

# Advaith Balaji

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## EDUCATION

- University of Michigan College of Engineering, Ann Arbor, MI (2022-Present)  
**Major:** Robotics **Minors:** Computer Science **GPA:** 3.83  
**Expected Graduation Date:** May 2026  
**Coursework:** Computational Linear Algebra, Intro AI and Programming, Robotic Mechanisms, Intro Human-Robot Systems, Discrete Math, Data Structures and Algorithms, Robot SLAM and Navigation, Differential Equations, Deep Learning for Robot Perception, Intro to Circuits
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## SKILLS

- Programming Languages:** C++, C, Python, Scala, Java, Julia, Swift
  - Technical Skills:** Git, SSH, OpenCV2, PyTorch, Tensorflow, ROS, SLAM, Path Planning, Apache Flink, sbt, AWS S3, MongoDB, Unit Tests, Arduino, RPi, Jetson, Linux, Differential Equations, Linear Algebra
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## WORK EXPERIENCES

### UM Robotics - Researcher

Aug 2023 - Present

- Developed design for a **pedestrian safety robot** that increases pedestrian visibility in low visibility environments by autonomously leading them across a crosswalk while using red light to alert vehicle operators.
- Created a **vision system** by integrating lidar data, YOLOv3 and depth estimates to identify pedestrians within crosswalk.
- Developed a **state estimation system** by fusing sensor measurements using **Kalman Filtering** for robust **pedestrian localization**.
- Assisted in developing a **VR testing environment** using Unity to perform preliminary VR human trials to determine optimal robot configurations for the most comfortable experience.
- Performed human subjects trials to generate extensive feedback pertaining to **human-robot interaction** such as physical design, robot likability, trust, and comfortability.

### HERE Technologies - Traffic Prediction Intern

May 2023 - August 2023

- Orchestrated the deployment of a high-performance **Flink pipeline** in **Scala** to efficiently extract traffic prediction data from **AWS S3** and efficiently evaluate predictor performance, resulting in a remarkable **20 predictions evaluated per second**.
  - Developed an algorithm in **Scala** that runs a performance calculation algorithm on extracted road speed prediction data and publishes the performance metrics of each prediction to **MongoDB**.
  - Improved traffic prediction performance by writing 20+ extensive **unit test cases** for the traffic "jam tendency" algorithm, exposing 5 core algorithmic bugs.
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## ACADEMIC EXPERIENCES

### UM Robotics - Deep Learning for Robot Perception

Jan 2024 - Present

- Programmed FasterRCNN and PoseCNN using **PyTorch** to detect, segment and evaluate object pose of common household objects and for manipulation.
- Constructed a deep learning based pipeline for **grape localization** using a grape bunch and stem segmentation model for grasp coordinate calculation to support robotic harvesting.
- Implemented a RANSAC **cylinder fitting** algorithm for rotational pose estimation of the grape bunches
- Tested grape localization pipeline on a mobile manipulation platform resulting in a **grasp success rate of 87%**

### Project Team - MRacing Autonomous Division

Jan 2023 - Present

- Constructed a robust **cone detection system** for an autonomous Formula SAE car by processing lidar data using RANSAC and ICP Clustering to plot cone detections on rviz.
- Performed coordinate transforms and bayesian state estimation for global cone locations to construct a map of the race track.

### UM Robotics - SLAM and Navigation

Sep 2023 - Nov 2023

- Integrated mapping, localization, and planning algorithms to build a **full SLAM stack** for autonomous exploration and navigation in unknown environments for an MBot.
- Implemented a **particle filter** for robot state estimation and visualized localization in rviz2
- Implemented **A\* search** for frontier exploration and optimal path planning for autonomous mapping of new environments.
- Built and ran a convolutional neural network using PyTorch and **OpenCV2** on robot's pi camera to classify images using CIFAR10 dataset. Evaluated performance of the model by generating accuracy data, and testing model architectures.
- Gained fluency in Linux environment and ROS2 architecture.