

# Charvi Kusuma

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## Education

Aug 2023 – **University at Buffalo**, NY, United States

Jan 2025 **Master of Science, Computer Science**, Advisor: *Dr.Shamsad Parvin*

Best MS Research Award Winner, GPA: 3.96/4.0

*Research:* Parameter Efficient Fine-Tuning Techniques, Computer Vision, Large-Scale Data Clustering, Pattern Analysis, Depth Estimation Techniques

Jul 2019 – **Vellore Institute of Technology**, AP, India

Jun 2023 **BTech, Computer Science and Engineering**, Advisor: *Dr.Sumathi Doraikannan*

Chancellor's Gold Medalist, GPA: 9.58/10.0

*Research:* Object Detection, Generative Adversarial Networks, Sentiment Analysis

## Professional Experience

Jan – June 2023 **Amazon**, *Software Development and Operations Intern*, Bangalore, KA, India.

### Certificate

- Designed and rectified 120+ Java integration test cases for CI/CD compliance, reducing weekly manual validation effort by 35%.
- Mitigated 20+ security vulnerabilities and developed efficient Python scripts for future data protection pipelines within S3 and SQS instances.
- Automated permission set onboarding workflows to AWS Secrets Manager, collaborating effectively with 5+ cross-functional Amazon Payments teams.
- Engineered a full-stack internal pricing and approval tool (React, Node.js, DynamoDB), automating data entry and reducing processing delays by 40%.
- Implemented backend automation using Sonar and RTN services for stakeholder email notifications, eliminating over 80 manual processing tickets monthly.

**Key Skills:** Java, Python, Amazon Web Services (Dynamo DB, Secrets Manager, S3, SQS), React, Node.js, DynamoDB

Jun – Jul 2022 **JP Morgan Chase & Co.**, *Software Engineering Intern*, Hyderabad, India.

### Certificate

- Delivered a proof-of-concept for Splunk-to-Grafana migration, creating 15+ dashboards that improved user engagement and monitoring usability.
- Configured Prometheus data feeds to monitor 4 critical performance indicators (latency, errors, throughput) for core account management services.
- Contributed to a core banking Java/Spring application, enhancing metric collection by redirecting 30% more data for transaction lifecycle monitoring in Grafana.
- Implemented a Kafka pipeline feeding Prometheus, enabling near real-time (within 5s latency) metric visibility for critical financial services.
- Centralized logs from 3 key backend systems using Elasticsearch, achieving sub-minute query performance for accelerated incident diagnosis.

**Key Skills:** Java Spring, Grafana, Splunk, Prometheus, Kafka, Elasticsearch, ActiveMQ, SoapUI Web Services, Microservices, System Design

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## Research Experience

Jan 2024 – **University at Buffalo**, *Research Assistant*, Buffalo, NY, United States.

Present Advisor: Prof. Erik Cambria

- Led 3 novel research projects in areas including crime pattern analysis, medical imaging and autonomous vehicle safety.
- Mentored 35+ students, fostering hands-on expertise in Hadoop, Spark, and large-scale data processing frameworks.
- Research 1: *Adaptive Driver Assistance: Context-based Approach to Pedestrian Safety*. Parameter Efficient Fine-Tuning (PEFT) Techniques on Pedestrian Behavior & Scene Context Classification Models. Reduced trainable parameters to 0.68% of Vision Transformer backbone maintaining 90% accuracy for 8 multi-task adapters. Processed 346 HD video clips from JAAD Dataset, extracted Region of interests (ROIs) with YOLOv8 as pedestrian detector. Proposed a real-time pedestrian safety solution for autonomous vehicles achieving 0.5ms inference time and reducing computational load by 98% using adaptable features. (Publication in process)
- Research 2: *Mapping Crime Dynamics: Integrating Textual, Spatial, and Temporal Perspectives*. Analyzed textual, temporal, and spatial data for a holistic view of crime dynamics. Designed 21 ML crime hotspot prediction models, incorporating LDA for topic modeling and LSTM for temporal analysis. Presented the end to end solution using Flask framework on CSE Demo Day, selected among 90 projects. Analyzed 1.5 million crime records to identify hotspots using clustering algorithms; optimized model training time by 40% through distributed computing techniques. ([Link](#))
- Research 3: *Cross-Domain Medical Imaging with PEFT*. Applied preprocessing techniques of Computer Vision - CLAHE, Gaussian blur, and Canny edge detection to skin, diabetic, retinal, brain and kidney datasets to compare the performances of LoRA, AdaLora and other techniques for a unified model design. (On-Going)

Jan – June 2022 **Nanyang Technological University (NTU)**, *Research Intern*, Remote.

Advisor: Prof. Erik Cambria, [Certificate](#)

- Analyzed over 25,000 tweets related to Immigration Reforms, providing error analysis and recommending performance enhancements for SenticNet APIs.
- Compared and identified API changes across 3 NLP tools (TextBlob, VADER, Gensim) focusing on concept parsing and sentiment polarity detection.
- Implemented an unsupervised machine learning solution for Semantic Similarity Analysis, contributing to improved policy strategies for 2 APIs.

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## Achievements

2024 **Best MS Research Project Award**: Selected from 90+ research projects presented at the bi-annual CSE Demo Day. ([Link](#))

2023 **Chancellor's Gold Medalist**: Honored as the Best Outgoing Student for exceptional contributions to the university. ([Link](#))

2022 & 2021 **Academic Excellence Awards**: Secured 2nd rank among 650+ BTech CSE students for two consecutive years. ([Link](#))

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## Publications

UEMCON 2024 Tarun Reddi, **Charvi Kusuma**, Shamsad Parvin, PhD. Mapping Crime Dynamics: Integrating Textual, Spatial, and Temporal Perspectives. 2024 IEEE 15th Annual Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON), Yorktown Heights, NY, USA, 2024. ([Link](#))

- ACCAI 2023 **Charvi Kusuma**, N. Meela, S. Saridena, Y. H. Kanuparthi, N. Kaushik Mantha and D. Sumathi. Automated Monitoring System for Healthier Aquaculture Farming. 2023 International Conference on Advances in Computing, Communication and Applied Informatics (ACCAI), Chennai, India, 2023. ([Link](#))
- ICDAM 2021 Banerjee T., Sharma A., **Charvi Kusuma**, Raman S., Regalla R.G., Sindhupriya T. Journey of Letters to Vectors Through Neural Networks. In Proceedings of Data Analytics and Management. Lecture Notes on Data Engineering and Communications Technologies, vol 90. Springer, Singapore. ([Link](#))
- ICCIDE 2021 Banerjee T., Karthikeyan S., Sharma A., **Charvi Kusuma**, Raman S. Attention-Based Discrimination of Mycoplasma Pneumonia. In Proceedings of International Conference on Computational Intelligence and Data Engineering. Lecture Notes on Data Engineering and Communications Technologies, vol 99. Springer. ([Link](#))

## Patents

- 2023 Sumathi D., Saketh S., **Charvi Kusuma**, Yamini H., Kaushik N, Tarun R. A Traffic Control System. Designed traffic clearance strategy by prioritizing waiting time for 5 different users. ([Link](#))
- 2023 **Charvi Kusuma**, Sheela J., Divya M.S., Sudha S.V., Varaprasad G. System and Method to Extract and Analyse Textual Features from an Image. Proposed textual feature extractor with Grey-level Co-occurrence Matrix (GLCM), highlighting 75 claims. ([Link](#))
- 2022 **Charvi Kusuma**, Anil K., Karthikeyan S., Nivas M., Aditya M., Snake Detector and Alerting Gadget for Rural India Using YOLO. Incorporated YOLO with IoT devices for 2x faster object localization and instant alerting at 52.8 FPS. ([Link](#))
- 2021 Tathaget B., **Charvi Kusuma**, Rasmika B., Santanu M., Sharma A., PY- Digital Writing Pad (Python Based Motion Sensing Digital Writing Pad). Developed motion-sensing digital writing pad with Python and OpenCV. ([Link](#))

## Skills

- Programing Python, Java, SQL, JavaScript, R, HTML, CSS
- Libraries NumPy, Pandas, Matplotlib, Scikit-learn, PyTorch, Keras, TensorFlow
- Technologies Git/GitHub, Docker, Apache (Spark, Hadoop, Kafka), AWS (S3, SQS, Secrets Manager), PostgreSQL, MongoDB, React, Node.js
- Expertise Machine Learning/AI Engineering, Computer Vision, Natural Language Processing (NLP), Big Data Processing, Full-Stack Development
- Courses Machine Learning, Deep Learning, Computer Vision, Data Intensive Computing, Data Structures, Analysis of Algorithms, Operating System, Database Management
- Language English, Telugu, Hindi, Kannada

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## Presentations

- Feb 2025 Annual SEAS Lightning Talk Competition, wrapping up months of research into a two-minute talk. ([Link](#))
- Dec 2024 Computer Science Winter Awards for Best Research Project presented during CSE Demo Day Fall 2024. ([Link](#))
- Oct 2024 STEM Research Opportunity Fair at UB, representing the CS Department and showcasing months of research work in Deep Learning and Computer Vision. ([Link](#))

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## Selected Projects

- Apr 2025 **Resonique – Multimodal Music Recommendation:** Integrated Gemini Flash to semantically describe user surroundings (text/image/audio) and Spotify song metadata, transforming them into high-fidelity vector embeddings using MPNet for emotion-based music retrieval. ([Link](#))  
**Key Skills:** Multi-modal Search, Generative AI, LLM, Vector Search, MPNet, CLAP (Contrastive Language-Audio Pretraining), Pinecone, Supabase, API Integration, Streamlit.
- Nov – Dec 2024 **Omni – Truly Personal AI Assistant:** Engineered a personalized AI agent for Google's Long-Context Challenge, fine-tuning Gemini for contextual understanding. Achieved 90% speech recognition accuracy with Whisper and enhanced vision with Apple DepthPro. Integrated RAG for context-aware responses. ([Link](#))  
**Key Skills:** Generative AI, LLMs RAG, Vector Databases, Pinecone, Leveraged Open-Source Models, AI Agents, Prompt Engineering.
- Jun – Dec 2024 **Adaptive Driver Assistance – Context-based Approach to Pedestrian Safety:** Applied task-specific tuning to retain base model knowledge, training 8 adapters that reduced parameters to 0.68% of the Vision Transformer backbone while maintaining 90% accuracy in context and behavior classification. ([Link](#))  
**Key Skills:** ViT, Low-Rank Adaptation, Fine-Tuning, YOLOv8, PyTorch, Computer Vision, Model Optimization.
- Jan – May 2024 **Food & Ingredient AI Suggestion Technology:** Integrated ingredient object detection and customized recipe generation with nutritional insights. Tokenized 2.2M recipes, annotated 100 ingredients using a zero-shot detector, and fine-tuned BERT and ChefTransformerT5 models, achieving a 70% fluency score. ([Link](#))  
**Key Skills:** Supervised Fine-Tuning, Object Detection, Hugging Face Transformers, BERT, GPT-2 (1.5B), PyTorch, Streamlit.
- Sep – Dec 2023 **CrimsonEye – Predictive Crime Analysis:** Analyzed textual, temporal, and spatial data for a holistic view of crime dynamics. Experimented 21 ML crime hotspot prediction models, incorporating LDA (Latent Dirichlet Allocation) for topic modeling and LSTM for time-series analysis. Presented an end-to-end deployed solution using Flask framework on [CSE Demo Day](#), selected among 120+ projects. ([Link](#))  
**Key Skills:** Machine Learning, Hotspot Clustering, Big-Data Processing, Flask, XGBoost, Bagging & Boosting Algorithms, Predictive Analysis.