

DHIRAJ MAJI

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EDUCATION

University of Michigan – Ann Arbor

August 2021 – April 2023

Master of Science in Robotics

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

July 2016 – July 2020

Bachelor of Technology in Mechatronics

GPA: 9.29/10.0

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

SKILLS

Languages: C++ (Object Oriented Programming), Python, CUDA, C, SQL, R, Matlab

Software: ROS, Docker, Git version control, Nvidia Isaac Sim, Carla Simulator, RobotStudio, Arduino, Catia

Libraries: PyTorch, TensorRT, Keras, OpenCV, PCL, Open3d, Scikit-Learn, Kalibr, Eigen, SciPy, Numpy

PROFESSIONAL EXPERIENCE

ArcBest Technologies

Fort Smith, AR

Robotics Engineer, Perception I

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%.
- 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.
- Directed the analysis and optimization of multiple sensor suite configurations in simulation environments before real-world implementations, and tailoring solutions to diverse customer requirements, reducing manual effort and time.

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

Research Intern, Path Planning

April 2021 – June 2021

- Developed a pipeline to convert inputs from Carla Simulator into Birds-eye view & Occupancy grids, improving data representation.
- 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.

RESEARCH EXPERIENCE & PROJECTS

UM Ford Centre for Autonomous Vehicles Lab (FCAV)

Ann Arbor, MI

Graduate Research Assistant

October 2021 – December 2022

- Developed a depth map estimation algorithm from stereo bio-inspired event cameras, utilizing back-projection of event rays into a 3D voxel grid and density-based sampling for enhanced spatial understanding.
- Automated the multi-camera calibration process using Kalibr for monochrome, event, RGB, cooled and uncooled thermal cameras.

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

Manipal, INDIA

Deep Learning, Semantic Segmentation, Keras

January 2020 – June 2020

- 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.

Autonomous Navigation of Mobile robot with SLAM

SLAM, Controls, 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.

Super Resolution GANs

Deep Learning, Generative Models

- Developed a GAN to enhance image resolution on Set5 and DIV-2k datasets, achieving a PSNR of 23.84 with custom loss function of MSE, Adversarial loss and Perceptual loss, surpassing traditional bicubic interpolation method.

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