THAI P. DUONG

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Research Interests

Robot Autonomy; Robot Dynamics Learning, Planning and Control; Model-based Reinforcement Learning; Robot Perception and Environment Representation; Robot Exploration and Safety.

Education

Ph.D. **University of California, San Diego** **2018 - 2024 (expected)**
Electrical and Computer Engineering. Track: Intelligent Systems, Robotics & Control. La Jolla, CA

M.S. **Oregon State University** **2015**
Electrical Engineering and Computer Science. Corvallis, OR

B.S. **Hanoi University of Science & Technology** **2011**
Electronics and Telecommunications. Advanced Program. Hanoi, Vietnam

Experience

Graduate Researcher **University of California, San Diego** **2018 – Present**
Advisor: Prof. Nikolay Atanasov, Existential Robotics Laboratory La Jolla, CA
Working on machine learning for robotics: robot dynamics learning, planning and control, robot exploration and safety, robot perception, decision making under uncertainty, etc. (ROS, C++, python, pytorch, tensorflow, quadrotors, cars)

Research Intern **Amazon Robotics** **2022**
Working on optimization-based motion planning for robot manipulators.

Software Engineer I/II **Microsoft Corporation, Office Performance Team** **2015 – 2018**
Working on bug/anomaly detection and power optimization (C++/C#).

Projects

Robot dynamics learning and control | *neural ODE, python/C++, aerial and ground robots* **2020 - Present**

- Encoding physics knowledge and Lie group constraints in machine learning models for dynamics learning and control. *Papers: [P1] [P4] [C2][C5].*
- Adaptive control with disturbance features learned from data. *Papers [W1][J2].*
- Safe navigation using physics-guided dynamics learning. *Papers [C4] [J3].*
- Learning distributed control policies from demonstration. *Paper [C3][P2].*

Environment understanding for robot navigation | *ROS, C++, ground robots* **2018 - Present**

- Sparse online Bayesian occupancy map of the environment using relevance vector machine and efficient collision checking algorithms for autonomous navigation. *Papers [C6] [J1].*
- Optimal scene graph planning with large language model guidance. *Paper [P3].*

Publications

Preprints

[P1] **T. Duong**, A. Altawaitan, J. Stanley, N. Atanasov, "*Port-Hamiltonian-based Neural ODE Networks on Lie Groups For Robot Dynamics Learning and Control*", submitted to IEEE Transactions on Robotics (T-RO), 2023 [website][[arxiv]][code].

[P2] E. Sebastian, **T. Duong**, N. Atanasov, E. Montijano and C. Sagues, "*Physics-Informed Multi-Agent Reinforcement Learning for Distributed Multi-Robot Problems*", submitted to IEEE Transactions on Robotics (T-RO), 2023 [website][arxiv][code].

[P3] Z. Dai, A. Asgharivaskasi, **T. Duong**, S. Lin, M. Tzes, G. Pappas, N. Atanasov, " *Optimal Scene Graph Planning with Large Language Model Guidance*", submitted to IEEE International Conference on Robotics and Automation (ICRA), 2024 [arxiv].

[P4] A. Altawaitan, J. Stanley, S. Ghosal, **T. Duong**, N. Atanasov, " *Hamiltonian Dynamics Learning from Point Cloud Observations for Nonholonomic Mobile Robot Control*", submitted to IEEE International Conference on Robotics and Automation (ICRA), 2024 [website][arxiv][code].

Journals

[J1] **T. Duong**, M. Yip, N. Atanasov, "*Autonomous Navigation in Unknown Environments with Sparse Bayesian Kernel-based Occupancy Mapping*", IEEE Transactions on Robotics (T-RO), 2022 [website][arxiv][code].

[J2] **T. Duong**, N. Atanasov, "*Adaptive Control of SE(3) Hamiltonian Dynamics with Learned Disturbance Features*", IEEE Control Systems Letters (L-CSS), 2022 [website][arxiv].

[J3] Z. Li, **T. Duong**, N. Atanasov, "*Robust and Safe Autonomous Navigation for Systems with Learned SE(3) Hamiltonian Dynamics*", IEEE Open Journal of Control System (OJ-CSYS), 2022 (*Invited Paper*) [website][arxiv].

Conferences

[C1] E. Sebastian, **T. Duong**, N. Atanasov, E. Montijano and C. Sagues, "*Learning to Identify Graphs from Node Trajectories in Multi-Robot Networks*", International Symposium on Multi-Robot & Multi-Agent Systems (MRS), 2023 [website][arxiv][code].

[C2] V. Duruisseaux, **T. Duong**, N. Atanasov, M. Leok, "*Lie Group Forced Variational Integrator Networks for Learning and Control of Robot Systems*", Learning for Dynamics & Control Conference (L4DC), 2023 [website][arxiv][code].

[C3] E. Sebastian, **T. Duong**, N. Atanasov, E. Montijano and C. Sagues, "*LEMURS: Learning Distributed Multi-robot Interactions*", IEEE International Conference on Robotics and Automation (ICRA), 2023 [website][arxiv][code].

[C4] Z. Li*, **T. Duong***, N. Atanasov, "*Safe Autonomous Navigation for Systems with Learned SE(3) Hamiltonian Dynamics*", Learning for Dynamics & Control Conference (L4DC), 2022 [website][arxiv] (*equal contribution).

[C5] **T. Duong**, N. Atanasov, "*Hamiltonian-based Neural ODE Networks on the SE(3) Manifold For Dynamics Learning and Control*", Robotics: Science and Systems (RSS), Virtual, 2021 [website][arxiv] [code].

[C6] **T. Duong**, N. Das, M. Yip, N. Atanasov, "*Autonomous Navigation in Unknown Environments using Sparse Kernel-based Occupancy Mapping*", International Conference on Robotics and Automation (ICRA), Virtual, 2020 [website][pdf] [code].

Workshops

[W1] **T. Duong**, N. Atanasov, "*Physics-guided Learning-based Adaptive Control on the SE(3) Manifold*", Physical Reasoning and Inductive Biases for the Real World Workshop at NeurIPS, Virtual, 2021 [pdf].

Talks

- "Learning and Control of Hamiltonian Dynamics on the SE(3) Manifold", 2022 SIAM Conference on Mathematics of Data Science (MDS'22)
- "Autonomous Navigation in Unknown Environments with Sparse Bayesian Kernel-based Occupancy Mapping", 2023 International Conference on Robotics and Automation (ICRA'23)
- "Learning Environment and Dynamics Representations for Autonomous Robot Navigation", Robograd Seminar, UCSD, 2023

Services

Reviewers: IEEE Transactions on Robotics (T-RO), IEEE Robotics and Automation Letters (RAL), IEEE International Conference on Robotics and Automation (ICRA), IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), American Control Conference (ACC), Learning for Dynamics and Control (L4DC).

Program Committee:

AAAI'23 workshop "When Machine Learning meets Dynamical Systems: Theory and Applications".

Technical Skills

Programming: C++/Python/Matlab, Object-oriented Design.
Operating Systems: Linux, ROS.
Libraries and Toolbox: CasADi, Pytorch, Pybullet, Gazebo, Docker.
Robot Platforms: RaceCar, PX4 Quadrotors.

Honors and Awards

ICRA 2023 Travel Grant, IEEE Robotics and Automation Society	2023
ECE Department Fellowships, University of California, San Diego	2018-2019
Jacobs Fellowships, University of California, San Diego	2018
First place, Microsoft Coding Competition, Oregon State University	2013
Phi Kappa Phi Society, Oregon State University	2013
President's Honors List, Hanoi University of Science & Technology	2011
Department's Honors List, Hanoi University of Science & Technology	2010

Teaching Experience

Teaching Assistant, Planning & Learning in Robotics, University of California, San Diego	Spring 2021
Teaching Assistant, Sensing & Estimation in Robotics, University of California, San Diego	Winter 2020
Teaching Assistant, Stochastic Signals & Systems, Oregon State University	Fall 2014
Teaching Assistant, Discrete Structures in Computer Science, Oregon State University	Summer 2014
Teaching Assistant, Intro. to Probability & Random Signals, Oregon State University	Winter 2014

Mentoring

M.S. students:	
Sambaran Ghosal (UCSD)	2022-present
Rishabh Bhattacharya (UCSD)	2023
Quan Lou (UCSD)	2022
Undergraduate students:	
Jason Stanley (UCSD)	2022-present
Yuchen Zhang, Behrad Rabiei, Adin Ackerman, Anthony Tseng (UCSD)	2022
Minh Pham (UCSD)	2020-2022
MAE Women's Mentoring Program:	
Zihang He (UCSD), David Yount (UCSD), Emily Huang (UCSD)	2023 - 2024
International Student Office's Mentorship Program:	
Iman Sayyadzadeh (UCSD), Taiga Morioka (UCSD)	2023