

Naitri Rajyaguru

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Perception and Robotics Group (PRG),

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[naitri-rajyaguru](#)

RESEARCH INTERESTS

I am interested in developing minimalist cognitive architectures by understanding the fundamental principles of artificial intelligence, computational imaging and computer vision that enable small, resource-constrained robots to perform complex tasks.

PUBLICATIONS

• **N. Rajyaguru***, S. Shah*, C. D. Singh, C. Metzler, Y. Aloimonos. “CodedVO: Coded Visual Odometry,” IEEE Robotics and Automation Letters (**RA-L**, **2024**; presented at ICRA40 2024. [[Paper Link](#)], [[Website](#)]

EDUCATION

- | | |
|---|--------------------|
| University of Maryland (UMD), College Park | Aug 2024 - Present |
| Ph.D. in Computer Science (Dean’s Fellowship) | GPA – 4.0/4.0 |
| Advisor: Prof. Yiannis Aloimonos at Perception and Robotics Group | |
| University of Maryland (UMD), College Park | May 2023 |
| Master of Engineering in Robotics | GPA – 3.7/4.0 |
| Gujarat Technological University, India | May 2019 |
| Bachelor of Electronics and Communication Engineering | CGPA – 8.76/10 |
| Gold Medalist | |

RESEARCH AND WORK EXPERIENCE

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| Computer Vision Research Engineer | Jul 2023 – Jan 2024 |
| ZUPT LLC, United States | |
| • Researched deep learning methods for high-precision object pose estimation in low-textured and challenging underwater environments. | |
| • Designed an underwater Blender scene to conduct Sim2Real experiments for object detection and pose estimation. | |
| • Developed a dynamic LiDAR simulator to evaluate the accuracy of different LiDARs in scene representation. | |
| Graduate Research Assistant | Aug 2021 – May 2023 |
| Perception and Robotics Group, UMD | Advisor: Yiannis Aloimonos |
| • Performed drone navigation experiments in unknown environments by identifying free space using the <i>aleatoric</i> uncertainty in optical flow as input. The work is published in Ajna (Science Robotics) journal. | |
| • Contributed to ongoing research in 3D vision and active perception by simulating scenarios in Blender. | |
| Perception Research Intern | Jun 2022 – Aug 2022 |
| Ford Motor Company, United States | |
| • Conducted research and developed a pipeline for pseudo-object removal, semantic and depth inpainting, HD map generation, and enhanced localization using classical methods (Navier-Stokes, Fast Marching) and deep learning (GAN) techniques. | |
| Research Engineer (Associate) | Feb 2021 – July 2021 |
| Swaayatt Robots, India | |
| • Researched on Visual and LiDAR odometry pipeline for precise localization in self-driving cars. | |
| • Independently developed LiDAR Odometry and Mapping (LOAM) pipeline, ensuring accurate sensor fusion capabilities. | |

*Equal Contributions.

SELECTED PROJECTS

- **Lottery Ticket Hypothesis in Low Data Regime** [\[Report\]](#)
Achieved superior accuracy with just 5% of model weights with 1000 samples using Iterative Magnitude Pruning to generate a model generalizable to computer vision downstream tasks.
- **Structure from Motion (SfM)** [\[Github\]](#)
3D reconstruction of a scene and pose estimation from a given set of images by feature correspondence. (Non-linear PnP and triangulation)
- **Vanilla NeRF**
Developed a fundamental implementation of Neural Radiance Fields (NeRF) to synthesize novel views of intricate 3D scenes using only a sparse set of input views.
- **Multi-Sensor-Fusion-Scene-Segmentation** [\[Github\]](#)
Conducted a comprehensive study on the impact of RGB, LiDAR, and Optical flow on semantic segmentation, exploring their combined effect on scene understanding.
- **WP-Net** [\[Github\]](#)
Designed an Online Waypoint Generation Network for a Quadrotor using Monocular Depth Estimation.
- **Point Painting : Point Cloud Object Segmentation** [\[Github\]](#)
Used SegFormer for Semantically segmenting point clouds and detecting objects using images.
- **Super pixel generation using SLIC and Image Segmentation** [\[Github\]](#)
Implemented image segmentation using superpixels generated with SLIC and k-means resulting in 95% accuracy with VGG16.
- **Auto-Pano** [\[Github\]](#)
Stitched images to create a panorama using classical (Homography estimation) and Deep learning supervised & unsupervised (HomographNet).
- **Auto Calib** [\[Github\]](#)
Implemented Zhang's camera calibration technique with non-linear optimization.
- **Depth from Stereo** [\[Github\]](#)
Developed a system for computing depth from a pair of stereo images.
- **Marine Rescue Drone**
A drone capable of detecting drowning people with the help of 3DCNN and a dropping ring for saving.

TEACHING EXPERIENCE

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|---|---------------------|
| • Teaching Assistant: CMSC422 Introduction to Machine Learning, UMD | Jan 2025 – May 2025 |
| • Teaching Assistant: CMSC426 Computer Vision, UMD | Aug 2024 – Dec 2024 |
| • Teaching Assistant: ENEE 408U Unmanned Aerial Vehicles, UMD | Jan 2023 – May 2023 |
| • Teaching Assistant: INST 750 Advanced Data Science, UMD | Jan 2023 – May 2023 |
| • Lead Peer Research Mentor : FIRE198 Autonomous Unmanned Systems , UMD | Jan 2022 – May 2022 |
| • Robotics Tutor : Introduction to Robot Modelling , UMD | Oct 2021 – Dec 2021 |

KEY SOFTWARE SKILLS

Programming Languages: MATLAB, Python, C, C++, Embedded C
Libraries and Tools: TensorFlow, Keras, PyTorch, NumPy, Pandas, Robot Operating System (ROS), ONNX, TensorRT, OpenCV, Open3D, CUDA, Rviz, Gazebo, MoveIt, Linux
Deep Learning Architectures: VGG16, ResNet, GANs, HomographNet, SfMLearner, Attention-Based Fusion, LSTM, Position Map Regression Network, VAE, Transformers, NeRF, Diffusion Model (DDPM)
Domain Skills: Robot Perception, Localization, Deep Learning, Computer Vision, Sensor Fusion, Calibration, Mapping, Artificial Intelligence