

DHIRAJ MAJI

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EDUCATION

University of Michigan – Ann Arbor
Master of Science in Robotics

August 2021 – April 2023
GPA: 3.96/4.0

- Coursework: Computer Vision, Machine Learning, Self-Driving Cars, Robotics Lab (SLAM), Math for Robotics

Manipal Institute of Technology (MAHE), Manipal
Bachelor of Technology in Mechatronics

July 2016 – July 2020
GPA: 9.29/10.0

- Coursework: Computer Vision & Image Processing, Path planning, AI, Machine Learning, Robot Kinematics and Dynamics

SKILLS

Languages: C++, Python, CUDA, C, SQL, R, Matlab, Object Oriented Programming
Libraries: PyTorch, TensorRT, Keras, OpenCV, PCL, Open3d, Scikit-Learn, Kalibr, Eigen, SciPy, Numpy
Software: ROS, Docker, Git version control, Linux, Nvidia Isaac Sim, Carla Simulator, Catia

PROFESSIONAL EXPERIENCE

ArcBest Technologies

Fort Smith, AR

Robotics Engineer, Perception

June 2023 – Present

- Led the migration of the perception team's pointcloud processing pipeline from **CPU to GPU using CUDA programming** on Nvidia Orin, boosting output frequency by 54% from 13 Hz to 20 Hz and reducing CPU utilization by 15%.
- Designed a multimodal **3D Object Detection** pipeline integrating 2D detections from a DETR model and LiDAR data to generate accurate 3D bounding boxes, enhancing object localization for autonomous systems by leveraging sensor fusion techniques.
- Developed a **Pallet Detection** pipeline using YOLOv8 in PyTorch, achieving a MAP of 0.91, by training on a curated dataset of real-world and synthetic data, enhancing object detection accuracy for auto pick and place operations.
- Optimized operational workflows by developing a **LiDAR-based Freight Dimensioner** with 2-inch accuracy, enabling precise measurement of freights, and enhancing navigation and path planning by auto updation of vehicle footprint with freight.
- Contributed to the design of an **Autonomous Barcode Detection** pipeline with oriented bounding boxes using YOLOv8, achieving a MAP of 0.89, reducing freight misplacement and enhancing inventory tracking.
- Engineered and implemented simulation environments in Nvidia Isaac Sim, streamlining **synthetic data generation** and collection workflows for improved efficiency and scalability.

Amazon Robotics

Boston, MA

Advanced Robotics Engineering Intern

May 2022 – August 2022

- Developed innovative joint camera calibration techniques, using 2D forward projection and 3D reconstruction methods, with Trust Region optimization, achieving a significant 18-23% reduction in error compared to OpenCV's algorithm.
- Engineered a highly flexible and modular camera calibration pipeline for robotic manipulator work cells, allowing easy customization of feature extraction methods, parameter initialization, optimizers, and non-linear cost functions.

Swaayatt Robots

Bhopal, INDIA

Robotics Intern

April 2021 – June 2021

- Developed a software pipeline to convert camera inputs from Carla Simulator to Birds-eye view & Occupancy grids.
- Designed an advanced path-planning system using RRT* as Local planner and A* as Global planner enhancing route optimization, coupled with precise and smooth path tracking using Pure Pursuit algorithm for optimal navigation in diverse environments.

PUBLICATIONS

- **Dhiraj Maji, Prarthana Sigedgar, Munendra Singh, [Attention Res-UNet with Guided Decoder for semantic segmentation of brain tumors](#)**, Biomedical Signal Processing and Control, Volume 71, Part A, 2022, 103077, ISSN 1746-8094

RESEARCH & ACADEMIC PROJECTS

Attention Res-UNet with Guided Decoder for Semantic Segmentation of Brain Tumors

Deep Learning, Semantic Segmentation

- Designed a novel Guided Decoder technique to explicitly supervise the learning process of each decoder layer.
- Developed an advanced Deep Learning architecture combining Res-UNet and Attention gates with the Guided Decoder, showcasing a significant increase in performance based on statistical analysis (0.05 p-value).
- Engineered a weighted guided loss for superior predictions, achieving Dice Scores of 0.911, 0.876, 0.801 on the BraTS dataset.

Super Resolution GANs

Deep Learning, Generative Models

- Implemented a Generative Adversarial Network (GAN) to enhance low-resolution images, surpassing baseline bicubic interpolation with a PSNR of 23.84 on the Set5 and DIV-2k datasets.
- Devised a custom loss function combining MSE, Adversarial, and Perceptual losses for superior image reconstruction.

Autonomous Navigation of Mobile robot with SLAM

SLAM, Path Planning

- Developed a SLAM system for mobile robots to create a map of its environment and localize its position using particle filters.
- Implemented A* algorithm for efficient path planning, facilitating autonomous exploration & navigation in unknown surroundings.

Meta-Learning for End-to-End Molecular Dynamics Simulation

Deep Learning, Meta-Learning

- Developed a Meta-Learning based dual loop architecture, achieving an 85x speed boost compared to traditional MD Simulations.
- Designed an inner loop with an unsupervised loss function to encode inductive bias, and outer loop for predicting particle states.