Narendhiran Vijayakumar

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PROFILE
Senior undergraduate student seeking research opportunities in robotics, computer vision, and sensor fusion, leveraging hands-on experience in real-time autonomous systems to drive innovative solutions.

PUBLICATIONS
COTS Navigation with Monocular Vision
ICRA 2025 *Deadline* (In-Draft)

EDUCATION
Bachelor of Technology, Major in Mechanical Engg. with Minor in Computer Science Nov. 2022- Jul. 2026
National Institute of Technology, Tiruchirappalli Grade: 8.71/10.00

RESEARCH EXPERIENCE
Summer Research Internship, IIT Bombay Jun. 2024 – Present
Dr. Leena Vachhani & Dr. Vivek Yogi
- Studied existing panoptic segmentation models to explore the advantages of combined tasks over end-to-end approaches.
- Employed depth camera with point clouds and RANSAC for ground plane segmentation labeling on the BDD100k dataset, conducted extensive pre-processing, and simulated the Kobuki robot in custom Gazebo worlds.
- Applied indirect transfer learning by freezing the YOLOP model's CSPDarknet encoder backbone, focusing solely on ground plane segmentation head.
- Replaced SPP and Pyramid pooling modules along with a lighter decoder, refining the segmentation decoder by removing other decoder heads. This approach aimed to enhance accuracy/FPS ratio, and overall model performance.

Winter Research Internship, NIT, Tiruchirappalli Jan. 2024 – Feb. 2024
Dr. Sridevi M, Associate Professor
- Implemented State-of-the-art YOLOv5 OBB on the new benchmark FAIR1M dataset to utilize the customized weights in an ongoing DRDO research dataset via transfer learning.
- Utilized a novel approach for calculating Fine-grained Intersection over Union (fIoU) tailored for object-oriented detection.
- Worked on achieving comparable mAP results with single-stage detectors like RTMDet, DAFNe, and other versions of YOLOv5 base models.

PROJECTS
Autonomous Search and Rescue Drone Apr. 2024 – Present
SAE AeroTHON24 Competition
- Designed an autonomous drone for design phase (round I) and progressed to flight tests (round II) out of about 100 teams.
- Utilized SSD Mobilenet V2 with FPN extractor, achieving 60.71 mAP and 73.4 mAP for shape classification, hotspot identification, and counting for the payload operation.
- Conducted Gazebo simulations with MAVROS & MAVLink protocols in ROS Melodic, incorporating the drone's takeoff, landing, and A* path planning algorithm for its navigation.

Line Following Parrot Mambo Minidrone Jul. 2024 – Present
MathWorks Minidrone Competition
- Designed path planning, image processing, and control systems in simulated environments for deployment in a Parrot Mambo minidrone for the annual competition using Matlab and Simulink.

Occlusion Masking for Obstacle Avoidance Mar. 2024
- Developed a Python script for robot navigation in 300x300 binary images, integrating tangent arc computation and masking techniques for obstacle avoidance.
- Enabled circular movement with adjustable radii and efficient path generation from a 90-degree starting angle.

Bearing Condition Monitoring   Jan. 2024
- Performed EDA with t-SNE on the CWRU Bearing dataset for classification of bearing faults.
- Built custom CNN,ANN and transformer models from scratch for analyzing its performance.

SKILLS
Languages: Python, C++
Libraries: Numpy, Pandas, Matplotlib, Scikit-learn, OpenCV
Frameworks/Tools: PyTorch, Linux, ROS, Gazebo, GitHub, Solidworks, AUTODESK Fusion 360

COURSEWORK

Undergraduate
- Mechatronics
- Data Structures & Algorithms
- DBMS
- Fourier & Numerical Techniques
- Matrices & Calculus
- Complex Analysis & Diff. Equation

Ongoing
- Sensor Fusion & Non-linear filtering
- Control Systems
- SLAM - NTNU, Taiwan
- Reinforcement Learning (NPTEL)
- Fundamentals of VR - IITM
- 3D Computer Vision

Completed Certifications
- Machine Learning Specialization
- Introduction to Robotics (NPTEL)
- CS231n - CNN (Stanford)
- Deep Learning (NPTEL)
- Python for Data Science
- Linux Command Line Mastery

POSITIONS OF RESPONSIBILTY

Avionics Engineer   Apr. 2024 – Present
Third Modelling Aerodynamics Club, NIT Tiruchirappalli
- Led the autonomous operation subteam in the SAE AeroTHON24 national competition and represented NIT Tiruchirappalli in the Mathworks Minidrone 2024 Competition.
- Mentored juniors in competitions such as e-Yantra, Smart India Hackathon (SIH), and Sangam-Intra Collegiate Hackathon.

Physics Manager   Mar. 2023 – Jul. 2024
IGNITTE, Teaching Club of NIT Tiruchirappalli
- Led free JEE training for government school and rural students, offering personalized mentoring to enhance academic performance and contributing to career guidance sessions for skill development and career planning.
- Personally mentored a junior who achieved admission into one of the top 10 NITs.

Public Relations Coordinator   Sep. 2023 – Jul. 2024
Pragyan, Techno-Managerial Fest of NIT Tiruchirappalli
- Directed the Public Relations desk for Pragyan, developing and executing impactful communication strategies, leading to an impressive footfall of about 1,500 people.
- Oversaw logistics and welcomed chief guests to the college, ensuring smooth operations and a successful event experience

Workshops Manager   Nov. 2023 – Present
Synergy, Annual Mechanical Symposium of NIT Tiruchirappalli
- Organized an informative robotics workshop, from establishing contact with the organizers to finalizing the agreement, showcasing a commitment to spreading education.
- Managed all aspects of the workshop, including crowd setup, speaker welcome, and accommodation arrangements, ensuring a successful and smooth event.

VOLUNTEERING

Robotics Awareness Program   Jan. 2024 – Feb. 2024
- Collaborated with an NIT Tiruchirappalli alumnus in First Robotics to demonstrate robotics kits to middle school students.
- Introduced students to the basics of robotics, fostering early interest in STEM fields.

National Service Scheme (NSS)   Jan. 2023 – Apr. 2023
- Participated in organized camps, engaging students through activities such as art competitions and awareness campaigns.
- Contributed to supporting and enriching the educational experience of government school students.