

EDUCATION

- **Massachusetts Institute of Technology** Cambridge, MA
Master of Engineering in Computer Science and Engineering; GPA 5.0/5.0 June 2022
- **Massachusetts Institute of Technology** Cambridge, MA
Bachelor of Science in Computer Science and Engineering; GPA 4.8/5.0 June 2021

EXPERIENCE

- **NVIDIA Driveworks: Autonomous Vehicle Motion Planning Team** Santa Clara, CA
Software Engineer July 2022 – Present
 - Developing numerical methods for trajectory optimization, control, and autonomous vehicle motion planning.
- **NVIDIA Driveworks: Autonomous Vehicle Motion Planning Team** Santa Clara, CA
Behavior Planning Thesis Co-Op June 2021 – December 2021
 - Developed a HBJ reachability safety module for certifying driverless vehicle will never be forced off of the road surface.
 - Isolated motion planning collision detector to single process node to enable safety certification.
 - Created a reachability-based extension of Safety Force Field module to certify traffic stop and wait condition obedience.
- **MIT Distributed Robotics Laboratory: Deep Drone Project** Cambridge, MA
Undergraduate/Graduate Research August 2020 - August 2021
 - Trained Neural ODE network policies for quadrotors to perform visual understanding and motion planning tasks.
 - Built pipeline for generating and consuming large imitation learning datasets from naturalistic Unreal Engine simulations.
 - Proved continuous-time Neural ODE networks are causal models and evinced they can outperform at causal understanding.
- **NVIDIA Driveworks: Autonomous Vehicle Motion Planning Team** Santa Clara, CA
Behavior Planning Intern June 2020 – August 2020
 - Developed a simulated testing scheme for Automotive Safety Integrity Level (ASIL D) certification of the NVIDIA Driveworks SafetyForceField collision-avoidance system.
 - Detected and fixed bugs in the SafetyForceField module, resulting in a 70% improvement in road test KPIs.
 - Developed a new module for aggregation of multiple redundant collision avoidance systems into an ensemble model.
- **MIT Driverless: Planning and Controls Team** Cambridge, MA
Team Lead September 2019 – September 2021
 - 2019-2020 Planning and Controls Team Lead for MIT - TU Delft Formula Student Driverless racing team.
 - Responsible for all controllers (LQR, Stanley, MPCC) and models (kinematic, dynamic) used on the race car.
 - Helped develop path planning strategies including lane detection and racing line generation.
 - Maintained embedded systems including vehicle CAN network, code-generated Matlab, and electrical integration.
- **MIT Formula SAE Electric Race Car: Software Team** Cambridge, MA
Controls Team Member September 2018 – June 2020
 - Built vehicle's torque-vectoring controller using vehicle model with normal forces and nonlinear Pacejka tires.
 - Improved sensing with direct groundspeed measurement, real-time derivative filtering, and higher wheel-speed resolution.
 - Helped translate codebase to STM32 chip family and reimplement vehicle control unit using real-time operating system.
- **Ocado Technology: 10x Research and Development** London, United Kingdom
Mechatronics Engineering Intern June – August 2018
 - Developed a testbed version of Ocado's robotic warehousing system for 10x research team.
 - Experimented with low-energy electropermanent magnetic gripping, contact sensing, and optical distance tracking.
- **MIT Space Systems Laboratory: International Space Station Astrobee** Cambridge, MA
Undergraduate Researcher Fall 2019
 - Performed embedded software and sensor integration for ground test copies of the Astrobee robotic astronaut assistants.
 - Worked with ROS, Gazebo, Matlab code-generated C++, force allocation models, estimators, and PID control.
- **PepsiCo Demand Xccelerator: Shopper Insights and Capabilities** White Plains, NY
Data and Software Engineering Intern June – August 2017
 - Developed web API and online dashboard for predicting new product performance using large-scale shopper datasets.

SKILLS AND INTERESTS

Relevant Coursework: Underactuated Robotics; Advances in Computer Vision; Artificial Intelligence; Principles of Autonomy; Dynamic Programming and Reinforcement Learning; Design and Analysis of Algorithms; Differential Equations; Linear Algebra;
Proficient With: C and C++; Python; Embedded Development; Numerical Optimization and Control
Interested In: Autonomous Systems; Robotics Control and Sensing; Computer Vision; Data Science and Visualization;

PUBLICATIONS AND PATENTS

“Causal Navigation by Continuous-time Neural Networks”. Charles Vorbach*, Ramin Hasani*, Alexander Amini, Mathias Lechner, Daniela Rus. NeurIPS, 2021. [link]

C. Vorbach, “Safety Assurance for Automated Vehicles Beyond Collision Avoidance”, 2022.

U.S. Patent Application 20220135075 A1: “Safety decomposition architecture for autonomous machine applications”. May 5, 2022