

Naitri Rajyaguru

Computer Vision Research Engineer,
Masters of Robotics Graduate 2023,
University of Maryland, College Park (UMD)

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in [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. Fermüller, C. Metzler, Y. Aloimonos. “Coded Visual Odometry”, IEEE Robotics and Automation Letters (RA-L)[*Under Review*[†]]
- **N. Rajyaguru**, A. Paras, C. D. Singh, Y. Aloimonos “AutoCalibNet: Self-Supervised Calibration For Visual-Inertial Systems”, 2024 [*Under Preparation*]

EDUCATION

🏛️ **University of Maryland (UMD), College Park** May 2023
Master of Engineering in Robotics GPA – 3.7/4
Courses: Foundations of Deep Learning, Visual Learning and Recognition, Perception for Autonomous Robots, Planning for Autonomous Robots, Software Development for Robotics, Computer Processing of Pictorial Information

🏛️ **Gujarat Technological University, India** May 2019
Bachelor of Electronics and Communication Engineering CGPA – 8.76/10
🏆 Gold Medalist
Courses: Fundamental of Image Processing, Embedded Systems, Microcontroller and Interfacing, Digital Signal Processing

RESEARCH AND WORK EXPERIENCE

Computer Vision Research Engineer Jul 2023 – Present
ZUPT LLC, United States

- Researching on 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 *aleatoric* 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.

[†]Drafts can be shared upon request. *Equal Contributions.

- Independently developed LiDAR Odometry and Mapping (LOAM) pipeline from scratch, ensuring accurate sensor fusion capabilities.

Software Engineer Intern
Omnipresent Robot Tech, India

Dec 2020 – Feb 2021

- Evaluated hot pepper stress detection using a drone and analyzed various multi-spectral Image processing techniques.
- Programmed on Data augmentation in QGIS, data classification and detection based on SVM with 80% accuracy.

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.
- **Depth Fusion** [[Github](#)]
 Generated a 3D representation of a scene by fusing depth images using the Truncated Sign Distance Function.
- **Point Paining : 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

- 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