


Haoru Xue

Developing High-Performance Autonomous Race Cars
AV Systems, Perceptions, and Controls Engineer

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Education

Carnegie Mellon University M.S. Robotics (4.16/4.0)	Aug 2022 - May 2024
University of California San Diego B.S. Electrical Engineering (3.94/4.0)	Aug 2018 - Dec 2021

Experience Highlights

Lead Software Developer | AI Racing Tech May 2021 – Present

- Won **2nd and 3rd place** in **Indy Autonomous Challenge** as principal technical lead with 30 members.
- Architected AV software system for autonomous IndyCar in high-speed, multi-vehicle competitions.
- Developed **multi-modal perception pipeline** with *Autoware.Universe* and *ROS2*: 2D-3D detection, sensor fusion, and target tracking to address high-speed AV perception requirements.
- Developed **motion controller** and **trajectory optimization** software above 160 mph (260 km/h).
- Managed simulation scenarios for ground-truth perception data collection and vehicle dynamics testing.
- Developed, validated, and deployed on-board autonomous software in the field.

Software Engineer | The Autoware Foundation Dec 2021 – Aug 2022

- Maintained **world's largest open-source autonomous driving projects** *Autoware.Universe* & *Autoware.Auto*.
- Integrated full-scale AV system on scaled platforms (F1TENTH, EV Kart) for competition, university education and research.
- Facilitated autonomous racing organizations among 10+ universities in US and Europe.

Engineering Psychiatry Research Intern | UCSD ECE & Psychiatry Dept. Jan 2020 – Jul 2021

- Designed **eye-tracking software with VR** for diagnosis of neurological conditions (PTSD and Alzheimer's).
- Developed and maintained pupillometry data analysis solutions in C# and SQLite.
- Collaborated with researchers and doctors at the Defense and Veterans Brain Injury Center in fieldwork for feedback on applying the technology on patients.

Team Principal | Triton AI Autonomous Racing Dec 2019 – Jul 2022

- Lead the technical development of UC San Diego's participation in the Indy Autonomous Challenge (IAC) through collaboration with AI Racing Tech.
- Developed multi-sensory autonomous robotic racers (Innovative Triton-AI-Racer platform).
- Developed **end-to-end deep learning** autonomous stack for scaled robotic vehicles.

Skills

Programming: C++, Python, MATLAB, C#

Tooling: ROS2, Git, Linux, Unity, Docker, SQLite, Continuous-Integration

Autonomous Vehicle: architecture, perception, motion controller, simulation, visualization, telemetry

Embedded Systems: ARM Mbed, NVIDIA Jetson, Raptor ECU, Arduino, Serial and CAN communications

Deep Learning: 2D & 3D detection, segmentation, domain adaptation, GAN

Awards

- **2nd Place:** **Indy Autonomous Challenge** at Texas Motor Speedway (**Technical Lead**) Nov 2022
- **3rd Place:** **Indy Autonomous Challenge** at CES 2023 Las Vegas Motor Speedway (**Technical Lead**) Jan 2023

Projects

art.pilot: Autonomous Race Car Software for High-Speed IndyCar Platform (ROS2 C++, Closed-Source)

I was the responsible software architect for AI Racing Tech's autonomous software in the Indy Autonomous Challenge, including AV perception, behavior planning, motion planning, controls, vehicle interfaces, and telemetry modules. I also developed the perception pipeline with industry-grade ROS2 packages from Autoware, and supported the software engineering for control optimization researches from participating universities.

Autoware.Auto on F1TENTH: Open-Source Full-Scale AV Platform on Scaled Vehicle (ROS2 C++)

I integrated full-size AV software on scaled F1TENTH vehicles for robotic competitions, educations, and researches. I also maintained general AV packages.

Triton-AI-Racer Autonomous Robotic Car Platform: End-to-End Deep Learning on Scaled Vehicle (Python)

End-to-end deep learning. Uses CV, LiDAR, depth-perception camera, and odometry. Designed to work with Jetson computers on scaled robotic vehicles. Built-in image pipeline and various neural-net backends.

VESC ROS2 Driver (C++)

VESC: Widely-used BLDC motor controller for scale robotic cars and drones.

I collaborated with the Autoware Foundation and F1TENTH in providing ROS2 support for VESC.