Jingyun Ning

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Summary

PhD candidate specializing in autonomous vehicle dynamics, control, and motion planning, with a strong track record in high-speed autonomous racing competitions. Experienced in both model-based and machine learning methods for vehicle control, with demonstrated expertise in developing and implementing advanced algorithms to address complex challenges in autonomous racing.

Education

University of Virginia Charlottesville, VA
PhD. in Computer Engineering, GPA: 3.8/4.0 Expected Dec 2025

University of Virginia Charlottesville, VA
M.Eng. in Computer Engineering, GPA: 3.5/4.0 Jan 2016-Dec 2017

Research Experience

Capstone Research Project, University of Virginia Mar 2018 - Aug 2018

- Established an autonomous driving environment using Airsim and Unreal Engine.
- Generated hours of driving imagery for dataset collection and preprocessing.
- Constructed an end-to-end deep learning architecture utilizing AlexNet.

Stormwater Management Study, University of Virginia Oct 2018 - Jan 2021

- Collaborated with two principal investigators on a stormwater management study.
- Built two stormwater systems using the SWMM (Storm Water Management Model) simulator.
- Designed four different rule-based control strategies.
- Implemented a data-driven Model Predictive Control (MPC) for real-time stormwater management.

ML-based Vehicle Dynamics Learning and Control, University of Virginia Jan 2022 - present

- Studied the vehicle dynamics for various types of vehicles and racecars.
- Developed Gaussian Process (GP) regression models to learn model residuals for racecars.
- Integrated Deep Neural Networks to improve GP performances.
- Implementing uncertainty-aware Model Predictive Control (MPC) on the GP-hybrid vehicle model for real-time dynamic control of the racecar.
- Developing online adaptation strategy to adjust the GP model dynamically under varying racing conditions.

Vehicle Dynamics and Control Lead, Cavalier Autonomous Racing Jun 2022 - present

- Studied the vehicle dynamics for various types of vehicles and racecars.
- Built and refined multiple vehicle models for a full-sized Indy racecar.
- Implemented a pure-pursuit control algorithm on the racecar.
- Implemented MPC on a bicycle model for real-time dynamic control of the racecar.
- Analyzed and optimized racecar on-track performance using telemetry data.

Autonomous Racing Competitions

Indy Autonomous Challenge at Indianapolis Motor Speedway Oct 23, 2021

- Awarded fastest American team status with an average lap speed of 126 mph.
- Implemented pure-pursuit control algorithms, boosting team efficiency and control accuracy.

Indy Autonomous Challenge at CES 2024 Jan 6, 2024

- Secured 2nd place, qualifying 1st with an MPC algorithm based on a single-track vehicle model.
- Executed high-speed autonomous overtakes at 143 mph, underscoring the model's reliability under extreme conditions.

Indy Autonomous Challenge at Indianapolis Motor Speedway Sept 6, 2024

- Won the time trial competition.
- Broke world records with a 52.628-second lap and achieved a top speed of 184 mph, pulling 2.25 lateral Gs.

Indy Autonomous Challenge at CES 2025 Jan 9th, 2025

- Competed in the first multi-agent exhibition race of the Indy Autonomous Challenge.
- Secured 2nd place in the competition.

Publications and Presentations

- Ning, J., Bowes, B. D., Goodall, J. L., & Behl, M. (2022, June). Data-Driven Model Predictive Control For Real-Time Stormwater Management. In 2022 American Control Conference (ACC) (pp. 1438-1443). IEEE.
- Ning, J., & Behl, M. (2023). Vehicle Dynamics Modeling for Autonomous Racing Using Gaussian Processes. arXiv preprint arXiv:2306.03405.
- Ning, J., & Behl, M. (2023, August). Scalable Deep Kernel Gaussian Process for Vehicle Dynamics in Autonomous Racing. In 7th Annual Conference on Robot Learning.
- Chrosniak, T., & Ning, J., & Behl, M. (2024) Deep Dynamics: Vehicle Dynamics Modeling with a Physics-Constrained Neural Network for Autonomous Racing. IEEE Robotics and Automation Letters.
- Ning, J., & Behl, M. (2024). Gaussian Processes for Vehicle Dynamics Learning in Autonomous Racing. SAE International Journal of Vehicle Dynamics, Stability, and NVH, 8(10-08-03-0019).
- Ning, J., & Behl, M. (2024). DKMGP: A Gaussian Process Approach to Multi-Task and Multi-Step Vehicle Dynamics Modeling in Autonomous Racing. arXiv preprint arXiv:2411.13755.
- Presented at American Control Conference (ACC), Atlanta, US, 2022.
- Presented at Conference on Robot Learning (CoRL), Atlanta, US, 2023.

Teaching Experience

Teaching Assistant, F1Tenth Autonomous Racing, University of Virginia 2021 & 2022

- Conducted labs, maintained 10 racecars, and facilitated learning for over 50 students per semester.
- Awarded Outstanding Graduate Teaching Award for exceptional engagement and course contribution.

Skills

Technical Skills: Python, ROS2, PyTorch, C++, MATLAB, Docker
Simulation Tools: AirSim, Unreal Engine, SWMM, dSPACE, AutoVerse
Soft Skills: Problem Solving, Communication, Leadership, Team Collaboration, Time Management