Koushik Reddy Parukola

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PROFESSIONAL SUMMARY

Researcher and engineer focusing on NLP and specializing in building research software for ML/AI. Experienced deploying production-ready AI systems on AWS Bedrock and HPC clusters, integrating secure data pipelines and building reproducible workflows in compliance-heavy domains like bio-medical, clinical and finance. Skilled at cross-disciplinary collaboration and translating complex technical systems into practical solutions for engineering and research teams.

TECHNICAL SKILLS

- **Languages:** Python, C/C++, Matlab, Rust, SQL, R, Java, SAS, TypeScript, Excel, Access, HTML5
- **Frameworks/Libraries:** PyTorch, TensorFlow, JAX, Huggingface, LoRA, DeepSpeed, CUDA, MPI, TensorRT
- **AI/ML:** RAG, graph-RAG, LangChain, LangGenius, Open AI, MLflow, Weights & Biases, MCP, RAG, Nemo Guardrails
- **Integration & Data:** GitHub Actions, REST/FAST APIs, ETL pipelines, Neo4j, SPARQL, RDF, FIASS, Knowledge Graphs
- **Cloud & Infrastructure:** Kafka, GCP, AWS (SageMaker, Bedrock, EC2, S3), Azure, Docker, Kubernetes, SLURM
- **Data and Viz:** MySQL, PostgreSQL, MongoDB, Redis, knowledge graphs, Power BI, Tableau, Matplotlib, Seaborn,

PROFESSIONAL AND RESEARCH EXPERIENCE

Lead Machine Learning Engineer (AI systems) – VervusAI – AI Consultants Startup **Jan 2024 – Present**

- Designed and deployed reproducible, modular AI pipelines on **AWS Bedrock and LangGraph**, ensuring compliance, scalability and robust infrastructure for multi-modal appraisal workflows – **reducing appraisal time by 60%.**
- Built **complex multi-source data integration** combining public records, county records, MLS feeds, zoning ordinances, geospatial layers from providers including Redfin and ATTOM into structured, compliance-ready data.
- **Fine-tuned LLMs** on domain corpora - MLS listing descriptions, historical sales comps, zoning, inspection notes and county records using **LoRA for parameter-efficiency** while maintaining latency and cost goals.
- Built a **reinforcement learning** pipeline by training a reward model from appraiser (expert) pairwise preferences and optimizing the policy with PPO under KL constraints, with **75% reductions** in post-edit effort and higher acceptance rates for valuation narratives and adjustment explanations.
- Tracked experiments and rollouts with **MLflow** in deployments and **Weights & Biases** for training, validation metrics, prompt/agent routing and RLHF runs, ensuring fully reproducible progress from prototype to production.
- Implemented data-governance controls (**privacy and compliance),** including field-level PII masking, encrypted storage with KMS, access controls and sensitive-data discovery also performed periodic bias and safety audits.
- Built evaluation and monitoring for accuracy, **bias, safety, user-intent coverage and multilingual performance** (English, Spanish, French) with offline test sets, A/B workflow experiments and live dashboards.

Research Associate - NLP Lab - Indiana University **Aug 2023 – July 2025**

- Developed secure, large-scale **NLP pipelines for biomedical and clinical text** (EHRs, record summaries) using spaCy, HuggingFace and transformer models for entity recognition, hierarchical relations and temporal reasoning.
- Integrated bio-medical ontologies **(UMLS, OMOP)** for hierarchical and structural feature extraction as context for LLMs and tested on various diseases, drugs and treatment pairs, resulting in a **15% improved information retrieval**.
- Fine-tuned domain-specific LLMs **(BioBERT, ClinicalBERT)** with LoRA and used **Graph-RAG**, improving phenotype detection and concept disambiguation across corpora on IU's supercomputer, noting **9% reasoning improvement**.
- Researched **embedding clusters and long-distance dependencies** addressing linguistic phenomena like **ellipsis, discontinuities** where most LLMs fail, presenting at Midwest Speech & Language Days at University of Notre Dame.
- Built and managed secure **SQL/Postgres** datasets and **ETL workflows** supporting studies, ensured data quality, stability and reproducibility through HPC workflows using **SLURM and Docker**.
- Developed researcher-facing utilities and lightweight services as needed using **FastAPI** with simple HTML and **JavaScript**, versioned code**, CI/CD in Git with Jenkins tests** and documentation for non-technical collaborators.
- Led **hands-on workshops** and delivered training programs for students and faculty on NLP/ML methods, reproducibility best practices and responsible AI. Provided mentorship to guide them in active research projects.
- **Collaborated across IU** (Luddy School of Informatics, School of Public Health, College of Arts and Sciences) with Prof. Damir Cavar, Prof. Larry Moss and Prof. Zoran Tiganj, translating research goals into softwares.

Junior Machine Learning Engineer – NovelTronix **Jan 2021 – Jul 2022**

- Developed end-to-end ML pipelines for heterogeneous **telemetry streams** (GPS, accelerometer, engine data), showcasing expertise in handling noisy, high-frequency sensor inputs at scale.
- Deployed **low-latency edge inference modules**, ensuring **real-time classification** under compute constraints.
- Built **sensor–ML integration layers** (C-Python bridges) enabling continuous data flow between embedded devices.
- Designed dashboards with full audit trails and model registry integration and business decision-making.

PROJECTS

Social Media Disaster Policy Analysis – Crisis Innovation and technology Lab **Oct 2023 – Feb 2024**

- In collaboration with CTI Lab at IU, I built a full-scale pipeline for analyzing **public policy reactions and sentiment trends** during large-scale events, disasters and policy decisions.
- **Collected and processed 1M+ social media posts,** merged structured (temporal/geotag) and unstructured (text) data into clean, analysis-ready datasets.
- Used advanced NLP techniques to analyze COVID-19 vaccine discourse, leveraging temporal clustering and regional mapping to uncover sentiment trends and evolving public narratives.
- Developed **interactive dashboards and spatial heatmaps** that highlighted narrative shifts, information surges and geographic impact zones, enabling faster interpretation by researchers and public health teams.

Cancer Drug Synergy – BioInformatics Machine Learning **Feb 2023 – Aug 2023**

- Designed a **multi-branch deep learning pipeline** using Message Passing Neural Networks **(MPNNs)** for drug molecules and Graph Convolutional Networks **(GCNs)** for cancer cell lines.
- Integrated dual **graph-based encoders** (MPNNs for drug molecules, GCNs for cancer cell lines) to model drug synergy across tissue types, advancing omics-driven precision medicine research.
- Used **NCI ALMANAC datasets** of drug–drug interactions and cell-line responses, encoding molecular graphs from **SMILES strings** and normalizing **high-dimensional genomic features** for robust cross-cancer predictions.
- Benchmarked models **against DeepSynergy** and gradient boosting baselines, achieving up to **12% performance improvement** while validating robustness across heterogeneous biomedical datasets.
- Applied explainability methods like **SHAP graphs** to highlight molecular substructures and genomic markers influencing synergistic effects, enabling biologically interpretable outputs for downstream drug discovery.

Synthetic Face Detection Via GAN Filtering – Twitter/X **Dec 2022 – July 2023**

- Developed multi-model ensemble system using **ResNet50** and **XceptionNet** and for GAN-generated fake face detection, achieving **94.2% accuracy** on social media images.
- Engineered this detection pipeline processing **50,000+ images** from FFHQ and **StyleGAN25k** datasets, reducing **false positive rates by 23%** through advanced feature engineering.
- Implemented end-to-end ML workflow combining traditional computer vision (**Haar Cascades**) with deep learning architectures for social media authenticity verification.

EDUCATION

M.S. in Data Science - Computational Science Track- Indiana University, Bloomington, IN Aug 2022 – May 2024

- Associate Instructor – Advanced Natural Language Processing

B.E. in Computer Science and Engineering - New Horizon College of Engineering, Bengaluru July 2017-Aug 2021

- Vice President – App Development Club at NHCE 2019-2021

CERTIFICATIONS AND AFFILIATIONS

- AWS Certified AI Practitioner (2025) / Anthropic - AI Fluency: Framework and Foundations with MCP
- IBM Quantum AI Challenge - Top 11% / IBM Qiskit Global Summer School: Excellence – 2024/25
- CI Pathways Scientific Parallel Computing program (Hosted by NCSA, UIUC, Pittsburgh Supercomputing Center)
- Organizing and Poster Committee: Quantum AI and NLP Conference 2025 (ACM SIGAI, IU Bloomington) – qnlp.ai

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PUBLICATIONS AND TALKS

- "NLQK"-IEEE QCE 2025-**Open Source PyPI module** for encoding hybrid quantum-classical AI and tensor processing.
- "Text Similarity in Hybrid Classical vs Quantum AI Systems" – **IEEE ICASSP 2025** – IEEE proceedings April 2025
- "Quantum Word Embeddings" – **Midwest Speech & Language Days – University of Notre Dame – 2025**
- "Traffic Sign Classification" – **IJISRT Research Journal**, Volume 6, Issue 6, 2021