Jingyun Ning

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Summary

PhD candidate specializing in autonomous vehicle dynamics, motion planning, and advanced control with expertise in Gaussian Processes (GP), Model Predictive Control (MPC), and real-time machine learning methods. Proven success in international autonomous racing competitions, holding world records and demonstrating the ability to integrate complex algorithms into high-speed environments.

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-May 2018

Research Experience

ML-Based Vehicle Dynamics Learning and Control, University of Virginia Jan 2022 – Present

- Developed advanced vehicle dynamics models by combining physics-based modeling with data-driven approaches using Gaussian Processes (GP).
- Proposed a Deep Kernel GP framework for learning multi-step residual dynamics across different driving modes.
- Integrating uncertainty-aware Model Predictive Control (MPC) into GP-enhanced models for real-time trajectory tracking and stabilization.
- Implementing online GP adaptation strategies to dynamically improve prediction accuracy under changing track and vehicle conditions.
- Evaluated model generalization across multiple racecar platforms using both simulation and real-world telemetry.

Vehicle Dynamics and Control Lead, Cavalier Autonomous Racing Jun 2022 – Present

- Led the development and deployment of dynamic models for a full-scale Indy Autonomous Challenge racecar.
- Designed and implemented both geometric (pure pursuit) and model-based (MPC) controllers tailored for high-speed racing scenarios.
- Integrated controller software with real-time telemetry pipelines for closed-loop control on-track.
- Analyzed vehicle logs to calibrate models and improve racecar performance across multiple competitions.
- Contributed to world-record-setting results, including 184 mph top speed and 2.25 lateral Gs on the Indianapolis Motor Speedway.

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.

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.

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.**, & Behl, M. (2025). DKMGP: A Gaussian Process Approach to Multi-Task and Multi-Step Vehicle Dynamics Modeling in Autonomous Racing. Proceedings of the 7th Annual **Learning for Dynamics and Control Conference**.
- 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).
- 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. (2023, August). Scalable Deep Kernel Gaussian Process for Vehicle Dynamics in Autonomous Racing. In 7th Annual **Conference on Robot Learning**.
- **Ning, J.**, & Behl, M. (2023). Vehicle Dynamics Modeling for Autonomous Racing Using Gaussian Processes. arXiv preprint arXiv:2306.03405.
- **Ning, J**., Bowes, B. D., Goodall, J. L., & Behl, M. (2022, June). Data-Driven Model Predictive Control For Real-Time Stormwater Management. In 2022 **IEEE American Control Conference**.
- Oral Presentation and nominated as a Best Paper candidate at the Learning for Dynamics and Control Conference (L4DC), Ann Arbor, USA, 2025.
- Poster Presentation at the Conference on Robot Learning (CoRL), Atlanta, USA, 2023.
- Oral Presentation at the American Control Conference (ACC), Atlanta, USA, 2022.

Professional Service

- Reviewer, Vehicle System Dynamics Journal, Taylor & Francis, 2025
- Reviewer, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2025
- Reviewer, IEEE Robotics and Automation Letters (RA-L), 2024
- Reviewer, IEEE International Conference on Robotics and Automation (ICRA), 2024

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** (2022) for exceptional mentorship in **F1Tenth Autonomous Racing course**.

Skills

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