Jugal Gajjar

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RESEARCH INTERESTS

Intelligent Autonomous Systems, Large Language Models (LLMs), Natural Language Processing (NLP), Software Security, AI in Software Engineering, Agentic AI, Multimodal Learning and Reasoning, Graph Learning

EDUCATION

MS in Computer Science (Machine Intelligence and Cognition)
The George Washington University, *Washington, DC*   May 2026 (Expected)
GPA: 3.95/4.0

B.Tech. in Computer Science and Engineering
Navrachana University, *Vadodara, India*   May 2024
CGPA: 9.39/10

RESEARCH PUBLICATIONS

Bridging Semantics & Structure for Software Vulnerability Detection using Hybrid Network Models
14th International Conference on Complex Networks and their Applications   Dec. 2025

SecureFixAgent: A Hybrid LLM Agent for Automated Python Static Vulnerability Repair
2025 International Conference on Machine Learning and Applications (ICMLA)   Dec. 2025

MLCPD: A Multi-Language Code Parser Dataset with Universal AST Representation
arXiv preprint (cs.SE)   Oct. 2025

MalCodeAI: Autonomous Vulnerability Detection and Remediation via Language Agnostic Code Reasoning
IEEE 26th International Conference on Information Reuse and Integration (IRI 2025)   Aug. 2025

Multimodal Sentiment Analysis on CMU-MOSEI Dataset using Transformer-based Models
arXiv preprint (cs.CL)   May 2025

Building Trust: The Sentient AI Framework for Emotionally Intelligent AI
International Journal of Creative Research Thoughts (IJCRT)   Nov. 2024

RESEARCH PROJECTS

Knowledge Graph Alignment with LLM-Guided Weak Supervision   Sep. 2025 – Present
- Developing a scalable framework for aligning heterogeneous knowledge graphs (KGs) using Large Language Models (LLMs) as weak supervisors.
- Combines structural embeddings, textual similarity, and LLM-based semantic judgments via a fusion model.
- Designing candidate-blocking and feature-fusion pipelines integrating FAISS, GCN/GraphSAGE/GAT embeddings, and LLM prompts/embeddings.

HyperComplEx: Adaptive Multi-Space KG Embeddings   Apr. 2025 – Oct. 2025
- Engineered a hybrid knowledge graph embedding framework with adaptive space attention for automatic selection of hyperbolic, complex, or Euclidean geometries per relation type.
- Outperformed 6 baselines across 5 scales (5K-25M entities) with 5-20% MRR gain over various scales and <85ms inference through memory-efficient sharding and mixed-precision training on consumer hardware.
- Under review at the 5th Workshop on Knowledge Graphs and Big Data in IEEE BigData 2025.

MultiLang Code Parser Dataset (MLCPD)   May 2025 – Oct. 2025
- Constructed a large-scale, language-agnostic dataset of ∼7M parsed source files across 10 programming languages, unified under our proposed universal Abstract Syntax Tree (AST) schema.
- Designed schema normalization pipelines for syntax alignment and stored the dataset in Apache Parquet for fast cross-language querying with 99.9999% successful conversions.
- Released on Hugging Face for research in cross-language deep learning and LLM-based code understanding.
- Published the preprint on arXiv (cs.SE).

VulnGraph: Graph+LLM Embeddings for Vulnerability Detection   Jul. 2025 – Sep. 2025
- Engineered a multimodal fusion model combining AST/CFG graph embeddings with LLM semantic embeddings using the proposed two-way gating mechanism.
- Achieved 93.57% accuracy, outperforming GNN-only (+8.36%) and LLM-only (+17.81%) baselines, while producing interpretable saliency subgraphs and natural language explanations.
- Accepted at the Complex Networks 2025 Conference (Springer SCI Series, SCOPUS-indexed).

SecureFixAgent: Hybrid LLM Agents for Vulnerability Detection   May 2025 – Aug. 2025
- Developed a hybrid LLM-agentic framework integrated with Bandit for iterative vulnerability detection, patching, and re-validation.
- Fine-tuned open-source models with LoRA on Apple MLX & NVIDIA CUDA, achieving 13.5% higher patch accuracy and 10.8% fewer false positives than baselines.
- Accepted in the Robustness and Security of Large Language Models special session at ICMLA 2025.

MalCodeAI: AI-Powered Malicious Code Detection   Jan. 2025 – May 2025
- Designed a dual-stage LLM pipeline using fine-tuned Qwen2.5-Coder-3B-Instruct for semantic code understanding and vulnerability detection and remediation suggestion.
- Integrated exploit reasoning, CVE scoring, and automated patch generation.
- Inspired ongoing thesis work and published and presented at the IEEE IRI Conference 2025.

Multimodal Sentiment Analysis using Transformers   Apr. 2025 – May 2025.
- Utilized transformer-based early fusion on the CMU-MOSEI dataset for multimodal sentiment analysis.
- Achieved 97.87% 7-class accuracy and a 0.9682 F1-score by integrating text, audio, and visual modalities.
- Published the preprint on arXiv (cs.CL).

EzyCart: Computer Vision Powered E-Cart System   Jul. 2023 – May 2024
- Engineered a patent-pending embedded system using real-time computer vision for autonomous object detection and pricing.
- Trained and deployed lightweight CV models (YOLOv5) on edge devices for efficient and low-latency inferencing with more than 95% accuracy.
- Demonstrated applied skills in CV, embedded ML, and hardware-software integration.

RELEVANT EXPERIENCE

Graduate Assistant
The George Washington University, *Washington, DC*   Sep. 2025 – Present
- Supporting an upper undergrad- & graduate-level Big Data and Analytics course (CSCI 4907/6444).
- Guiding and grading students on assignments and projects, focusing on tools like Spark, Hadoop, and S3 Bucket, and programming in languages like Python, Java, and Linux-Bash.
- Assisting with analytical methods, including machine learning, and provide support for cloud-based and distributed systems projects.

Independent Researcher
The George Washington University, *Washington, DC*   Jun. 2025 – Present
- Conducting thesis research on autonomous AI systems for vulnerability detection, exploitation, and remediation in software.
- Designing a secure code analysis pipeline using LLMs, reasoning models, and agent-based simulation architectures.
- Exploring exploit generation and patching strategies using dynamic analysis techniques.

Teaching Assistant

Navrachana University, *Vadodara, India*   Jan. 2024 – May 2024

- Mentored 80+ undergraduate students through code review, grading, and structured feedback on 750+ lab reports.
- Assisted in designing rubrics, evaluating technical writing, and improving student understanding of test-driven development.
- Supported curriculum delivery in collaboration with faculty, focusing on code quality, documentation, and debugging.

NVIDIA Jetson AI Project Coordinator

Navrachana University, *Vadodara, India*   Mar. 2022 – Jun. 2022

- Conducted workshops on CV and NLP using the Jetson Nano platform, introducing students to embedded AI and real-time inference.
- Mentored 5+ student research projects selected by the NVIDIA Deep Learning Institute.
- Promoted student research initiatives and hands-on learning in edge AI systems.

CERTIFICATIONS & HONORS

NVIDIA-Certified Associate: Generative AI LLMs   2025
GW SEAS Dean's Award Scholarship   2024
Runner-Up, Tinkerthon 2.0 Hackathon   2024
SSIP Innovation Grant – EzyCart   2023
NVIDIA Jetson AI Specialist   2022
Gold Medalist, International Karate Championship (Team India)   2017

SKILLS

Programming & Scripting: Python, C++, Java, Bash, SQL, R, MATLAB, JavaScript
Machine Learning & AI: Large Language Models (LLMs), Deep Learning, Transformers, Natural Language Processing (NLP), Programming Language Analysis, Computer Vision, Graph Neural Networks (GNNs), Anomaly Detection, Multimodal Learning, Explainable AI, Agentic AI
Frameworks & Libraries: PyTorch, TensorFlow, Scikit-learn, Hugging Face, LangChain, Ollama, spaCy, PyG, OpenCV, YOLOv5, Pandas, NumPy, Pinecone
Tools & Platforms: Git, Docker, Spark, Hadoop, NVIDIA CUDA, Multi-GPU Training, Apple MLX, Amazon Web Services (AWS), Google Cloud, Jetson Nano, Linux/Unix
Soft Skills: Research Writing, Academic Presentation, Technical Mentoring, Teaching Assistance, Team Collaboration, Project Leadership