Indumathi Madhu

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Interests / Research Focus

Autonomous navigation, 3D vision, and multi-modal sensor fusion (camera, LiDAR, radar) for rovers and vehicles, computer vision, multi-task perception, and cybersecurity including anomaly detection in connected vehicles.

Skills Summary

Programming:	Python (primary), C, SQL
ML / DL Frameworks:	PyTorch, TensorFlow, (JAX willing to learn), Keras, Scikit-learn, NumPy, OpenCV
Computer Vision / Robotics:	3D object detection & tracking, semantic segmentation, SLAM, visual odometry, multi-modal sensor fusion
Tools & Platforms:	ROS, Docker, Git, Linux, NVIDIA Jetson
Automotive / Robotics Tools:	VehicleSpy, Vector, PCAN View
Soft Skills:	Research mentoring, systematic thinking, collaborative teamwork

Selected Projects / Research

- **Visual Odometry and 3D Mapping for Rover Navigation** – Feature extraction, motion estimation, and sparse 3D map reconstruction using LiDAR and camera data for autonomous rover systems.
- **AI-based IDS for Automotive Networks** – Designed ML framework for anomaly detection using in-vehicle network data.
- **OVERTON: Real-Time Vehicle Network Anomaly Detection** – Deployed on Raspberry Pi and Jetson Nano.
- **BITLabs Remote Control** – Built a remote desktop solution enabling secure access to physical lab setups, integrating robotics and networked devices.
- **Privacy-Preserving ITS Services with Homomorphic Encryption** – Applied ML models for CO2 emission prediction with encrypted vehicle data.

Lab Experiments

- Autonomous Emergency Braking (AEB) Prototype – Implemented YOLOv8 for object detection and tracking to study AEB behavior.
- Object Detection and Classification using CNN – Applied deep learning to detect and classify objects in various datasets.
- Training a CNN for Metal Surface Defect Classification – Used VGG16 architecture for supervised defect detection tasks.
- CNN for Longitudinal Vehicle Control – Trained custom CNN models for vehicle speed and distance control.
- Traffic Sign Classification – Implemented LeNet CNN to classify road traffic signs.
- 3D Segmentation and Clustering on LiDAR Point Clouds – Processed raw LiDAR data to identify and cluster objects in 3D space.
- 3D Object Detection via Sensor Fusion – Combined LiDAR and RGB camera data for multi-modal 3D object detection.

Education

The George Washington University, Washington, DC, USA — Aug 2024 – Present
Ph.D. in Computer Science; GPA: 3.80/4.00
Research Focus: V2X Security, Sensor Security, Autonomous navigation, 3D perception, multi-modal sensor fusion
Courses: Algorithms, Robotics, Computer Networks

Birla Institute of Technology & Science, Hyderabad, India — Jan 2020 – Jul 2022
M.Tech. in Software Systems (Cybersecurity); GPA: 8.02/10

Bharathiar University, Coimbatore, India — May 2016 – May 2019
M.Sc. in Computer Science; GPA: 7.07/10

Hindusthan College of Arts and Science, Coimbatore, India — Jul 2013 – May 2016
BCA; GPA: 7.89/10

Professional Experience

Birla Institute of Technology and Science — 2022 – 2024
Visiting Faculty

- Configured and visualized LiDAR and camera systems for perception and navigation experiments.
- Designed in-vehicle networking labs (CAN, CAN-FD, Ethernet).
- Developed CAN bus exploitation and IDS experiments using feature extraction and ML pipelines.
- Collaborated with industry partners on autonomous systems and multi-modal perception projects.

ReynLab by Sirius Motorsports — 2020 – 2022
Instructor

- Built an Automotive Cyber Systems lab; implemented CAN exploitation and perception experiments on steer-by-wire systems.

Earlier Experience (2016 – 2020)
Cognizant, Wipro, Aalan Technology – IT infrastructure and software trainee roles (condensed for brevity).

Teaching & Mentoring Experience

Design of Autonomous Systems Lab, GWU — 2024 – 2025
Teaching Assistant

- Led labs in Python, Algorithms, Object Detection, ROS, and Linux.
- Guided projects on ROS waypoint navigation, traffic sign detection, Raspberry Pi integration, PID control, and EKF fundamentals.

Automotive Cyber Systems Lab, BITS Pilani — 2020 – 2024
Lab Faculty

- Conducted hands-on sessions on Automotive Networking, Communication, and Security.

Honors

- Academic Scholarship, Birla Institute of Technology and Science

References

Available upon request.