Thai Duong Le

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- ▷ Work in the autonomous vehicle industry since 2018.
- ▷ PhD in Robotics and AI focusing 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*

- Founding engineer of Fallback System (an advanced backup system designed to safely control the vehicle and guide it to a secure location in case of a failure in the main system).
- Design the entire Fallback framework and implement the core algorithms for the Fallback Motion planning and Fallback Control system.
- Led a team of engineers to develop new features and enhance the capability of the Fallback system, including emergency maneuver and teleguidance system.
- **Successfully deployed the Fallback system on the commercial fleet with the take-over success rate ≈99%.**
- Collaborate with hardware and vehicle teams on compute requirements, sensor selection, and architecture for the intelligent safety stack across vehicle generations.

Perceptive Automata *Boston, Massachusetts*

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

- Implement autonomous vehicle motion planning and control using SOMA (company prediction model) for intelligent navigation around pedestrians, cyclists, and vehicles.
- Develop motion planning algorithms for autonomous vehicles in dynamic environments following industry best practices.
- Develop an autonomous driving framework with a simulator to measure key metrics and assess input effects on driving performance.
- Continuously research, experiment with, and integrate the latest trends in autonomous vehicle planning, including trajectory generation and control optimization.

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

Motion Planning Engineer *May 2018 - October 2019*

- Develop motion planning algorithms for safe, comfortable trajectories that enable efficient and accurate maneuver decisions.
- Develop motion planning algorithms for Lane Centering, Automatic Lane Change, Lane Keep Assist, and Automatic Parking.
- Analyze data to assess and improve system performance.
- Integrate, test, improve, and specify hardware and software for motion planning systems.

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 presents an efficient, real-time motion planning method for autonomous vehicles in complex urban environments. It separates motion planning into path and velocity planning using a novel approach called HSL-RRT*, which integrates historical data into the RRT* technique for efficient path tree growth. The velocity planner optimizes speed along the path while considering vehicle constraints and comfort. The approach is validated through analysis and simulations, emphasizing its robustness and efficiency in complex scenarios..

Task and Motion Planning for Multi-Robot System with Dynamics

- This project advances AI and robotics research by providing a framework that enhances multi-robot systems. It enables mission specification in Planning-Domain Definition Language (PDDL) and automatically computes collision-free, dynamically-feasible trajectories for each robot.

Interactive Search for Action and Motion Planning with Dynamics

- This project introduces the INTERACT framework, an interactive search approach that combines sampling-based motion planning with action planning to solve task- and motion-planning problems for mobile robots in known environments with static and movable objects.

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

- This project addresses motion-planning for high-dimensional mobile robots with nonlinear dynamics in complex environments, using a framework that integrates sampling-based motion planning with discrete search over workspace decomposition.

SKILLS AND EXPERIENCE

Programming Languages

- Fluent in C/C++, Python.
- Proficient in using version control software.

Autonomous Vehicle software experience

- Developed motion planning framework with advanced motion planning algorithms.
- Implemented an autonomous driving platform consistent with industry best practices.
- Successfully deployed a motion planning system on a commercial fleet.

Autonomous Vehicle platform experience

- Experience with autonomous vehicle hardware platform.
- Experience with robotics hardware includes mobile platforms, sensors, actuators, and control systems.

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.

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