

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 (Perception & Control), Robotics Lab (SLAM)

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: Python, C++ (Object Oriented Programming), C, SQL, R, Matlab, Git version control, HTML, React

Software: ROS, Isaac Sim, Carla Simulator, RobotStudio, Arduino, Catia, Simulink

Libraries: PyTorch, Keras, OpenCV, PCL, Open3d, Scikit-Learn, Kalibr, Tkinter

PROFESSIONAL EXPERIENCE

ArcBest Technologies

Fort Smith, AR

Robotics Engineer, Perception I

June 2023 – Present

- Research and development of advanced algorithms for the perception of warehouse environments for autonomous forklifts.
- Development and testing of perception software in simulation environments as well as forklift hardware.
- Design of sensor suites for various tasks and features to meet customer requirements.
- Development of software for innovative and critical features in perception, and taking it to production.

Amazon Robotics

Boston, MA

Advanced Robotics Engineering Intern

May 2022 – August 2022

- Development of joint calibration techniques for single & multi-camera systems, using 2D forward projection and 3D reconstruction.
- Designed a camera calibration algorithm that gives 18 - 23% less error in meter space as compared to OpenCV.
- Developed a camera calibration pipeline for robotic work cells providing flexibility, modularity and ease of customization of feature extraction method, parameter initialization process, optimizer, and non-linear cost function.

Swaayatt Robots

Bhopal, INDIA

Research Intern, Path Planning

April 2021 – June 2021

- Developed a software pipeline to convert visual sensor inputs from Carla Simulator to Birds-eye view & Occupancy grids.
- Designed a path-planning system for autonomous vehicles with RRT* algorithm as Local and A* algorithm as Global planner.

Forbes Marshall

Pune, INDIA

Software Intern

May 2019 – June 2019

- Designed a Graphic User Interface for on-site calibration and testing of a Microwave moisture sensor, and included crucial features like data logging, warning signals, auto and manual calibration options, and graphical displays showing trends in the data.

RESEARCH EXPERIENCE

UM Ford Centre for Autonomous Vehicles Lab (FCAV)

Ann Arbor, MI

Graduate Research Assistant

October 2021 – December 2022

- Automated the multi-camera calibration process using Kalibr and experienced working with a plethora of cameras like monochrome cameras, event cameras, RGB cameras and cooled and uncooled thermal cameras.
- Depth Map estimation from stereo bio-inspired event cameras using back-projection of event rays into 3D Voxel grid.

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.
- Devised an end-to-end Deep Learning architecture combining Res-UNet and Attention gates along with the Guided Decoder technique showing significant increase in performance based on statistical analysis done with 0.05 p-value.
- Achieved Dice Scores of 0.911, 0.876 and 0.801, and mean IOU of 0.838, 0.781 and 0.668 on the BRATS 2019 dataset.

ACADEMIC PROJECTS

Autonomous Navigation of Mobile robot in unknown environments

SLAM, Controls, Path Planning

- Developed a SLAM system for a Mobile robot to create a map of its environment and localize its position using particle filters.
- Implemented the A* algorithm for path planning and designed algorithm for autonomous exploration of an unknown environment.

Vehicle Detection and Classification on Kitti dataset

Deep Learning, Object Detection

- Implemented Deep Learning models of Res-Net, Dense-Net and VGG-Net using PyTorch framework on the Kitti dataset for vehicle detection and classification tasks, and compared the performance of our modified Res-Net against these architectures.

Super Resolution GANs

Deep Learning, Generative Models

- Implemented a Generative Adversarial Network to convert low resolution images to high resolution, and devised a custom loss with MSE, Adversarial loss and Perceptual loss, to obtain a better PSNR of 23.84 as compared to 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