

MU XIE

Philadelphia, PA, USA · Phone: +1 (215) 605-8303
Email: mux2001@seas.upenn.edu (preferred), xiem@live.com
Webpage: <https://mux2001.github.io/>

RESEARCH INTERESTS

Robotics · Safe and Learning-Based Control · Model Predictive Control (MPC) · Mixed-Integer Optimization · Learning-to-Optimize (L2O)

EDUCATION

University of Pennsylvania, Philadelphia, PA

M.S.E., Electrical Engineering

2024.01 - 2025.05

GPA: 3.78/4.0

Relative Curriculum: Learning in Robotics, Modern Convex Optimization, Advanced Robotics, F1Tenth Autonomous Racing

Zhejiang University, Hangzhou, China ¹

B.Eng., Electrical Engineering

2019.09 - 2023.06

GPA: 3.56/4.0

Relative Curriculum: Undergrad Math Courses, Signal and System, Machine Learning, Numerical Analysis

University of Illinois, Urbana-Champaign ¹

B.S., Electrical Engineering

2019.09 - 2023.06

GPA: 3.26/4.0

Relative Curriculum: Digital Signal Processing, Digital System, Electronic Circuits, Linear & Feedback Control System

RESEARCH EXPERIENCE

Research Assistant, X-Lab

2025.05 - Present

University of Pennsylvania, Philadelphia, PA

Advisor: Prof. Rahul Mangharam

- Conduct research on safe control and learning-based optimization for autonomous robotic systems.
- Develop differentiable optimization layers and learning-to-optimize methods for mixed-integer model predictive control (MI-MPC).
- Implement and evaluate learning-based controllers on autonomous driving and racing benchmarks.

Learning-to-Optimize Framework for Mixed-Integer MPC

2025.09 - Present

X-Lab, University of Pennsylvania

- Built a hybrid L2O framework for MI-MPC by combining integer prediction networks with a differentiable QP layer.
- Designed a mixed supervised/self-supervised loss to enhance integer optimality and feasibility.
- Achieved superior solve speed and solution quality on benchmark MI-MPC tasks versus supervised and self-supervised baselines.
- Tools: PyTorch, CVXPYLayer, Gurobi, NumPy

¹Dual Degree Enrollment

Gaussian Process Dynamics with MPPI Control

2025.06 - Present

X-Lab, University of Pennsylvania

- Learned nonlinear vehicle dynamics using Gaussian Process regression over multi-dimensional state-control datasets from autonomous racing tasks.
- Integrated GP-based dynamics into Model Predictive Path Integral (MPPI) control to account for model uncertainty in trajectory optimization.
- Evaluated tracking performance and robustness under stochastic disturbances, comparing GP-MPPI to nominal MPC baselines on simulated racing tracks.
- Tools: PyTorch, JAX, NumPy, ROS 2

PUBLICATIONS

A Hybrid Learning-to-Optimize Framework for Mixed-Integer Quadratic Programming

V.-A. Le, M. Xie, and R. Mangharam, 2025. Submitted to Learning for Dynamics and Control (L4DC)

SELECTED PROJECTS

Course Project: F1TENTH Autonomous Racing

2025.01 - 2025.05

University of Pennsylvania

- Built a complete ROS 2 stack including perception, planning, and control.
- Implemented wall-following, gap-following, pure pursuit, and MPC controllers with dynamic obstacle avoidance and race-line optimization.
- Developed LiDAR-based localization and vision based vehicle detection.
- Finished 2 time trials and 1 head-to-head race.
- Tools: ROS2, Python, C++

Course Project: LLM-Guided Navigation for F1TENTH

2024.09 - 2024.12

University of Pennsylvania

- Created an LLM-based planner converting natural-language commands to driving primitives and interacting with environment.
- Integrated symbolic reasoning with classical control for interactive autonomous-navigation tasks.
- Validated system in simulation and real F1TENTH environments.

Course Project: Quadrotor Control Paper Reproduction

2025.01 - 2025.05

University of Pennsylvania

- Reproduced nonlinear quadrotor control using cascaded attitude/position controllers.
- Analyzed robustness under parameter uncertainty and external disturbances.
- Developed simple grid-based planners and sensor-fusion routines for trajectory generation.

Course Project: Image-to-GPS Regression

2024.10 - 2024.12

University of Pennsylvania

- Implemented a ViT-based model for geolocation from street-level images.
- Built datasets and benchmarked performance against ResNet-based regressors.
- Tools: PyTorch, OpenCV, NumPy

TEACHING & INDUSTRY EXPERIENCE

Teaching Assistant, Simulation Modeling & Analysis (ESE 5030)

2025.01 - 2025.05

University of Pennsylvania, Philadelphia

- Led office hours, assisting students with stochastic modeling and simulation assignments.
- Prepared and graded homework and exam solutions, providing detailed feedback on mathematical answers.

Internship at Fusion Array Co. Ltd

2023.07 - 2023.12

Fusion Array Co. Ltd, Hangzhou, Zhejiang

- Developed FPGA logic and test benches for an ADC chip testing system.
- Worked with high-speed interfaces and data acquisition pipelines to validate chip performance.
- Tools: Verilog HDL, Quartus, Cadence SPB

TECHNICAL SKILLS

<i>Programming Languages</i>	C/C++, PYTHON, L ^A T _E X, MATLAB
<i>Development Tool</i>	ROS 2, PYTORCH, JAX