# Zirui Li 李子睿

Ph.D. candidate (graduate in Jun. 2025) School of Mechanical Engineering Beijing Institute of Technology, China Incoming Postdoctoral Research Associate at Nanyang Technological University (AutoMan lab)

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#### **WEB IDENTITY**

#### Homepage GoogleScholar ResearchGate LinkedIn

#### **AREAS OF INTEREST**

- ≻ Collective Intelligence Emergence in Edge (Postdoctoral research)
- $\triangleright$ Data-driven interactive behaviour modelling and Motion Planning in Dense environment
- $\triangleright$ Continual Learning (or lifelong learning) in Robotics (e.g., Automated Vehicles)
- $\triangleright$ Traffic Safety Assessment

## FDUCATION

	DUC				
	> B	eijing Institute of Technology	Beijing, China	Sep. 2019 –Jun. 2025	
	0	Ph.D. Candidate in Mechanical Engineering,	<u>VRC lab</u>		
	o Thesis: Interactive Motion Planning of Automated Vehicles based on Spatiotemporal Risk Continual Learning				
	0	Supervisor: Prof. Jianwei Gong			
	> Te	echnische Universität Dresden	Dresden, Germany	Jun. 2022 - Jun. 2024	
	0	Visiting Researcher, Chair of Traffic Process A	Automation		
	0	Supervisor: Prof. Meng Wang			
Þ	> D	elft University of Technology	Delft, The Netherlands	Jun. 2021 – May. 2022	
	0	Visiting Researcher, Department of Transporta	ation & Planning		
	0	<ul> <li>Supervisor: Prof. Bart van Arem, Prof. Meng Wang and Dr. Victor Knoop</li> </ul>			
	> B	eijing Institute of Technology	Beijing, China	Sep. 2015 – Jun. 2019	
	0	Bachelor of Engineering, Xuteli Talent School	l (Mechanical Engineering)	-	
	0	<ul> <li>Outstanding Graduate &amp; Outstanding Undergraduate Thesis</li> </ul>			
	0	Thesis: Analysis of influencing factors for driv	vers' decision-making at urban intersect	tions	
Р	ROF	<b>TESSIONAL EXPERIENCE</b>			
	B	eijing Institute of Technology, NSFC	Project/BIT-SAIC Project	Sep. 2019 – Now	
		• Developed an interactive behaviour model, which can accurately predict positions of traffic participants.			
A Start	~	• Created a spatiotemporal risk model for automated vehicle, which can continual learning and update.			
BELLINA	MOLOGY	• Developed an interactive motion planner i	n dense environment with low compute	ation cost and high safety.	
STITUTE OF T	EC	• Developed a motion planner by integrating	g objective and passengers' subjective r	isk.	
Þ	D	<b>Delft University of Technology, CSC Project/SHAPE-IT</b> Jun. 2021 – Jun. 2022			
		• Conducted <i>a large-scale online survey</i> to	collect perceived risk data from 2,16	64 participants, providing a rich	
<u>N</u>		perceived risk dataset for further research	in this field.		
TUDe	elft	<ul> <li>Developed two trajectory prediction mode</li> </ul>	el and rank 1 <sup>st</sup> in INTERPRET challeng	е.	
		• Developed a reachability analysis-based ri	isk assessment model for automated mo	odel. (News)	
	- Te	echnische Universität Dresden, CSC	Project/VAMOS	Jun. 2022 – Jun.2024	
		• Developed a high-performance model for	bus/tram arrival time prediction.		
	ISCHE SITAT	• Constructed a dataset and benchmark for	public transport arrival time prediction.		
C DRESDE	EN				

• Leading the IEEE standard development (P3439) as the working group chair.

#### SELECTED PUBLICATIONS (# Shared first authorship, \* Corresponding author)

#### Books:

- [B1] Lu C, Li Zirui, et al. Scene Understanding and Behavior Prediction for Intelligent Vehicles. Beijing Institute of Technology Press, 2021. (In Chinese)
- [B2] Lu C, Gong J, Li Zirui. Interactive Behavior Prediction and Decision-making for Intelligent Vehicles. *Beijing Institute of Technology Press*, 2025. (In Chinese)

#### Key Journal Publications:

- [J1] Li Zirui, et al. Interactive Behavior Prediction for Heterogeneous Traffic Participants in the Urban Road: A Graph-Neural-Network-based Multitask Learning Framework. *IEEE/ASME Transactions on Mechatronics* 26.3 (2021): 1339-1349. [PDF]
- [J2] Li Zirui, et al. Importance Weighted Gaussian Process Regression for Transferable Driver Behaviour Learning in the Lane Change Scenario. *IEEE Transactions on Vehicular Technology*, 2020, 69(11): 12497-12509. [PDF]
- [J3] Li, Zirui, et al. A Hierarchical Framework for Interactive Behaviour Prediction of Heterogeneous Traffic Participants based on Graph Neural Network. *IEEE Transactions on Intelligent Transportation Systems*, 2021, 23(7): 9102-9114.
   [PDF]
- [J4] Li, Zirui, et al. Personalized driver braking behavior modeling in the car-following scenario: An importance-weightbased Transfer Learning Approach. *IEEE Transactions on Industrial Electronics*, 2022, 69(10): 10704-10714. [PDF]
- [J5] Li Zirui, et al. Interactive Behavior Modeling for Vulnerable Road Users with Risk-Taking Styles in Urban Scenarios: A Heterogeneous Graph Learning Approach. *IEEE Transactions on Intelligent Transportation Systems*, 2024, 25(8): 8538-8555. [PDF]
- [J6] Li Zirui, et al. ArrivalNet: Predicting City-wide Bus/Tram Arrival Time with Two-dimensional Temporal Variation Modeling. *IEEE Transactions on Intelligent Transportation Systems*, 2025. [PDF]
- [J7] Li Zirui, et al. Continual Driver Behaviour Learning for Connected Vehicles and Intelligent Transportation Systems: Framework, Survey and Challenges. *Green Energy and Intelligent Transportation*, 2023, 2(4): 100103. [PDF]
- [J8] Li Zirui, et al. Interactive Trajectory Primitives Representation and Extraction Based on Naturalistic Driving Data, Automotive Engineering, 46.8 (2024): 1382-1393. (In Chinese) [PDF]
- [J9] Gong H<sup>#</sup>, Li Zirui<sup>#</sup>, et al. Leveraging Multi-Stream Information Fusion for Trajectory Prediction in Low-Illumination Scenarios: A Multi-Channel Graph Convolutional Approach. *IEEE Transactions on Intelligent Transportation Systems*, 2023, 25(5): 3854-3869. [PDF] [Code]
- [J10] Lin Y<sup>#</sup>, <u>Li Zirui</u><sup>#</sup>, et al. Continual Interactive Behavior Learning with Traffic Divergence Measurement: A Dynamic Gradient Scenario Memory Approach. *IEEE Transactions on Intelligent Transportation Systems*, 2023, 25(3): 2355-2372.
   [PDF] [Code]
- [J11] Xu, J<sup>#</sup>, Li Zirui<sup>#</sup>, et al. A Transferable Energy Management Strategy for Hybrid Electric Vehicles via Dueling Deep Deterministic Policy Gradient. *Green Energy and Intelligent Transportation*, 2022, 1(2): 100018. [PDF] [Code]
- [J12] He, X<sup>#</sup>, Li Zirui<sup>#</sup>, et al. Reading minds on the road: Decoding perceived risk in automated vehicles through 140K ratings. Submitted to Proceedings of the National Academy of Sciences (PNAS). [Code]
- [J13] Li, Zirui, et al. Exploring the Over-stationarization in Deep Learning-based Bus/Tram Arrival Time Prediction: Analysis and Non-stationary Effect Recovery. Under review at IEEE Transactions on Neural Networks and Learning Systems.
- [J14] Li, Zirui, et al. Complementary Learning System Empowers Online Continual Learning of Vehicle Motion Forecasting in Smart Cities. Submitted to Nature Machine Intelligence. [Code]
- [J15] Lin Y<sup>#</sup>, Li Zirui<sup>#</sup>, et al. H2C: Hippocampal Circuit-inspired Continual Learning for Lifelong Trajectory Prediction in Autonomous Driving. Under review at IEEE Transactions on Pattern Analysis and Machine Intelligence. [Code]
- [J16] Yan, P<sup>#</sup>, Li, Zirui<sup>#</sup>, et al. An Imputation-enhanced Hybrid Deep Learning Approach for Traffic Volume Prediction in Urban Networks: A Case Study in Dresden. *Data Science for Transportation*, 2024, 6(3): 22. [PDF]

[J17] Li J, <u>Li Zirui</u>\*, et al. Experience-Shared Variable-Step Predictive Control of Range-Extended Electric Vehicles Using Transferable Driver Model. *IEEE Transactions on Intelligent Transportation Systems*, 2025, 26(1): 1123-1133.
 [PDF]

#### Key Conference Publications:

- [C1] Li Zirui, et al. An Ensemble Learning Framework for Vehicle Trajectory Prediction in Interactive Scenarios. 2022 IEEE Intelligent Vehicles Symposium (IV). IEEE, 2022: 51-57. [PDF][Code]
- [C2] Li Zirui, et al. Transferable Driver Behavior Learning via Distribution Adaption in the Lane Change Scenario. 2019 IEEE Intelligent Vehicles Symposium (IV). IEEE, 2019: 193-200. [PDF]
- [C3] Li Zirui, et al. Development and Evaluation of Two Learning-based Personalized Driver Models for Pure Pursuit Path-tracking Behaviors. 2018 IEEE Intelligent Vehicles Symposium (IV). IEEE, 2018: 79-84. [PDF]

#### **PROFESSIONAL ACTIVITIES**

#### External Reviewer

- Journals: IEEE Trans on ITS, IEEE Trans on NNLS, IEEE Trans on PAMI, IEEE Trans on IV, IEEE Trans on T-VT, Accident Analysis & Prevention, TR Part C/F, IEEE RA Letter, etc.
- Conferences: IEEE IVs, IEEE ITSC, TRBAM, IEEE IROS, IEEE ICRA, etc.

#### Awards

- China Association for Science and Technology Youth Talent Support (40,000 CNY)
- o The 3rd Place Prize in ROAD mode of TRA VISIONS 2024 Young Researcher Competition [News]
- IEEE ITSS New Initiatives Proposal (6,000 USD)
- IEEE ITSS Young Professionals Travelling Fellowship (Twice, 2023 and 2025)
- Two-Year Graduate Student Fellowship of China Scholarship Councils (CSC)
- Excellent Graduate Study Scholarship (First class, twice, 2021 and 2024)
- National Scholarship for College Student, Ministry of Education of China (Twice, 2021 and 2024)
- NORINCO Scholarship
- Champions for Formula Student Driverless China, 2017&2018 [Video 1] [Video 2] [Video 3] [News]
- o First Prize Innovation Scholarship, Ministry of Industry and Information Technology 2018

#### Invited Talks

- Apr. 2024 ArrivalNet: Multi-step Bus/tram Arrival time Prediction in Dresden at 2024 TUD-KTH joint workshop.
- Nov. 2023 Towards integrating subjective and objective risks in human-centric automated driving at 2023 ITS WiE/YP Workshop & Research Forum, Cairo, Egypt.
- o Sep. 2023 Continual Driver Behavior Learning in Interactive Urban Scenarios at ITSC 2023, Bilbao, Bizkaia, Spain.
- Dec. 2022 Interactive Behavior Modeling for Vulnerable Road Users with Risk-taking Styles in Urban Scenarios: A Heterogeneous Graph Learning Approach at IEEE ITSC 2022 workshop.
- Dec. 2022 Towards Safe, efficient and Co-operative Decision-making for CAVs in Mixed Autonomy: An Attention-Enhanced Graphic Reinforcement Learning Approach at MFTS 2022.
- Nov. 2022 Interactive Behavior Modeling for Vulnerable Road Users with Risk-taking Styles in Urban Scenarios: A Heterogeneous Graph Learning Approach at IEEE ITSC 2022 workshop Cooperative and Automated Driving.
- Oct. 2022, Graph Convolution-Based Deep Reinforcement Learning for Multi-Agent Decision-Making in Mixed Traffic environments at IEEE ITSC 2022.
- Jun. 2022, Interactive Behavior Modeling for Vulnerable Road Users with Risk-taking Styles in Urban Scenarios: A Heterogeneous Graph Learning Approach at the Chair of Traffic Process Automation TU Dresden.
- o Oct. 2021, Defining the Interactive Behavior: A Mutual Information-based Approach at hEAT Lab, TU Delft.
- Jun. 2021, Graph Neural Network for Interactive behaviours: Modelling, Risk Assessment and Multi-task Prediction at Traffic Dynamics, Modelling and Control lab, TU Delft.
- Apr. 2021, Graph Neural Network for Interactive behaviours: Modelling, Risk Assessment and Multi-task Prediction at hEAT Lab, TU Delft.
- o Jun. 2019, Transferable Driver Behavior Learning via Distribution Adaption in the Lane Change at IEEE IV 2019.

 Jun. 2018, Development and Evaluation of Two Learning-Based Personalized Driver Model for Pure pursuit Path-Tracking Behaviors at IEEE IV 2018.

### > (Co) Chairs

- $\circ~$  Working group leader, intelligent vehicle risk assessment under IEEE Standard Assosiation
- o Co-chair, Cooperative Decision-making for Connected and Automated Vehicles in ITS at IEEE ITSC 2023
- Associate Editor for IEEE IV 2023
- o Chair, Social, interactive and safe behaviors for AVs: benchmarks, models and applications at IEEE IV 2023
- Organising committee and Proceedings editor, <u>MFTS 2022</u>
- $\circ~$  Chair, Social and Interactive Behavior Modelling in ITS at IEEE ITSC 2021

#### > Supervisor

- Beijing Institute of Technology: <u>Cheng Gong</u>, <u>Yunlong Lin</u>, Chenxu Wen, Haowen Wang, <u>Hailong Gong</u>, Lianzhen Wei, <u>Yangtian Yi</u>, <u>Xianqi He</u>, <u>Jingyi Xu</u>, Yingqi Tan, <u>Tanran Chen</u>.
- o TU Dresden: Fanyi Wei.