

John Chrosniak

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EDUCATION

University of Virginia, School of Engineering & Applied Science

Charlottesville, VA

Master of Science, Computer Science – GPA: 3.96/4.0

December 2023

Certificate, Cyber-Physical Systems

University of Virginia, School of Engineering & Applied Science

Charlottesville, VA

Bachelor of Science, Computer Engineering & Computer Science – GPA: 3.91/4.0

May 2022

Minor, Engineering Business

LEADERSHIP EXPERIENCE

Cavalier Autonomous Racing Team

Charlottesville, VA

Perception Team Lead

March 2021 - Present

- Orchestrated the design, development, and deployment of the object detection, tracking, and trajectory prediction stack for a full-scale autonomous racecar competing in the Indy Autonomous Challenge
- Trained and deployed a LiDAR object detection neural network using PyTorch and TensorRT to detect opponent vehicles

University of Virginia Solar Car Team

Charlottesville, VA

Embedded System Team Lead

May 2020 – July 2022

- Spearheaded PCB and RTOS design for a distributed embedded architecture that interfaces the motor, battery pack, and other components of a full-scale, solar-powered racecar via CANbus
- Helped lead the team to compete in its first race in over 20 years

WORK EXPERIENCE

University of Virginia Dept. of Computer Science

Charlottesville, VA

Machine Learning Head Teaching Assistant

August 2022 - December 2023

- Reinforce students' understanding of AI/ML theory and practice through office hours and grading
- Mentor students throughout a semester-long project where they use AI/ML to benefit the Commonwealth of Virginia

ENSCO, Inc.

Springfield, VA

Research Intern

May 2023 - August 2023

- Designed and deployed a LiDAR processing algorithm to survey the topography of railroad crossings
- Built a LiDAR calibration library using scan matching and Bayesian optimization to synchronize multiple sensors

Leidos, Inc.

Arlington, VA

Autonomous Systems Engineer Intern

June 2021 - August 2021

- Created a software development suite in Java to support communication within a fleet of autonomous mobile robots
- Developed an automated setup platform for hardware-in-the-loop simulation across a network of edge devices

RESEARCH EXPERIENCE

Combining AI & Physics for Vehicle Dynamics Modeling – [\[Preprint\]](#)

Fall 2023

- Pioneered a physics-informed neural network capable of estimating time-variant coefficients for a physics-based vehicle model using observations of the vehicle's motion
- Introduced a constraining mechanism to ensure estimated coefficients always lie within their physically-meaningful range
- Tools: [Python, PyTorch, ROS2, Comet ML]

RACECAR Autonomous Racing Dataset – [\[Code\]](#), [\[IROS Paper\]](#)

Spring 2023

- Developed a multi-threaded library to convert ROS2 bag files to the nuScenes dataset format for community release
- Facilitated collaboration from six international universities to release the first autonomous racing dataset
- Tools: [C++, ROS2, ROSBag API, OpenCV, PCL, Docker]

Trajectory Prediction of Formula Racing Cars – [\[Code\]](#), [\[ICRA Workshop Paper\]](#)

Spring 2021

- Trained an LSTM neural network to estimate the future trajectory of opponent Formula race cars using historical observations of motion
- Designed a filtering algorithm to simulate visual occlusion for a virtual camera in the Deep Racing simulator
- Tools: [Python, PyTorch, UDP, Shapely]

PROJECTS

Real-Time Cube Crusher – [\[Code\]](#), [\[Video\]](#)

Spring 2023

- Developed the RTOS, graphics, and state machine for a cube crusher video game run on the TM4C microcontroller
- Tools: [C, ARM Assembly]

Point Cloud Augmentation – [\[Code\]](#)

Spring 2023

- Analyzed the impact of LiDAR perturbations on state-of-the-art 3D object detection neural networks when trained on data from the KITTI and RACECAR datasets
- Tools: [Python, PyTorch, PCL]

Autonomous Mobile Robot Search & Rescue – [\[Code\]](#), [\[Video\]](#)

Fall 2022

- Demonstrated autonomous navigation in an unknown and cluttered environment while using LiDAR to detect objects of interest and simultaneously construct a map of the object's surroundings
- Tools: [Python, C++, ROS, PCL]

Free Throw Fixer Wearable Device – [\[Code\]](#)

Fall 2022

- Leveraged IMU data collected from an Android smartwatch to train an LSTM recurrent neural network capable of predicting free throw outcomes by observing shooting form
- Tools: [Python, Java, TensorFlow]

AIPD: Enforcing Traffic Violations with Autonomous Vehicles – [\[Code\]](#)

Spring 2022

- Created a proof of concept demonstration of how autonomous vehicles could effectively enforce traffic laws without the need for traffic stops using the nuScenes dataset
- Tools: [Python, ROS, ROSBag API, OpenCV, Qt]

Anti-Theft Package Delivery System – [\[Firmware\]](#), [\[Hardware\]](#), [\[Web App\]](#)

Fall 2021

- Designed the embedded software and hardware for a prototype package delivery system that allows users to generate single-use passcodes and view video footage from deliveries on a web application
- Tools: [Raspberry Pi, C++, Python, AWS S3, OpenCV, Flask, KiCad]

Semantic Segmentation of Agricultural Fields – [\[Code\]](#)

Fall 2020

- Deployed a semantic segmentation model to identify agricultural regions at risk of polluting the Chesapeake Bay watershed using satellite images
- Tools: [Python, Tensorflow, Keras, GeoPandas, Rasterio]

THESES

- [1] J. Chrosniak, "Deep Dynamics: Vehicle Dynamics Modeling With a Physics-Informed Neural Network for Autonomous Racing," Master's thesis, University of Virginia, School of Engineering and Applied Science, 2023. [Online]. Available: <https://doi.org/10.18130/0qav-fv52>
- [2] J. Chrosniak, "Bouncer Locking System; Internet of Risky Things: Investigating the Social Construction of IoT Devices," University of Virginia, School of Engineering and Applied Science, Tech. Rep., 2022. [Online]. Available: <https://doi.org/10.18130/ppe1-at69>

PRESENTATIONS

- [2023] **ROSCon**, 'ROSBAG2nuScenes: Share the Bags, Spread the Joy - Autonomous Vehicle ROS Datasets Deploy', Oct 2023, New Orleans, LA – [\[Recording\]](#)
- [2023] **Link Lab Research Day**, 'Deep Dynamics: Merging Physics & AI for Agile Autonomous Racing', Oct 2023, Charlottesville, VA
- [2022] **University of Virginia**, 'Machine Learning in Autonomous Vehicles', Dec 2022, Charlottesville, VA

SKILLS SUMMARY

- **Languages:** Python, C/C++, MATLAB, Java, Assembly (x86/ARM), CUDA
- **Tools:** PyTorch, TensorFlow, Keras, PCL, OpenCV, TensorRT, AWS, Docker, Travis-CI, Git, MySQL
- **Frameworks:** ROS, ROS2, Django, Flask, MbedOS
- **Platforms:** Linux, STM32, MSP432, Arduino, Raspberry Pi, Jetson
- **Domain Areas:** Machine Learning, Object Detection/Tracking, Kinematics/Dynamics, Motion Prediction