Khai Nguyen

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Education

Carnegie Mellon University (CMU) Pittsburgh, PA
M.S. in Mechanical Engineering – Research Program May 2024
- GPA: 4.00/4.00, Vingroup Scholar
- Thesis: TinyMPC: Model-Predictive Control on Resource-Constrained Microcontrollers

ETH Zürich (ETHZ) Zürich, Switzerland
Robotics Summer School and Robotics Student Fellowship Programs Summer 2023

Hanoi University of Science and Technology (HUST) Hanoi, Vietnam
B.S. in Control Engineering and Automation – Talent Program Oct 2021
- GPA: 3.85/4.00 (top 1% university)
- Thesis: Robust Optimal Control for Nonlinear Systems Based on Reinforcement Learning

Publications

- TinyMPC: Model-Predictive Control on Resource-Constrained Microcontrollers
  International Conference on Robotics and Automation (ICRA), 2024 [pdf] [website]
  K. Nguyen*, S. Schoedel*, A. Alavilli*, B. Plancher, Z. Manchester
  Best Paper Award in Automation; Best Conference Paper and Best Student Paper Finalists
- DEQ-MPC: Deep Equilibrium Model Predictive Control
  International Conference on Learning Representations (ICLR), 2025 (In Submission) [pdf]
  S. Gurumurthy, **K. Nguyen**, A. Bishop, Z. Manchester, Z. Kolter
- Code Generation for Conic Model-Predictive Control on Microcontrollers with TinyMPC
  arXiv Preprint, 2024 [pdf] [website]
  S. Schoedel*, **K. Nguyen***, E. Nedumaran, B. Plancher, Z. Manchester
- Formation Control with Reinforcement Learning for a Group of Multiple Surface Vehicles
  International Journal of Robust and Nonlinear Control (IJRNC), 2024 [pdf]
  K. Nguyen, V. T. Dang, D. D. Pham, and P. N. Dao
- Output DC Voltage Stabilizer and Efficiency Improvement in Wireless Power Tranfer Systems
  Measurement, Control, and Automation (MCA), 2021 [pdf]
  NX Khai, LCN Anh, NT Diep, NK Trung
- Adaptive Reinforcement Learning Motion/Force Control of Multiple Uncertain Manipulators
  Intelligent Systems and Networks (ISN), 2021 [pdf]
  PN Dao, DD Pham, **XK Nguyen**, TC Nguyen

Abstracts, Posters, and Others

- Deep Equilibrium Model Predictive Control
  Conference on Robot Learning (CoRL) Workshop Differentiable Opt. Everywhere, 2024 [pdf] [host]
  S. Gurumurthy, **K. Nguyen**, A. Bishop, Z. Manchester, Z. Kolter
- A Robot Learning System for Viewpoint-aware Legible Motion Planning
  Robotics: Science and Systems (RSS) Workshop Learning for Assistive Robotics, 2024 [pdf] [host]
  K. Nguyen*, Y. H. Chiu*, P. Tyagi*, S. Kambil*, I. Kang
- Optimizing at All Scales: Edge (Non)linear Model Predictive Control from MCUs to GPUs
  Robotics Science and Systems (RSS) Workshop Frontiers of Optimization for Robotics, 2024 [pdf] [host]
  E. Adabag*, X. Bu*, **K. Nguyen***, S. Schoedel*, ..., Z. Manchester, B. Plancher
  Spotlight Talk
- Enforcing Non-Fixed Hard Convex Constraints on Neural Networks and Its Applications
  Robotic Systems Lab, ETH Zürich, Switzerland, 2023
  K. Nguyen, J. Tordesillas, V. Klemm, M. Hutter

Experience

Laurent's Group, VinUniveristy — Hanoi, Vietnam
Research Assistant, advised by Prof. Laurent El Ghaoui — July 2024 – Present

- Managing a research group of six students, directing tasks, resources & fostering collaboration.
- Studying the generalization and robustness of deep implicit networks in tasks such as reasoning, language modeling, and computer vision.

Robotic Exploration Lab, CMU — Pittsburgh, PA
Research Assistant, advised by Prof. Zachary Manchester — Sep 2022 – Present

- Co-led TinyMPC, a high-speed and low-memory-footprint MPC solver, outperforming existing solvers on compute-limited platforms; collaborated with *Prof. Brian Plancher*.
- Built a pipeline to auto-generate fast multi-threaded robot dynamics on CPU and GPU.
- Developed DEQ-MPC, a novel approach that co-develops the solver and architecture unifying the optimization solver and deep network inference problems.

Robotic Systems Lab, ETHZ — Zürich, Switzerland
Research Assistant, advised by Prof. Jesus Tordesillas, Prof. Marco Hutter — Summer 2023

- Proposed two frameworks to strictly enforce runtime varying constraints on neural networks through implicit optimization-based and explicit learning-based modules.
- Employed the frameworks to learn to solve constrained optimization problems with different types of constraints; aiming to realize safe learning-enabled control.

Advanced Control and Robotics Group, HUST — Hanoi, Vietnam
Research Assistant, advised by Prof. Phuong Nam Dao — Mar 2019 – Aug 2022

- Explored motion/force robust control algorithms for cooperative mobile manipulators.
- Leveraged control theory to boost the adaptability and robustness of RL algorithms.
- Developed scalable hierarchical formation control for multi-agent systems with guarantees.

Viettel Aerospace Institute (VTX) — Hanoi, Vietnam
Autopilot Intern/Engineer — Aug 2020 – May 2022

- Investigated guidance and control; tuned an attitude controller to improve performance.
- Implemented controllers in embedded systems including STM32 ARM (C/C++) and FPGA.
- Authored one peer-reviewed article in the internal Institute Journal on genetic algorithm-based control design for pneumatic actuators.

Advanced Power Electronic System Lab, HUST — Hanoi, Vietnam
Research Assistant, advised by Prof. Trung Kien Nguyen — Nov 2019 – Feb 2021

- Developed efficient static and dynamic wireless power transfer systems for electric vehicles.
- Proposed using extended Kalman filter to dynamically estimate vehicle states and parameters.

Academic Services

Reviewers for: *International Journal of Robust and Nonlinear Control (IJRNC)*
Journal of the Franklin Institute (JFI)
International Conference on Intelligent Robots and Systems (IROS 2024)
Conference on Decision and Control (CDC 2024)
International Conference on Humanoid Robots (Humanoids 2024)
International Conference on Robotics and Automation (ICRA 2025)
American Control Conference (ACC 2025)

Teaching

Assistant, *Carnegie Mellon University*, Fall 2023
Advanced Control Systems Integration (graduate level), with *Prof. Mark Bedillion*.

Instructor, *GSTT Initiative*, 2018
Advanced STEM subjects for the Talent Program's entry exams at HUST.

Awards and Honors

- **Runner-up of Best Poster Award**, IEEE TC on Model-based Optimization for Robotics 2024
- **Best Paper Award in Automation**, International Conference on Robotics and Automation 2024
- **Best Conference Paper Finalist**, International Conference on Robotics and Automation 2024
- **Best Student Paper Finalist**, International Conference on Robotics and Automation 2024
- **Best Poster Award**, CMU Mechanical Engineering MS Research Symposium 2024
- **ETH Zürich Robotics Student Fellowship**, awarded to 08 students world-wide 2023
- **ETH Zürich Robotics Summer School**, awarded to 50 students world-wide 2023
- **Vingroup Scholarship**, full-ride scholarship for graduate studies 2022
- **Award for Graduating with Excellence**, outstanding graduating students at HUST 2022
- **Honda Scholarship**, awarded to 100 outstanding students nation-wide 2021
- **Top 15 Finalists of The Honda Young Engineer and Scientist's Award** 2021
- **CCU Virtual Internship Program**, National Chung Cheng University, Taiwan 2021
- **University Academic Scholarship**, "top 1% GPA" undergraduates at HUST 2018 – 2022
- **Global Project-Based Learning Program**, Shibaura Institute of Technology, Japan 2020
- **Acecook Happy Scholarship**, Acecook Vietnam 2020
- **Top 2 Best Oral Presentation Award**, Student Forum 2020 – Renewable Energy 2020
- **Best Poster Award**, HUST Departmental Undergraduate Research Symposium 2020
- **Third Prize in the Olympic Circuit Theory**, School of EE, HUST 2019

Extra curriculars

Member, *Carnegie Autonomous Racing*, 2023
Co-led the team finishing at 04/12 at the 12th F1TENTH Grand Prix at CPS-IoT 2023.

Member, *MIT-PITT-RW Racing Team*, 2023
Verified GPU-based MPPI controller on optimal planning and obstacle avoidance.

Organizer, *European Union*, 2019
Organized European music concerts to promote cultural exchanges in Vietnam.

Interpreter, *Plan International*, 2019
Visited remote areas to raise awareness of child rights and safety in Vietnam.

Skills

Domains: Machine Learning, Optimization, Planning, Controls, State Estimation, System Identification, Rigid Body Dynamics, Simulation

Programming: Python, MATLAB, Julia, C/C++

Tools: Git, Simulink, Eigen, ROS 1/2, Torch, JAX, Drake, OCS2, MuJoCo, IsaacGym, Gazebo, CARLA, Trello, and various optimization libraries.

Robots: Crazyflie quadrotor, F1TENTH car, SuperMegaBot vehicle, Unitree Go1 quadruped, xArm6 manipulator, ANYmal quadruped (sim)