Thai Duong Le

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- ▷ Work in the industry of autonomous vehicle since 2018.
- ▷ PhD in Robotic and AI with focus on Motion Planning and Control.
- ▷ 3 patents on motion planning and control for autonomous driving system.
- ▷ Developed advanced algorithms and deployed on commercial vehicles fleet

EDUCATION

The Catholic University of America (CUA) *Washington, DC*

Ph.D. in Computer Science, field: Robotics and Artificial Intelligence *2019*

- Thesis Title: Task And Motion Planning for Multi-Robot Systems with Dynamics
- Advisor: Erion Plaku, Ph.D.

The Catholic University of America (CUA) *Washington, DC*

M.S. in Computer Science *2015*

The Catholic University of America (CUA) *Washington, DC*

B.S. in Electrical Engineering *2013*

Work Experience

Didi Research America, LLC *Mountain View, CA*

Staff Software Engineer *August 2022 - Present*

- Developing cutting-edge AI solutions to enable autonomous driving.
- Runtime optimization and architect highly performance AV software.
- Collaborating with various specialists to get planning algorithms and ML models deployed and integrated into the AV stack, with an eye on optimization and simplification of these procedures.
- Working with hardware and vehicle teams to guide compute requirements, sensor selection, and sensor suite architecture in support of the intelligent safety stack, both for current and future vehicle generations.

Perceptive Automata *Boston, Massachusetts*

Sr.Software Engineer, Motion Planning *October 2019 - June 2022*

- Implement autonomous vehicle motion planning and control that integrates Perceptive-Automata state-of-mind predictions (SOMA) to help navigate intelligently in the presence of other road users such as pedestrian, cyclists, and other vehicles.
- Develop motion planning algorithms for autonomous vehicles in dynamic environments consistent with industry best practices;
- Develop an autonomous driving framework integrated with simulator that enables measurement of key driving metrics in order to assess how different inputs can be used to improve automated driving performance.
- Continually research, experiment with, and incorporate the latest trends in state-of-the-art autonomous vehicle planning techniques including trajectory generation, control theory/optimization, and geometric- and/or sampling-based planning algorithms.
- Develop and test mobile robot logic for use in simulation environments and in the field.

American HAVAL Motor Technology, LLC *Farmington Hills, Michigan*

Motion Planning Engineer *May 2018 - October 2019*

- Develop motion planning algorithms for comfortable and safe trajectories efficiently and correctly to make critical decisions on maneuvers.
- Develop algorithms including path planning algorithms for Lane centering, Automatic Lane Change, Lane Keep Assist, Automatic Parking, etc.
- Model vehicle and controller dynamics and use these models to characterize and accelerate controller improvements.
- Analyze data to assess and improve system performance. Collaborate with the ADS team in localization, perception, mission/behavior planning, motion planning, and platform control.
- Integrate, test, improve and specify hardware and software to support the motion planning systems users.

Patents

US Patent Application No. 62768425 **Memory Based Optimal Motion Planning With Dynamic Model for Automated Vehicle**, Granted May 2021

US Patent Application No. 62768439 **Motion Planning Methods And Systems For Autonomous Vehicle**, Granted May 2021

US Patent Application No. 62768431 **Efficient Optimal Control With Dynamic Model For Autonomous Vehicle**, Granted May 2021

HIGHLIGHT PROJECTS

Historical Improvement Optimal Motion Planning for On-road Autonomous Vehicle

- This project present an efficient, robust and real-time motion planning method for the on-road autonomous vehicle.This approach aims to enhance the performance of motion planning in complex environments such as driving in the urban area. This approach uses path velocity decomposition method to separate the motion planning problem into path planning and velocity planning. The novelty is in the use of historical data in the SL coordinate in the framework of a tree version of Rapidly-exploring Random Graph (RRT*) technique in path planner, called HSL-RRT*, which grows the path tree efficiently by the data from previous planning cycle. The velocity planner generates optimal velocity along the path generated from the path planner, taking account of vehicle constraints and comfort. Analytic and simulation results are presented to validate the approach, with a special focus on the robustness and efficiency of the algorithm operating in complex scenarios.

Task and Motion Planning for Multi-Robot System with Dynamics

- This project seeks to advance the research at the intersection of AI and Robotics. This research provides a framework that increases the capability of multi-robot systems by planning the motions necessary to carry out user-specified high-level missions. The framework makes it possible to specify the mission in Planning-Domain Definition Language (PDDL) and it automatically computes the collision-free and dynamically-feasible trajectories for each robot.

Interactive Search for Action and Motion Planning with Dynamics

- This project proposes an interactive search approach, termed INTERACT, which couples sampling-based motion planning with action planning in order to effectively solve the combined task- and motion-planning problem. INTERACT is geared toward scenarios involving a mobile robot operating in a fully-known environment consisting of static and movable objects

Guiding Sampling-Based Tree Search for Motion Planning with Dynamics via Probabilistic Roadmap Abstractions

- This project focuses on motion-planning problems for high-dimensional mobile robots with nonlinear dynamics operating in complex environments. It is motivated by a recent framework that combines sampling-based motion planning in the state space with discrete search over a workspace decomposition

SKILLS AND EXPERIENCE

Programming Languages

- Fluent in C/C++, C#, Python, Java, Matlab.
- Familiar with web programming languages: Javascript, HTML, Nodejs.
- Familiar with version control software.

Tools and Frameworks

- Self-driving car platforms: Apollo
- Self-driving simulator: LG-SIM, CARLA
- Libraries and robotic frameworks: ROS (Robot Operating System), OMPL (Open Motion Planning Library), OpenCV.
- Robotic simulators: V-Rep, Gazebo, Webots, OpenGL.

Software developer experience

- Developed various advanced motion planning algorithms
- Implemented an autonomous driving platform consistent with industry best practices.
- Developed various programs to enhance autonomy of robots, include robot AI, robot controller.
- Developed various applications using machine learning and artificial intelligence

Robot platform experience

- Experience with self-driving car hardware platform.
- Experience with robotics hardware includes mobile platforms, sensors, actuators, and control systems.

Operating Systems

- Unix/Linux, Windows.

PUBLICATIONS

1. **Duong Le** and Erion Plaku (2021): *"Multi-Robot Motion Planning with Unlabeled Goals for Mobile Robots with Differential Constraints"*, 2021 IEEE International Conference on Robotics and Automation (ICRA)
2. Zhichao Liu and **Duong Le**, Kai Zhang, Bin Zhang(2019): *"Real-time Motion Control with Iterative Optimization and Robustness Analysis for Autonomous Driving."*, Proceedings of the 2019 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM)
3. Zhichao Liu and **Duong Le**, Kai Zhang, Renxiang Chen, Darong Huang, Bin Zhang (2019): *"Iterative Trajectory Optimization for Real-Time Motion Planner of Autonomous Driving."*, 2019 International Conference on Sensing, Diagnostics, Prognostics, and Control (SDPC)
4. **Duong Le** and Zhichao Liu, Jingfu Jin, Kai Zhang, Bin Zhang (2019): *"Historical Improvement Optimal Motion Planning for On-road Autonomous Vehicle."*, IECON 2019-45th Annual Conference of the IEEE Industrial Electronics Society
5. **Duong Le** and Erion Plaku (2019): *"Multi-robot motion planning with dynamics via coordinated sampling-based expansion guided by multi-agent search"*, IEEE Robotics and Automation Letters
6. **Duong Le** and Erion Plaku (2018): *"Cooperative, Dynamics-Based, and Abstraction-Guided Multi-Robot Motion Planning."*, Journal of Artificial Intelligence Research, vol. 63, pp. 361–390
7. **Duong Le** and Erion Plaku (2018): *"Multi-Robot Motion Planning with Dynamics Guided by Multi-Agent Search."*, Proceedings of the International Joint Conferences on Artificial Intelligence, pp. 5314–5318
8. **Duong Le** and Erion Plaku (2017): *"Cooperative Multi-Robot Sampling-Based Motion Planning with Dynamics"*, Proceedings of the International Conference on Planning and Scheduling, pp. 513–521 **(Best Robotics Paper)**
9. Erion Plaku and **Duong Le** (2016): *"Interactive Search for Action and Motion Planning with Dynamics."*, Journal of Experimental and Theoretical Artificial Intelligence, vol. 28, pp. 849–869
10. **Duong Le** and Erion Plaku (2014): *"Guiding Sampling-Based Tree Search for Motion Planning with Dynamics via Probabilistic Roadmap Abstractions."*, Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems, pp. 212–217

HONORS & AWARDS

2017 **Best Paper Award**, The 27th International Conference on Automated Planning and Scheduling

2015 **Finalist**, The Cimpress Tech Challenge

2013 **Best senior project award**, The Catholic University of America, School of Engineering

2013-2016 **CUA Graduate Assistantship**, The Catholic University of America

2011-2013 **CUA Undergrad Scholarship**, The Catholic University of America