HAKKA MADAN

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EDUCATION

Arizona State University — Tempe, Arizona
MS Computer Science, GPA: 4.22/4.0 — 2024 – Present

Manipal institute of Technology, Manipal — Karnataka, India
B.Tech Mechatronics Engineering & FinTech, CGPA: 9.3/10 — 2020 – 2024

Relevant Coursework: Artificial Intelligence, Natural Language Processing, Probability Theory, Inferential Statistics, Calculus 1-4, Advanced Algorithms, Cloud Computing, Linear and Non-linear Control Theory, ROS Laboratory

TECHNICAL SKILLS

- **Languages:** Python, C, C++, JavaScript
- **Database & Analysis:** MySQL, NoSQL, Excel, PowerBI
- **ML Frameworks:** JAX, PyTorch, TensorFlow, Keras, MATLAB, OpenCV, CNN, LLM, VLM, VLA, GNN, GAN, NumPy, Pandas, Scikit Learn, Seaborn, Matplotlib, Scala, Spark
- **Other Tools:** Git, ROS-1, ROS-2, AWS EC2, AWS IoT Greengrass, AWS Lambda, Docker, LaTeX, Linux, MS Office

WORK EXPERIENCE

Safe Robotics Group, Arizona State University — Tempe, AZ
Graduate Research Aide, Thesis Project, Chair - Dr. Kunal Garg — Feb 2025 – Present

- Developing formal verification methods for Multi-Agent Systems to ensure safe and optimal trajectories emerging from underlying Quadratic Programming or Multi-Agent RL algorithms in stochastic environments.
- Probing the GNN-based Graph Control Barrier Function (GCBF+) framework for **safety** to identify and fix false negatives (collisions), while extending the pipeline to MARL algorithms (MAPPO, MADDPG) to verify various non-linear properties.

Indian Institute of Technology Delhi — New Delhi, India
Machine Learning Research Intern, Advisor - Dr. Amber Srivastava — Jan 2024 – May 2024

- Derived stability radius for sparse and high-dimensional linear systems using Atomic Norm Regularization, formulating convex optimization problems in MATLAB's polymorphic paradigms to identify the system and guarantee system stability.
- Engineered custom struct-based storage mechanisms for sparse matrices, reducing memory complexity from $O(n^2)$ to $O(n)$.
- Integrated the high-level system identification pipeline with low-level Auto-Correlation (ACF , PACF) functions using eigen-decomposition, improving the time-series forecasting accuracy by 11% for stochastic financial models.

CPM India Sales and Marketing Pvt. Ltd. — New Delhi, India
Data Science Intern — Jun 2023 – Jul 2023

- Deployed a custom YOLOv8 CNN for real-time product detection, identification, and counting (Share of Shelf - KPI), maintaining 97.8% accuracy by implementing a dynamic training loop with fresh field data to mitigate data drift.
- Architected an edge-to-cloud pipeline where edge devices streamed images to autoscalable EC2 instances for ML inference.
- Developed interactive dashboards in D3.js and PowerBI for volatility forecasting with GARCH models and retail KPIs.

Marelli Talbros Chassis Systems India Pvt. Ltd. — India
Product and Process Engineering Intern — Dec 2022 – Jan 2023

- Conceptualized a Mixture of Experts ensemble with ResNet-50, EfficientNetV2, and DenseNet to predict vehicle water fording from heatmaps, snorkel mesh, and underbody images, cutting down 66% of CFD simulation time.
- Integrated wind tunnel drag curves, velocity profiles, and weld depths based polynomial regression with the CNN ensemble to enhance model robustness, achieving 74.5% accuracy.
- Optimized suspension systems' performance-weight tradeoff with Hyperworks Optistruct, retaining 80% of client's design.

PUBLICATIONS

- Co-authored: *"Autonomous UAV navigation using deep learning-based computer vision frameworks: A systematic literature review,"* Array, Vol 23, Elsevier. — Sep 2024
- Co-authored: *"Herbicide spraying and weed identification using drone technology in modern farms,"* Results in Engineering, Vol 21. — Feb 2024
- Co-authored: *"Exploration and advancement of NDDI leveraging NDVI and NDWI in Indian semi-arid regions: A remote sensing-based study,"* Case Studies in Chemical and Environmental Engineering, Vol 9, Elsevier. — Nov 2023

RESEARCH AND ACADEMIC PROJECTS

Fraud Detection at Scale | *ResNet-50, ResNet-18, VGG-19, Scala, Spark, PyTorch, CUDA* — May 2025

- Maximized deep learning data handling with Apache Spark, PostgreSQL and Scala for 10 Million synthetic IDNet images.
- Accelerated transfer learning on ResNet-18 and ResNet-50 with custom CUDA kernels for parallel processing in A100 GPUs, reducing 40% training time, and classifying fraudulent government IDs with 95% and 97% accuracies with high recall.

Autonomous Hexacopter UAV | *ROS, Mission Planner, Python, Pixhawk, RaspberryPi, Sensor Fusion* — Jan 2022

- Led a cross-functional team of 5 to design and fabricate a Level 3 autonomous multi-rotor, enabling sensor fusion with RPi-V2 and RunCam. Deployed a custom CNN on RPi-4 for edge-computed target detection, achieving autonomous payload pickup/drop with 98% accuracy, with a PID controller on an onboard Pixhawk for waypoint navigation.