real-time **multi-object tracking**, utilizing **Kalman** and **Particle Filters** for precise motion prediction, trajectory estimation, and minimized **identity switches**.

Protein Fold Recognition | *NLP, Transformers, Bio-Informatics* **Aug 2022**

- Implemented advanced **NLP techniques** to improve protein fold recognition for low similarity datasets such as **DD, EDD, TG, and SCOPe** baseline datasets encompassing diverse amino acid-based protein sequences and their corresponding folds.
- Extracted **features** by utilizing evolutionary **PSSM and HMM profiles** of protein sequences, and concatenating them with global **Convolutional** and **Skip Bi-gram features**.
- Implemented **BERT and ESM by Meta transformer-based models** for classification, achieving an impressive accuracy **exceeding 93%** across all datasets, **surpassing the previous 85% accuracy**.
- The project has been documented and submitted to **IEEE Transactions on Computational Biology and Bioinformatics**, where it is currently under review.

SKILLS

Languages: Python, R, Java, Golang, C++, C, JavaScript, Typescript
Libraries: PyTorch, TensorFlow, Keras, Jax, Langchain, LlamaIndex, Seldon, MLFlow
Technologies: Parallel Programming, RESTful services, Flask, Django, Docker, Jenkins, CI/CD, R Shiny
Database: SQLite, PostgreSQL, MySQL, MS SQL, MongoDB, NoSQL, DynamoDB, Redis
NLP: NLTK, spaCy, Word2Vec, Transformers, BERT, GPT, RNNs, LSTMs, GRUs, NER, LLM, Guardrails
Computer Vision: OpenCV, YOLO, SSD, R-CNNs, GANs, Vision Transformers, Triplet Loss, Kalman Filters
LLMs: Fine-tuning, Prompt Engineering, RAG (Retrieval Augmented Generation), Vector Databases, Parameter-Efficient Fine-Tuning (PEFT), AI Agents, MCP Servers

PUBLICATIONS

GeoSAFE- Geospatial Artificial Intelligence Safety Assurance Framework and Evaluation for LLM Moderation

- Proposed a geospatial AI safety taxonomy with six hazard categories, curated a dataset of **12,078** annotated prompts, and fine-tuned LlamaGuard achieving a **97% F1 score**;
- Paper accepted at **AACL-IJCNLP 2025**.

Retaining Emotions, Removing Identity: Valence–Arousal Guided De-Identification for Educational Applications

- Developed a StyleGAN-based de-identification framework using valence-arousal guided identity replacement, achieving 89.97% privacy preservation while maintaining 92.4% expression fidelity for emotion recognition in classroom environments.
- Paper accepted at **ACM Symposium on Applied Computing**.

Challenges of Applying Computer Vision for Emotion Detection in Educational Settings: A Study on Bias

- The paper analyzes the accuracy of emotion recognition from video in several different learning environments, with respect to four attributes of the images: skin tone, lighting, resolution, and camera angle.
- Paper accepted at **26th International Conference on Artificial Intelligence in Education**.

An Effective Framework for the Prediction of Protein Folds using NLP and Evolutionary Features

- Developed a high-performance framework for protein fold recognition by combining NLP-based features with evolutionary profiles, significantly improving classification accuracy across multiple benchmark datasets.
- Paper currently under review in **IEEE Journal of Biomedical and Health Informatics**.

Multi Modal Affect Aware Tutoring Systems | *Data Visualization, Machine Learning, Deep Learning*

- Developed a novel idea of "Multi-modal Affect Aware Tutor System using Video Bots".
- Paper is documented and in submission at **IEEE Transactions in Learning Technologies Journal**.

Interestingness from COVID-19 Data: Ontology and Transformer-Based Methods

- Identify interesting patterns using ontology-based mining techniques and process them with transformer models for identifying interesting rules from the mined corpora.
- Paper accepted for publication at **ICON 2022** (SCOPUS indexed).

Ontology-Based Semantic Data Interestingness Using BERT Models

- Implemented a data curation pipeline with semantic integration using the ConstApriori algorithm for RDF data, leveraging Clinical BERT and Bio BERT models with cosine similarity to identify the most semantically interesting rules, optimizing decision-making.
- Paper published in **Taylor and Francis' Connection Science Journal** (SCI and SCOPUS Indexed).

ACHIEVEMENTS

- Northeastern Laurel and Scroll 100 Recipient
- Graduate Research Award, Northeastern Khoury College of Computer Sciences (2026)
- Director's Gold Medal for the Best Outgoing Student at IIIT Dharwad.
- Best Research Poster in Novelty and Impact at the Khoury Research Day 2025.
- 2-time Google Summer of Code (2022, 2023) Recipient.
- Reviewer at ICCE and T4E conferences in the Education Technology domain.
- Led a team to the Grand Finals of Smart India Hackathon 2022.
- Open Source Contributor to Rucio (CERN), PEcAn Project, CircuitVerse.
- Founder and President of Velocity, Web and App Dev Club of IIIT Dharwad.