Niraj Gupta

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EDUCATION

Mississippi State University **Starkville, MS**

B.S. in Computer Science; Minor in Data Science; GPA: 4.0/4.0 *Expected May 2028*

Relevant Coursework: Data Structures & Algorithms, Operating Systems I, Machine Learning, Artificial Intelligence, AI in Robotics

EXPERIENCE

National Oceanic and Atmospheric Administration (NOAA) **Starkville, MS**

Machine Learning Intern *Aug 2026 - Present*

- Built sparse-matrix CatBoost regressors from 229,357 16S rRNA ASV features aligned with metadata for 1,226 water samples; normalized sequencing replicates and modeled seven surface-water physicochemical targets.
- Designed leakage-resistant cruise-grouped 80/20 held-out testing and five-fold cross-validation, fitting fold-specific prevalence filters (2,660-2,840 ASVs) and selecting six configurations via out-of-fold MAE.
- On held-out cruises, achieved temperature R^2 of 0.748 (1.773°C MAE; 50.2% lower RMSE vs. mean baseline) and salinity R^2 of 0.603; produced TreeSHAP feature attribution, station-level error analyses, and reproducible A100/Slurm runs.

MSU Wireless | Mississippi State University **Starkville, MS**

Undergraduate Research Assistant *Oct 2025 - Jul 2026*

- Implemented and evaluated barrage and random physical-layer jamming on an over-the-air 5G NR testbed using a USRP SDR jammer and Soft-T UE; analyzed gNB scheduler KPIs to distinguish clean and jammed traffic without IQ capture.
- Designed a two-stage PyTorch pipeline with an LSTM autoencoder for unsupervised feature learning and a BiLSTM-attention classifier for three-class jamming classification.

REEU AI2F | Mississippi State University **Starkville, MS**

Research Intern, Department of Industrial and Systems Engineering *May 2025 - Oct 2025*

- Trained ResNet50/Xception transfer-learning classifiers for Southern Yellow Pine and Red Oak wood-chip classification, achieving 90% accuracy; built a PyTorch U-Net/ResNet34 semantic-segmentation pipeline for tree-ring detection using elastic augmentations and Dice loss.
- Accelerated Raspberry Pi vision inference from 1 to 30 FPS through Hailo NPU deployment, hardware-level normalization, and INT8 quantization.

PROJECTS

EcoCAR | Road Object Detection PyTorch, Ultralytics YOLO, YAML, Pytest

- Designed a YAML-configurable, CLI-driven PyTorch and Ultralytics YOLO pipeline to audit, train, benchmark, select, and run detectors across 860 road images, 3,418 labeled objects, and 14 classes.
- Fine-tuned and benchmarked YOLO26n/s/m; selected YOLO26s at 40.26% mAP50-95 and 23.42 ms mean latency, then reached 40.75% mAP50-95 and 76.15% F1 on 86 untouched test images; added 42 Pytest tests, dataset fingerprints, and SHA-256 integrity checks.

PatrolBot | Vision-Guided Autonomous Inspection Robot ROS 2, OpenCV, ArUco

- Built a ROS 2/OpenCV TurtleBot3 navigation system that follows floor tape and recognizes ArUco intersections and patrol points; used homography, local-contrast segmentation, and RANSAC to estimate lateral offset and heading.
- Developed one-time ArUco camera calibration and a pinhole-camera synthetic test environment covering 11 failure scenarios; achieved sub-millimeter calibration error on synthetic images and kept the robot within 2 cm of the tape.
- Built a LiDAR-aware state machine that returns the robot to the last intersection and uses Dijkstra to reroute around blocked roads; validated recovery in Gazebo and deployed the ROS 2 patrol stack on a Raspberry Pi.

LatentLink | Optical Transfer VQ-VAE, PyTorch, FastAPI, QR/CRC32

- Built a VQ-VAE image-compression pipeline that reduced 512 x 512 RGB images from 768 KB to about 4 KB (about 190x) at 27.4 dB PSNR, enabling transfer in about 27 QR frames.
- Deployed a PyTorch and FastAPI inference system with QR-based transfer, CRC32 validation, sequence tracking, and selective retransmission for missing frames.

SKILLS

Programming & Tools: Python, C/C++, Bash, SQL, Linux, Git/GitHub, Docker, Pytest

Computer Vision & ML: OpenCV, PyTorch, Ultralytics YOLO, ArUco, camera calibration, homography, image segmentation, RANSAC, pinhole camera models, synthetic data, NumPy, Matplotlib, TensorRT/CUDA

Robotics: ROS 2 (rclpy), Gazebo, TurtleBot3, LiDAR, odometry, Dijkstra, state machines, Raspberry Pi