

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

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| 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

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| The George Washington University , Washington, DC, USA 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 | Aug 2024 – Present |
| Birla Institute of Technology & Science , Hyderabad, India M.Tech. in Software Systems (Cybersecurity); GPA: 8.02/10 | Jan 2020 – Jul 2022 |
| Bharathiar University , Coimbatore, India M.Sc. in Computer Science; GPA: 7.07/10 | May 2016 – May 2019 |
| Hindusthan College of Arts and Science , Coimbatore, India BCA; GPA: 7.89/10 | Jul 2013 – May 2016 |

Professional Experience

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| Birla Institute of Technology and Science Visiting Faculty | 2022 – 2024 |
| <ul style="list-style-type: none">• 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 Instructor | 2020 – 2022 |
| <ul style="list-style-type: none">• 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

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| Design of Autonomous Systems Lab, GWU Teaching Assistant | 2024 – 2025 |
| <ul style="list-style-type: none">• 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 Lab Faculty | 2020 – 2024 |
| <ul style="list-style-type: none">• Conducted hands-on sessions on Automotive Networking, Communication, and Security. | |

Honors

- Academic Scholarship, Birla Institute of Technology and Science

References

Available upon request.