Charles Vorbach

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Education

- **Massachusetts Institute of Technology** — Cambridge, MA
  Candidate for Bachelor of Science in Computer Science and Engineering; GPA 4.7/5.0 — *Expected June 2021*

Experience

- **MIT Distributed Robotics Laboratory: Deep Drone Project** — Cambridge, MA
  Undergraduate Researcher — *August 2020 - Present*
  - Training Neural ODE networks to pilot drones through simulated naturalistic environments without collision.
  - Automated data collection for imitation learning in Airsim using constrained pathfinding.
- **NVIDIA Driveworks: Autonomous Vehicle Motion Planning Team** — Santa Clara, CA
  Planning Intern — *June 2020 – August 2020*
  - Developed a simulated testing scheme for Automotive Safety Integrity Level 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.
  - Created a graphical interface to the SafetyForceField module, enabling human-interpretable exploration of failures.
  - Developed a new module for aggregation of multiple redundant collision avoidance systems into an ensemble model.
- **MIT Driverless: Planning and Controls Team** — Cambridge, MA
  Subteam Lead — *September 2019 – Present*
  - 2019-2020 Planning and Controls Team Lead for MIT - TU Delft Formula SAE 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.
  - Implemented movement planner and Wi-Fi communication in C and C++ on low-cost ESP32 microcontrollers.
- **MIT Space Systems Laboratory: International Space Station Astrobees** — Cambridge, MA
  Undergraduate Researcher — *Fall 2019*
  - Performed embedded software and sensor integration for MIT's ground test copies of the Astrobee robotic astronaut assistants onboard the ISS.
  - Helping to clear research projects before their deployment onboard the ISS.
  - Working 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 PepsiCo's existing household- and store-level shopper databases.
- **MIT Robotics Team MicroTransat: Autonomous Atlantic Crossing** — Cambridge, MA
  Electronics and Programming Subteam — *2017 – 2018*
  - Lead software development for GPS navigation, sensor reading, motor control, and power management in C and C++.

Skills and Interests

Relevant Coursework: Underactuated Robotics; Advances in Computer Vision; Artificial Intelligence; Principles of Autonomy; Design and Analysis of Algorithms; Software Construction; Computational Structures; Differential Equations; Linear Algebra;
Proficient With: Embedded C and C++; Python;
Interested In: Autonomous Systems; Robotics Control and Sensing; Computer Vision; Data Science and Visualization;

Activities and Honors

MIT Course Planner Team: Full Stack Developer — *2018 – 2019*
MIT Student Information Processing Board Keyholder: January Term Classes Coordinator — *2017 - Present*
Eagle Scout: Boy Scouts of America — *October 2016*
Licensed Ham Radio Operator — *August 2016*