Thai Duong Le

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- ▷ Working in the autonomous vehicle industry since 2018.
- ▷ PhD in Robotics and AI with a focus on motion planning and control.
- ▷ Hold three patents in motion planning and control for autonomous driving.
- ▷ Designed and deployed motion planning and control algorithms on commercial autonomous vehicle fleets.

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.

Work Experience

Didi Research America *Mountain View, CA*

STAFF SOFTWARE ENGINEER – AUTONOMOUS DRIVING *Aug 2022 – Present*

- Founding engineer and **owner** of the vehicle **fallback system**, responsible for safe behavior when perception, planning, or compute modules fail in production autonomous fleets.
- Owned the **end-to-end fallback motion planning and control pipeline**, from algorithm design to on-vehicle integration and validation.
- Designed and implemented a **deterministic fallback planner and controller** executing minimal-risk maneuvers such as safe stop, controlled deceleration, and lane keeping under degraded conditions.
- Defined **failure-detection conditions** and **real-time constraints** to ensure **deterministic response timing** in worst-case scenarios.
- Reached approximately **99% successful takeover rate** in production testing, reducing manual interventions and improving overall fleet safety.
- Served as **tech lead** for a cross-functional team covering planning, control, vehicle integration, and testing; led design reviews and key architectural decisions.

Perceptive Automata *Boston, MA*

SENIOR SOFTWARE ENGINEER – MOTION PLANNING *Oct 2019 – Jun 2022*

- Developed autonomous vehicle motion planning and control algorithms using SOMA (company prediction model) for safe navigation around pedestrians, cyclists, and vehicles.
- Designed planning solutions for highly dynamic urban environments, balancing safety, comfort, and efficiency.
- Built a simulation framework to evaluate planner behavior, quantify key metrics, and assess the impact of model and parameter changes.

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

MOTION PLANNING ENGINEER *May 2018 – Oct 2019*

- Developed motion planning algorithms for safe, comfortable, and efficient trajectory generation in production ADAS systems.
- Implemented planning features including Lane Centering, Automatic Lane Change, Lane Keep Assist, and Automatic Parking.
- Integrated and validated motion planning software with vehicle hardware through testing and data-driven iteration.

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

- Strong proficiency in **C/C++** and **Python** for production autonomous driving systems.
- Experienced with collaborative software development using modern version control workflows.

AUTONOMOUS DRIVING SOFTWARE

- Designed and developed motion planning frameworks and algorithms for autonomous driving systems.
- Built and deployed motion planning software following industry-standard safety and reliability practices.
- Delivered motion planning systems deployed on **commercial autonomous vehicle fleets**.

ROBOTICS AND VEHICLE PLATFORMS

- Hands-on experience with autonomous vehicle hardware platforms, including sensors, actuators, and control systems.
- Worked across the full robotics stack, from perception inputs to control outputs, in real vehicle environments.

TOOLS AND FRAMEWORKS

- Autonomous driving platforms: Apollo.
- Simulation and testing: CARLA, LG-SIM.
- Robotics and planning libraries: ROS, OMPL, OpenCV.
- Simulation and visualization tools: Gazebo, V-REP, 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