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: Dec 2025
  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, Robotic Manipulation, Autonomous Drones, Dynamics and Vibrations

SKILLS

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

WORK EXPERIENCES

Autonomous Robotic Manipulation Lab - Researcher
May 2024 - Present

- Designed and developed an autonomous **open-vocabulary object retrieval system** to allow mobile manipulators to find, identify and retrieve any objects in an outdoor environment.
- Constructed a **semantic reasoning system** using **LLM probability outputs** to guide the robot along semantic locations of the mapped area to efficiently search for an object in a large outdoor environment.
- Implemented an **open-vocabulary object localization** pipeline using GroundingDINO and Segment Anything resulting in a highly reliable and accurate object tracking system to inform robot grasping in the wild.
- Developed an **outdoor grasping system** combining Grasp Pose Detection and RANSAC grass filtering to ensure dependable grasps while partially **occluded by grass.**
- Deployed the software stack on the Boston Dynamics **Spot robot** and tested the object retrieval pipeline in an outdoor environment, resulting in an **success rate of 80%**.

UM Robotics - Independent 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 **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.

ACADEMIC EXPERIENCES

UM Robotics - Deep Learning for Robot Perception
Jan 2024 - Aug 2024

- Constructed a deep learning based pipeline for **grape localization** using a grape bunch and stem segmentation model for grasp pose estimation to support robotic harvesting.
- Implemented a RANSAC cylinder fitting algorithm for **pose estimation** of the grape bunches
- Tested grape localization pipeline on the Fetch mobile manipulation platform resulting in a grasp **success rate of 87%**

UM Robotics - Unmanned Aerial Systems
Aug 2024 - Present

- Constructed a quadrotor drone from scratch and implemented a **4DOF PID drone controller** for highly precise and stable teleoperated control of roll, pitch, yaw and altitude..
- Implemented **3D position control** using OptiTrack for accurate autonomous waypoint navigation and **visual object tracking** from above to allow the drone to follow objects.