Shihao Li

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Research Interests

- Autonomous Driving
- Decision-Making
- Spatiotemporal Planning
- Maneuver Homotopy
- Cooperative Planning
- Vehicle Interaction
- On-Road AV
- Off-Road UGV

Education

Beijing Institute of Technology   **Sep. 2022 – Jun. 2026 (Expected)**
Ph.D. Candidate in Mechanical Engineering   *Beijing, China*

Beijing Institute of Technology   **Sep. 2020 – Jun. 2022**
M.Eng. in Mechanical Engineering   *Beijing, China*

Wuhan University of Technology   **Sep. 2016 – Jun. 2020**
B.Eng. in Vehicle Engineering   *Hubei, China*

Projects

Research on the Hybrid Unmanned Tracked Mobile Platform with High Environmental Adaptability and Traversability   Jun. 2020 – Current
Supported by the Ministry of Industry and Information Technology   Key Contributor

- Designed a heavy tracked unmanned ground vehicle (HTUGV) working in the unstructured environment.
- Designed the autonomous driving framework for the HTUGV and collected driving datasets under manual and autonomous modes.
- Established the suspension-aware vehicle-terrain contact model (PHISI), which was applied to the motion planning on uneven terrain and the safety verification of obstacle-crossing control.

The 6th and 7th China Ground Unmanned Systems Challenge   Sep. 2021 – Sep. 2023
Supported by the Intelligent Vehicle Research Center   Team Leader

- As the team leader, led the team to participate in competitions across three categories.
- Developed and maintained the off-road topology extraction technology based on satellite imagery.
- Developed planning and control algorithms for unstructured environments, including FSM-A*-based global decision-making, V2V-based following strategy, PHISI-based local motion planning, and MPC-based tracking control algorithm.

Theoretical Fundamentals and Key Technologies of Brain-Machine Hybrid Control for Ground Mobile Platforms   Sep. 2020 – Jun. 2022
Supported by the National Nature Science Foundation of China   Leader of the Autonomous Platform Group

- Designed an Autonomous Suburban Utility Vehicle (ASUV) based on commercially available vehicles, capable of operating in both structured and unstructured environments.
- Proposed a time-series risk field as a brain-machine interface for drivers and autonomous systems. Constructed by collecting the driver's visual attention and Electroencephalography (EEG), it facilitates human-like planning for autonomous modules.
- Proposed an efficient risk-aware spatiotemporal trajectory planning method based on Adaptive Motion Primitives and Bilevel Corridor.

Economic Motion Planning and Powertrain Control Method for Hybrid Commercial Vehicles Based on Intelligent Network Connection   Jan. 2021 – Current
Supported by the National Nature Science Foundation of China   Key Contributor

- Proposed a spatiotemporally coupled decision-making and planning technique with both lateral and longitudinal integration.
- Proposed Behavior Cell for rapid semantic-level enumeration of maneuver homotopy in the spatiotemporal drivable space.
- Integrated and validated the proposed algorithm in real-world complex traffic scenarios.

Research on the Autonomous Capability Assessment System for Ground Unmanned Platforms and the Construction of an Environmental Database   Sep. 2020 – Jun. 2022
Supported by the Ministry of Industry and Information Technology   Key Contributor

- Constructed a hierarchical assessment model for autonomous capabilities based on environment-task-performance.
- Proposes a sampling-based multi-dimensional entropy hierarchical evaluation method to quantify the environmental complexity.
- Built the data collection platform in the real-world environment and collected environmental datasets from various types of scenes.

Publications

Papers

[1] **S. Li**, W. Wang, B. Wang, H. Guan, H. Liu, S. Wu and H. Chen, Hierarchical Trajectory Planning Based on Adaptive Motion Primitives and Bilevel Corridor, ***IEEE Transactions on Vehicular Technology*** (under review).

[2] **S. Li**, X. Zhang, W. Wang, B. Wang, C. Lv, and H. Liu, Selecting Maneuver at Spatiotemporal Domain: A Generalized Framework Integrating Decision-making and Planning for Urban Driving, ***IEEE Transactions on Intelligent Transportation Systems*** (under review).

[3] S. Wu, **S. Li**, J. Gong and Z. Yan, Modeling and Quantitative Evaluation Method of Environmental Complexity for Measuring Autonomous Capabilities for Unmanned Ground Vehicles, ***Unmanned Systems*** (Co-first author).

[4] **S. Li** and J. Li, PHISI: Suspension-aware Vehicle-Terrain Contact model for Pose Estimation in Unstructured Scenarios, (Work in Progress).

Patent

[1] H. Liu, **S. Li**, M. Xue, X. Zhang, Z. Li, B. Wang and H. Chen, et al. A method for safety verification and control in unmanned off-road vehicles navigating through obstacle terrain. NO. 202311088086.3, China.

[2] H. Liu, **S. Li**, M. Xue, X. Zhang, Z. Li, B. Wang and H. Chen, et al. A method for safety behavior detection in autonomous off-road vehicles. NO. 202311088074.0, China.

[3] B. Wang, Z. Yan, **S. Li**, J. Gong, S. Wu, J. Qi and Z. Zang, et al. A method and system for evaluating the quality of unmanned vehicle path planning. NO. 202221836601.2, China.

[4] L. Xv, **S. Li**, G. Yi, R. Zheng, L. Zeng, Q. Lai, Y. Liu and K. Liu, et al. A convective heat exchange device based on vortex low-speed circulation air supply. NO. 201910247180.6, China.

Awards

Scholarship

National Scholarship	Sep. 2017
National Scholarship	Sep. 2018
Grand-prize scholarship in Wuhan University of Technology	Sep. 2019
First-prize scholarship in Beijing Institute of Technology	Sep. 2023
First-prize scholarship in Beijing Institute of Technology	Sep. 2022
Second-prize scholarship in Beijing Institute of Technology	Sep. 2021
Second-prize scholarship in Beijing Institute of Technology	Sep. 2020

Competitions

The 7th Ground Unmanned Systems Challenge (1st)	Sep. 2023
The 6th Ground Unmanned Systems Challenge (2nd)	Sep. 2021
The 6th Ground Unmanned Systems Challenge (6th)	Sep. 2021
National College Student Energy Conservation and Reduction Competition (1st)	Sep. 2019
China Post-Graduate Mathematical Contest (3rd)	Jan. 2023

Honorary Title

Excellent Student in Hubei Province	Sep. 2020
Excellent Student Leader in Wuhan University of Technology	Sep. 2020
Outstanding Student Cadre in Beijing Institute of Technology	Sep. 2021

Technical Skills

Platform: Rich working experience in software and hardware deployment for autonomous driving vehicles.
Languages: C/C++, Python, MATLAB/Simulink, Bash and LaTeX
Technologies/Softwares: Linux/Ubuntu, Robot Operating System (ROS), Git, CarSim, Common Road and Prescan.

Technical Video Homepage

🌐 https://lshasd123.github.io//Personal-Webpage/research/HMP
🌐 https://lshasd123.github.io//Personal-Webpage/research/BC
🌐 https://lshasd123.github.io//Personal-Webpage/research/PHISI