

# 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 an end-to-end **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 end-to-end **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 Sigedra, 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.