TIANYU SHI

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Google Scholar: H index: 7, citation: 255

EDUCATION

University of Toronto *September 2021 - present*

- Ph.D. in Transportation Engineering
- Research topic: Deep reinforcement learning for intelligent transportation system decision making and control

McGill University *January 2020 - Sep 2021*

- Master of Engineering (MEng) Thesis Option, GPA:3.8/4.0
- Research topic: Deep reinforcement learning, Robotics, Intelligent transportation system

Beijing Institute of Technology *September 2015 - July 2019*

- Mechanical Engineering (BEng), Major GPA: 3.7/4.0, Overall Ranking: 1/66
- First Class Honors graduate

JOURNAL PUBLICATIONS

Tianyu Shi*, Omar Elsamadisy*, llia Smironov, and Baher Abdulhai (2024). Safe, Efficient and Efficient and Comfortable RL-Based Autonomous Driving with Lane-Changing and Analytic Safety Guarantees. *IEEE Transactions on Intelligent Vehicles (in submission)* .

Jianshuai Feng, Kaize Lin, Tianyu Shi, et al (2024) Cooperative Traffic Optimization with Multi-agent Reinforcement Learning and Evolutionary Strategy: Bridging the Gap between Micro and Macro Traffic Control. *Physica A: Statistical Mechanics and its Applications*

Kaiyun Jiang, Tianyu Shi, Shifeng Lu, Norhayati Mahyuddin (2024) A Review of Predicting Indoor Environment and HVAC Energy Consumption of HVAC Buildings Based on a Multi-Output Prediction Model. *Indoor and Build Environment*

Shi, T., Devailly, F. X., Larocque, D., & Charlin, L. (2024). Improving the generalizability and robustness of large-scale traffic signal control. *IEEE Open Journal of Intelligent Transportation Systems.*

Li, J., Lin, S., Shi, T., Tian, C., Mei, Y., Song, J., ... & Li, R. (2023). A Fully Data-Driven Approach for Realistic Traffic Signal Control Using Offline Reinforcement Learning. arXiv preprint arXiv:2311.15920. *IEEE Transactions on Intelligent Transportation Systems (under review)*

Chu, C. H., Donato-Wodger, S., Khan, S., Shi, T., Leslie, K., Abbasgholizadeh-Rahimi, S., ... & Amanda, G. (2023). Strategies to Mitigate Age-Related Bias in Machine Learning: A Scoping Review. *JMIR Aging.*

Tianyu Shi*, Omar Elsamadisy*, llia Smironov, and Baher Abdulhai. Safe, Efficient and Comfortable Reinforcement-Learning-Based Car-Following for AVs with Analytic Safety Guarantee and Dynamic Target Speed. *Transportation Research Record* (2023) .

Feng, J., Shi, T., Wu, Y., Xie, X., He, H., Tan, H. (2023). Multi-Lane Differential Variable Speed Limit Control via Deep Neural Networks Optimized by an Adaptive Evolutionary Strategy. *Sensors* (2023).

Chu, Charlene H., Simon Donato-Woodger, Shehroz S. Khan, Rune Nyrup, Kathleen Leslie , Alexandra Lyn, Tianyu Shi, Andria Bianchi, Samira Abbasgholizadeh-Rahimi, Amanda Grenier. Age-related Bias and Artificial intelligence: A Scoping Review. *Nature: Humanities and Social Sciences Communications*(2023).

Ye Ma*, Tianyu Shi*, Wei Zhang, Yu Hao, Junbing Huang, Yinan Lin. A Comprehensive Evaluation of NEV Development in China, Japan, the United States and Germany based on the AHP-EW Model, *Journal of Cleaner Production, 2019 Mar 20;214:389-402.*.

CONFERENCE PROCEEDINGS

Chen Yang, Tianyu Shi. TSDiT: Traffic Scene Diffusion Models with Transformers. *2024 International Joint Conference on Artificial Intelligence (IJCAI)* (under review)

Meiling Tao, Xuechen liang , Tianyu Shi et al. RoleCraft-GLM: Advancing Personalized Role-Playing in Large Language Models. *The 62 Annual Meeting of the Association for Computational Linguistics (ACL'24)* (under review)

Wang, Y., Wang, B., Shi, T*., Fu, J., Zhou, et al. (2023). Sample-efficient Antibody Design through Protein Language Model for Risk-aware Batch Bayesian Optimization. *NeurIPS 2023 AI for Science*

Kaize Lin, Peiqi Li, Ziher Jia, Tianyu Shi, and Alaa Khamis. Cooperative Variable Speed Limit Control using Multi-agent Reinforcement Learning and Evolution Strategy for Improved Throughput in Mixed Traffic(2023). *In 2023 IEEE International Conference on Smart Mobility (SM).*

Tianyu Shi, Yifei Ai, Baher Abdulhai. Bilateral Deep Reinforcement Learning Approach for Better-than-human Car Following Model. *The 2022 IEEE International Conference on Intelligent Transportation (ITSC).*

Chen Xi, Tianyu Shi*,Qingpeng Zhao et al. WILD-SCAV: Benchmarking Deep Reinforcement Learning Algorithms in 3D Open-World Games. *3D FPS games challenge at 2022 IEEE Conference on Games (CoG).*

Zhiyuan Yao, Tianyu Shi, Site Li et al. Towards Modern Card Games with Large-Scale Action Spaces Through Action Representation. *The 2022 IEEE Conference on Games (CoG)* (**Oral presentation**).

Tianyu Shi*, Dong Chen, Kaian Chen, Zhaojian Li . Offline Reinforcement Learning for Autonomous Driving with Safety and Exploration Enhancement. *Workshop on Machine Learning for Autonomous Driving, 2021 Conference on Neural Information Processing Systems (NeurIPS).*

Tianyu Shi*, Jiawei Wang*, Yuankai Wu, Luis Miranda-Moreno, Lijun Sun. Multi-agent Graph Reinforcement Learning for Connected Automated Driving. *Workshop on AI for Autonomous Driving , 2021 International Conference on Machine Learning (ICML).*

Tianyu Shi*, Chenyang Xi*, Yuankai Wu, Lijun Sun. Efficient Motion Planning for Automated Lane Change based on Imitation Learning and Mixed-Integer Optimization. *The 2020 IEEE International Conference on Intelligent Transportation(ITSC).*

Tianyu Shi*, Pin Wang*, Ching-Yao Chan. A Data Driven Method of Optimizing Feedforward Compensator for Autonomous Driving Vehicle,*The 2019 IEEE Intelligent Vehicles Symposium (IV).*

Tianyu Shi*, Pin Wang*, Ching-Yao Chan. Driving Decision and Control for Automated Lane Change based on Deep Reinforcement learning,*The 2019 IEEE International Conference on Intelligent Transportation (ITSC).*

Yang Li, Jianqiang Wang, Tianyu Shi, Xiao-Yun Lu, Qing Xu, Keqiang Li. Pedestrian Trajectory Prediction at Un-Signalized Intersection Using Probabilistic Reasoning and Sequence Learning,*The 2019 IEEE International Conference on Intelligent Transportation(ITSC).*

ACADEMIC EXPERIENCE

Toronto ITS Centre, University of Toronto September 2021 - present
PhD Student, supervised by Prof.Baher Abdulhai

- ***Reinforcement learning for Mixed-autonomy Driving***
- Investigate the effect of bilateral car following models to stabilize mixed traffic as well as improve travel efficiency at the same time.

Lawrence S. Bloomberg Faculty of Nursing, University of Toronto April 2022 - present
Research assistant, supervised by Prof.Charlene Chu & Prof.Shehroz S.Khan

- ***Age-related bias and artificial intelligence***
- Investigate the achieve fairness for age related attributes in skin lesion detection
- Scoping review for bias mitigation strategy
- Scoping review for ageism and artificial intelligence
- Research accepted by CAG 2023, GSA 2023, HSSCOM

Smart Transportation Group, McGill University January 2020 - September 2021
Master Student, supervised by Prof.Lijun Sun

- ***Multi-agent Graph Reinforcement Learning for Automated Driving***
- Develop the graph attention networks in the navigation setting of multi-agent reinforcement learning for mixed-autonomy cooperation.
- Introduce Dynamic relational index based on both velocity and position information to capture attention features among surrounding agents.
- Improve the traffic flow efficiency and mitigate congestion. Present our paper in ICML 2020.

Berkeley Deep Drive, UC Berkeley July 2018 - September 2018
Research Assistant , supervised by Dr.Ching-Yao Chan & Dr. Pin Wang

- ***Research on Decision-making and Control System based Deep Reinforcement Learning (Project Link)***
- Designed two similar Deep Q learning frameworks with quadratic approximator for deciding how to select a comfortable gap and follow the preceding vehicle.
- Proposed a novel hierarchical deep reinforcement learning for decision making and control of lane change situations.
- Explored and optimized planning and control module based on customized reference trajectory and pure pursuit controller.

Tsinghua University July 2019 - September 2019
Research Assistant at State Key Lab of automotive Safety and Energy

- ***Research on Pedestrian Trajectory Prediction***
- Participated in designing a new hybrid model DBN-Seq2Seq for pedestrian trajectory prediction through an adaptively online weighing algorithm, which adjusts the weights of Seq2Seq and DBN models by estimating the stopping probability and their prediction errors at previous steps.
- Employed data-augmentation techniques to enlarge the original dataset for learning-based approaches.

INTERNSHIP EXPERIENCE

BioMap Dec 2022 - June 2023
Research assistant, supervised by Zhizhuo Zhang

- ***Active Learning Antibody Design***
- Improve exploration efficiency by using protein language models to filter out mutants with low fitness scores
- Design a risk-aware acquisition function based on the uncertainty of the prediction to improve the explorers ability
- Demonstrate the effectiveness of our proposed method on multiple antibody datasets

WarpEngine Feb 2023 - May 2023
Research assistant, supervised by Hang Chu

- ***Learning personalized talking behavior***

- Investigate and benchmark the large lanugage models' performance, such as ChatGLM, GPT3, LLaMA.
- Implement supervised fine-tuning to learn personalized talking behavior.
- Propose an ensemble-based framework to improve generalization ability for personalized data

Mila - Quebec AI Institute, Montreal August 2020 - September 2021
Research Intern, supervised by Prof.Laurent Charlin & Prof.Denis Larocque

- ***Research on improving robustness of Reinforcement learning for traffic signal control given missing data***
- Measure the impact of faulty or noisy data on the policy learned by graph neural network based reinforcement learning.
- Improve decision making robustness given missing data based on imputation method and distributional reinforcement learning approach.

Momenta.AI, Beijing January 2019 - September 2019
Planning and Control Research Intern at L4 self-driving group, supervised by Dr.Jie Chen

- ***Data-driven Motion Planning***
- Transformed the lane change mission into Mixed Quadratic Problem (MIQP) with logical constraints to guarantee safe and comfortable lane change movements.
- Proposed a hierarchical imitation learning with classification layer and action generation layer to provide online, fast and more generalized motion planning.

Megvii Technology, Beijing September 2019 - December 2019
Computer Vision Research Intern at Base model group, supervised by Dr.Xiangyu Zhang

- ***Neural Network Architecture Optimization***
- Designed efficient neural network structure based on Neural Architecture Search (NAS) Method.
- Improved residual bottleneck's performance based on channel and spatial attention mechanism.

HONORS & AWARDS

Silver award in *Kaggle* Google Research - Identify Contrails to Reduce Global Warming	*Sep 2023*
2023 DiDi Autonomous Driving Graduate Awards **(two recipients in Uoft Civmin)**	*Jan 2023*
Dr. Mazen Hassounah Graduate Scholarship in Mass Events Transportation	*Oct 2022*
2022 University of Toronto Fellowship, Department Of Civil Engineering	*Sep 2022*
2022 DiDi Autonomous Driving Graduate Awards **(two recipients in Uoft Civmin)**	*Dec 2021*
2021 Graduate Merit-Based Entrance Scholarship**(five recipients in Uoft Civmin)**	*Sep 2021*
2020 IVADO Excellence Scholarship(**five Recipients of McGill**)	*April 2020*
Graduate Excellence Fellowship (GEF)(**funding new graduate of McGill**)	*Jan 2020*
MIIT Scholarship for Scientific Innovation (**ten undergrad winners in BIT**)	*January 2019*
First Prize of the CASC Scholarship (**one winner in our department of BIT**)	*October 2018*
SWAT Scholarship(**ten winners in our department of BIT**)	*Fall 2018*
First Prize of the Fast Gear Scholarship(**one winner in our major of BIT**)	*November 2017*
Grand Prize of Academic Competition of BIT (**top 1%**)	*May 2017*
North Industry Scholarship for All-round Development(**ten winners in BIT**)	*December 2016*
Second Prize of National Undergraduate Mathematical Modeling Contest(**top 10%**)	*December 2016*
Second Prize of Undergrad Physical Experiment Competition of Beijing (**top 10%**)	*November 2016*

TALKS AND PRESENTATIONS

Distributional reinforcement learning for improving robustness and generalizability of large scale traffic signal control, at UofT ITS Innovation Lab, UT Austin. *April 2021*
Efficient Connected and Automated Driving System with Multi-agent graph Reinforcement Learning, at TRB Annual Meeting, CMU Safe AI Lab , UCLA Mobility Lab. *Jan 2021*
Data Driven motion planning for Autonomous Driving at The 2020 IEEE International Conference on

Intelligent Transportation (ITSC). *Oct 2020*

PROFESSIONAL SERVICES

Reviewer

• NeurIPS 2022 Datasets and Benchmarks• NeurIPS workshop on Machine Learning for Autonomous Driving• IEEE Transactions on Intelligent Transportation Systems • Transportation Research Part C: Emerging Technologies • TRB Annual Meeting - Transportation Research Board• IEEE International Conference on Intelligent Transportation Systems • IEEE Intelligent Vehicles Symposium •ACM SIGKDD Conference on Knowledge Discovery and Data Mining

Teaching Assistant

- Teaching Assistant for ECE1724HF -Bio-inspired Algorithms for Smart Mobility at UofT
- Teaching Assistant for CSC165H1 Mathematical Expression and Reasoning at UofT
- Teaching Assistant for ECE324 Introduction To Machine Intelligence at UofT
- Teaching Assistant for MIE443 Mechatronics Systems: Design Integration at UofT
- Teaching Assistant for CIV332 Transport II-Performance at UofT
- Teaching Assistant for CSC2702H Technical Entrepreneurship at UofT
- Teaching Assistant for CIV100 Mechanics at UofT
- Teaching Assistant for APS106 Fundamentals of Computer Programming at UofT
- Teaching Assistant for APS360 Artificial Intelligence Fundamentals at UofT
- Teaching Assistant for APS1070 Foundations of Data Analytics and Machine Learning at UofT
- Teaching Assistant for APS1080 Introduction to Reinforcement learning at UofT
- Teaching Assistant for COMP551 Applied Machine Learning at McGill

MENTORSHIP

Oct. 2023 - Present	**Chen Yang**, Algorithm Engineer at Haomo Technology
Sep. 2023 - Present	**Miao Zhang**, Master student at Tsinghua University
Oct. 2022 - Present	**Jianshuai Feng**, PhD student at Beijing Institute of Technology
Jun. 2022 - Jun. 2023	**Kaize Lin**, Master student at University of Toronto (Software developer at Huawei)
Sep. 2021 - Jun. 2022	**Yifei Ye**, Master student at University of Toronto (Software developer at Intel)
Jun. 2018 - Jun. 2019	**Xuxin Cheng**, undergrad at Beijing Institute of Technology (M.S. in Robotics at CMU)

DATA ANALYTICS SKILLS

Programming Languages	Python, C/C++, MATLAB
Python Packages	Pandas, Matplotlib, Numpy, Scipy, Pytorch, Tensorflow
Software & Tools	LaTeX, Excel, SPSS, R, Photoshop , PROE , SolidWorks , CAD