

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
Senior Machine Learning Research Engineer July 2023 – Present
 - An original and key research engineer on Nvidia's end-to-end self-driving project.
 - Technical owner for all learned lateral behaviors including lane change, nudging, borrowed bike lanes, etc.
 - Directly led a small team of other machine learning, data preparation, evaluation, and platform engineers.
 - Created techniques for overcoming DAGger-style covariate shift between open- and closed-loop distributions.
 - Invented causal graphical training tricks to support user commanded lane changes and speed settings.
 - Advised and contributed to projects leveraging internet-scale video and language pretraining.
 - Solved problems across the stack in training, data preparation, model deployment, and post-processing.
- **NVIDIA Driveworks: Autonomous Vehicle Motion Planning Team** Santa Clara, CA
Optimization and Behavior Planning Engineer June 2022 – July 2023
 - Formulated in-lane nudging problem to plan safe trajectories around bicyclists and to avoid partial lane obstructions.
 - Vectorized optimizer's bottleneck computations using ARM Neon intrinsics - speeding up solver iterations by 4x.
 - Developed a HBJ reachability safety module for certifying driverless vehicle will never be forced off of the road surface.
- **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 showed they can outperform at causal understanding.
- **MIT Driverless: Planning and Controls** Cambridge, MA
Team Lead September 2018 – September 2021
 - 2019-2020 Planning and Controls Team Lead for MIT - TU Delft Formula Student Driverless racing team.
 - Responsible for all planners (LQR, Stanley, MPCC) used on the race car.
 - path planning strategies including lane detection and racing line generation.
 - Built vehicle's torque-vectoring controller using vehicle model with normal forces and nonlinear Pacejka tires.
- **MIT Space Systems Laboratory: International Space Station Astrobees** 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.
- **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.
- **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: Imitation and Reinforcement Learning; Pytorch; Python; C and C++; Numerical Optimization and Control
Interested In: Machine Learning; Autonomy; Robotics Control and Sensing; Computer Vision; Probability and Data Science

PUBLICATIONS AND PATENTS

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

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

U.S. Patent 12,202,518 B2: “Behavior Planning for Autonomous Vehicles”. May 5, 2022