

Joseph Taylor

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Education

University of Michigan, Ann Arbor, MI
Robotics M.S., 3.000 / 4.000

August 20203 – April 2025 (expected)

University of Michigan, Ann Arbor, MI
Robotics B.S.E., GPA: 3.822 / 4.000, *summa cum laude*

August 2020 – April 2023

Selected Coursework: Linear Systems Theory *EECS 560*, Mobile Robotics Methods and Algorithms (SLAM) *ROB 530*, Math for Robotics (estimation, real analysis, optimization) *ROB 501*, Applied Optimal Control *ROB 498.004*, Deep Learning for Robotic Perception *ROB 498.002*, Data Structures and Algorithms (C++) *EECS 281*.

Industry

Software Development Engineer Intern

May 2023 – August 2023

Amazon Robotics R&D, Gluon Team - Onboard Software for Proteus

- Collaborated with a partner to design, implement, and deploy an autonomous mapping subsystem on Proteus, replace the current manual mapping methodology, and improve generated map quality.
- Developed an algorithm for planning a mapping path to produce optimal maps for subsequent localization while minimizing path length. Used techniques from graph search and combinatorial optimization.
- Built multi-process ROS architecture for gathering data from the system, running the algorithm, navigating the generated path, and monitoring the process through a web interface using C++, Python, and JavaScript.
- Unit tested the system extensively with GTest, PyTest, and ROSTest, and deployed to hardware. Provided a superior and complete system for map generation. Received an inclined evaluation.

Software Development Engineer Intern

May 2022 – August 2022

Amazon Robotics R&D, Gluon Team - Onboard Software for Proteus

- Developed two algorithms for pose estimation of floor markers viewed by stereo cameras for downstream localization. Used OpenCV, developing in Python and testing with PyTest, interfacing with ROS.
- Collaborated with photorealistic simulator engineers to generate a synthetic dataset for training an existing panoptic segmentation model to segment the floor markers as an additional class.
- Collected a testing and validation dataset and analyzed algorithm performance. Presented recommendations to the engineering team. Received an inclined evaluation.

Research

Graduate Research Assistant

January 2024 – May 2024

ARM Lab, Prof. Dmitry Berenson

- Developing a faster implementation of [Constrained Stein Variational Trajectory Optimization](#) to improve performance in dynamic environments when deployed as an MPC planner. Leveraging the C++ API for PyTorch for efficient parallel trajectory optimization. Aiming to test on bi-manual manipulation hardware.

Graduate Research Assistant

January 2024 – May 2024

ROAHM Lab, Prof. Ram Vasudevan

- Developing a semantic mapping pipeline in C++ leveraging OpenVDB for performance and compression, inspired by the TSDF integration implementation in [VDBFusion](#).

Undergraduate Research Assistant

January 2023 – April 2023

Field Robotics Group, Prof. Katie Skinner

- Designed, fabricated, and set up sensing mounts for a multi-ultrasonic sensing system as part of a project exploring the usage of NeRF's with ultrasonic sensors for navigation in environments with transparent obstacles.

- Brainstormed with the project team. Characterized ultrasonic sensors to enable algorithm development. Collected experimental data to facilitate algorithm validation.

Teaching

Graduate Student Instructor

August 2024 – December 2024

Intro to Programming and AI *ROB 102*, Prof. Odest Chadwicke Jenkins

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Graduate Student Instructor

January 2024 – April 2023

Robot Operating Systems *ROB 320*, Prof. Odest Chadwicke Jenkins

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Head Course Developer

August 2023 – January 2024

Robot Operating Systems *ROB 320*, Prof. Odest Chadwicke Jenkins

- Designed a novel course structure providing an introduction to concurrent programming, inter-process communication, middleware implementation, geometric modeling, and motion planning, advised by Prof. Odest Chadwicke Jenkins.
- Developed course projects, including a custom messaging protocol built on Linux TCP sockets, a binary-JSON based RPC library, and a complete centralized publisher-subscriber library analogous to ROS/TCPROS, all in C++. Tested with GTest and removed core implementations to produce starter code.
- Developing and coordinating weekly homeworks and lab sessions to introduce relevant software and robotics concepts, so far including build management with CMake, Linux sockets, and multithreading.

Graduate Student Instructor

August 2023 – December 2023

Intro to Programming and AI *ROB 102*, Prof. Odest Chadwicke Jenkins

- Lectured in weekly lab sessions on topics providing a basic introduction to autonomous navigation for freshmen. 31 students with little or no programming experience successfully implemented basic planning algorithms in C++ (bug navigation, A*) on small autonomous vehicles with a provided SLAM stack.
- Managed a team of 12 staff members, maintained the course website, updated homeworks and projects from previous semesters, and managed the release and grading of all assignments.

Instructional Aide

January 2023 – April 2023

Robot Operating Systems *ROB 320*, Prof. Odest Chadwicke Jenkins

- Assisted students with course projects including implementations of URDF-based forward kinematics, gradient-based inverse kinematics, A*, RRT, and RRT-connect planners.
- Conducted over 10 hours of office hours per week, helping a class of over 140 students. Collected student feedback and pushed for a course redesign to focus the first half of the course on middleware.

Instructional Aide

August 2022 – December 2022

Intro to Programming and AI *ROB 102*, Prof. Odest Chadwicke Jenkins

- Maintained fleet of 23 kiwi-drive RPi-based mobile robots with 2D LiDARs and cameras, running a simple Monte Carlo localization and occupancy grid SLAM stack.
- Soldered circuit boards and motors, replaced and repaired hardware, and verified system functionality. Updated firmware and software, and addressed software malfunctions. Built new robots to expand the fleet.
- Assisted freshmen students with writing and debugging C++ implementations of bug navigation and A*, as well as handwritten digit recognition, run on hardware.

Projects

- Performed graph optimization on the Intel dataset using GTSAM factor graphs in C++ to recover optimized trajectories. Implemented continuous counting sensor model mapping to store map grid cell mean and variance based on both semantically labeled and unlabeled corresponding observation datasets in Python.
- Completed a basic navigation stack on a differential drive robot with a 2D LiDAR. Implemented motor controllers and odometry, occupancy grid and particle filter SLAM, and A* based navigation in C++.
- Successfully explored an unmapped maze autonomously.
- Manufactured a small ballbot. Implemented and tuned a PID controller for teleoperation via a PS4 controller. System tracked velocity during teleoperation and maintained balance on an oscillating stage.
- Designed and implemented an LQR controller and an NMPC controller for a ballbot in simulation using MATLAB. Successfully tracked position and velocity references and recovered from disturbances.

Technical

Development: C++, Python, C, MATLAB, JavaScript; Ubuntu, Git, GitHub, Jira.

Libraries and Frameworks: ROS, Catkin, CMake, GTest, PyTest, PyTorch, OpenCV, GTSAM, Eigen, Three.js.

SLAM and Perception: KF, EKF, UKF, InEKF, PF, graph optimization, classical CV, semantic segmentation.

Planning and Control: A*, RRT, shooting, direct collocation, sampling (Stein Variational) MPC, MPC, LQR, PID.

Awards

James B. Angell Scholar , College of Engineering	<i>March 2024</i>
Dean's List , College of Engineering	<i>April 2023</i>
University Honors , University of Michigan	<i>April 2023</i>
Distinguished Academic Achievement Undergraduate Award , Robotics Department	<i>March 2023</i>
Dean's List , College of Engineering	<i>December 2022</i>
University Honors , University of Michigan	<i>December 2022</i>
Dean's List , College of Engineering	<i>April 2022</i>
University Honors , University of Michigan	<i>April 2022</i>
Dean's List , College of Engineering	<i>December 2021</i>
University Honors , University of Michigan	<i>December 2021</i>
Dean's List , College of Engineering	<i>April 2021</i>
University Honors , University of Michigan	<i>April 2021</i>
William J. Branstrom Freshman Prize , College of Engineering	<i>January 2021</i>
Dean's List , College of Engineering	<i>December 2020</i>
University Honors , University of Michigan	<i>December 2020</i>
National Merit Finalist , National Merit Scholarship Corporation	<i>March 2020</i>
Eagle Scout Award , Boy Scouts of America	<i>January 2020</i>