

Xujie Song

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Bio I am a **Master student** graduated from **Tsinghua University**. My research interests include **Neural Network**, **Reinforcement Learning**, as well as their applications in **Autonomous Driving** and **Intelligent Transportation System**.

🎓 Education

Sep. 2021 – Jun. 2024	Tsinghua University , M.Phil > Vehicle Engineering > Big Data Certificate Program	GPA : 4.0/4.0 Rank : 1/35	↗ Beijing, China
Sep. 2017 – Jun. 2021	Delft University of Technology , Joint B.Eng > Traffic and Transportation		↗ Delft, Netherlands
Sep. 2017 – Jun. 2021	Beijing Jiaotong University , B.Eng (dual degrees) > Traffic and Transportation > Computer Science and Technology	GPA : 3.91/4.0 Rank : 1/54 GPA : 3.98/4.0	↗ Beijing, China



📖 Publications

- > **X. Song**, J. Duan, W. Wang, et al. "LipsNet : A Smooth and Robust Neural Network with Adaptive Lipschitz Constant for High Accuracy Optimal Control," *International Conference on Machine Learning (ICML)*, 2023.
📄 Paper 🖼️ Poster 📺 Video 🏠 GitHub
- > **X. Song**, L. Chen, T. Liu, et al. "FlipNet : Fourier Lipschitz Smooth Policy Network for Reinforcement Learning," *Annual Conference on Neural Information Processing Systems (NeurIPS)*, 2024 (under review).
🌐 Website 📺 Video 🏠 GitHub
- > **X. Song**, T. Liu, S. E. Li, et al. "Training Multi-layer Neural Networks on Ising Machine," **Nature Communications**, 2024 (ready to submit).
📄 Paper
- > L. Chen*, **X. Song***, L. Xiao, et al. "Smooth Reinforcement Learning Based Trajectory Tracking for Articulated Vehicles," *Journal of Harbin Institute of Technology (Ei Compindex)*, 2023.
📄 Abstract
- > L. Chen*, **X. Song***, W. Wang, et al. "A Smooth Reinforcement Learning Method for Trajectory Tracking and Collision Avoidance of Wheeled Vehicle," *IEEE Transactions on Intelligent Transportation Systems (TITS)*, 2024 (under review).
- > Y. Wang, W. Wang, **X. Song**, et al. "Smoothing Neural Network with Adaptive Liquid Time-constant for Reinforcement Learning Tasks," *Annual Conference on Neural Information Processing Systems (NeurIPS)*, 2024 (under review).
📄 Abstract
- > W. Wang, J. Duan, **X. Song**, et al. "Smooth Filtering Neural Network for Reinforcement Learning," *IEEE Transactions on Intelligent Vehicles (TIV)*, 2024 (under review).
📄 Abstract
- > Y. Wang, L. Wang, Y. Jiang, W. Zou, T. Liu, **X. Song**, et al. "Diffusion Actor-Critic with Entropy Regulator," *Annual Conference on Neural Information Processing Systems (NeurIPS)*, 2024 (under review).
📄 Paper
- > **X. Song** and Z. Lin, "Non-zero-sum Game Control for Multi-vehicle Driving via Reinforcement Learning," *arXiv preprint arXiv:2302.03958*, 2023.
📄 Paper 🏠 GitHub
- > S. E. Li, **X. Song**, et al. "A Method for Training Feedforward Neural Networks on Ising Machine," *Patent, No. 2023113797497*, 2023.
- > S. E. Li, W. Wang, Z. Zheng, C. Zhang, Y. Yang, Y. Zhang, J. Gao, J. Li, **X. Song**, et al. "Offline Simulation System for the General Optimal Control Problem Solver (V2.0)," *Software Copyright, No. 2023SR0225863*, 2023.
📄 Docs 🏠 GitHub
- > **X. Song**, S. Dai, C. Lin, et al. "LiDAR Data Enhancement via Pseudo-LiDAR Point Cloud Correction," *Journal of image and Graphics (JIG)*, 2021.
📄 Paper 🏠 GitHub
- > C. Lin, **X. Song**, S. Dai, et al. "A Method and Device for 3D Point Cloud Densification Based on Stereo RGB Images," *Patent, No. CN111612728B*, 2020.

Experiences

- 2021.9 – 2024.6 | **Tsinghua University**, Research Assistant ↗ Beijing, China
> Research on autonomous driving, reinforcement learning, neural network control, and quantum computing as a research assistant.
Autonomous Driving Reinforcement Learning Neural Network
- 2024.2 – 2024.6 | **QBoson Ltd.**, Research Intern ↗ Beijing, China
> Research on quantum training of neural networks. It provides alternative to gradient-based Back-propagation method.
Quantum Computing Neural Network
- 2023.7 – 2023.9 | **Alibaba Group Ltd.**, Research Intern ↗ Beijing, China
> Research on aligning LLM (Large Language Model) with safety constraints, by inference based on conditional probability. It provides alternative to Safe-RLHF (RL from Human Feedbacks).
Large Language Model Align with Human Preference Safety Constraint
- 2022.3 – 2023.1 | **MEGVII Technology Ltd.**, Research Intern ↗ Beijing, China
> Research on the application of sequential 3D object construction based on the reinforcement learning and computer vision methods.
Reinforcement Learning 3D Vision Sequential Construction
- 2022.1 – 2022.2 | **ProbQuant Ltd.**, Research Intern ↗ Beijing, China
> Design a multi-stage quantitative stock position optimization algorithm, then develop the system using CasADi and IPOPT.
Quantitative Investment Combination Optimization Optimal Stock Position
- 2021.6 – 2021.8 | **SenseTime Group Inc.**, Research Intern ↗ Shanghai, China
> Research on intelligent signal control. Design a integrative algorithm for green waves coordinating and breakpoints partitioning on arteries, then develop the system using OR-Tool and Coin-or.
Intelligent Transportation Operational Research Traffic Signal Green Wave

Researches & Projects

- 2022 – 2023 | **Training Quantized Neural Network on Quantum Devices** ↗ Tsinghua University, Beijing
> Design an optimization framework in QUBO format for training QNN. Use the Quantum Annealing/Coherent Ising Machine, to complete the training immediately.
> It is the first work that proposes training deep feedforward neural network on Ising Machine.
Quantized Neural Network Quantum Annealing Coherent Ising Machine
- 2021 – 2022 | **Smooth and Robust Neural Network for Reinforcement Learning** ↗ Tsinghua University, Beijing
> To address the action fluctuation in RL, we proposed a smooth and robust neural network named LipsNet, proved to be Lipschitz continuous. It can be used as actor network in most RL algorithms.
> Experiments show that it has smooth actions on MuJoCo and autonomous driving tasks.
Reinforcement Learning Neural Network Lipschitz Continuity
- 2021 – 2021 | **Traffic Prediction for Cities with Transfer Learning** ↗ MIT, Remote
> Design a traffic state prediction method for different cities with transfer learning. The project has investigated Graph-ResNet, Unet and LSTM, etc.
> Advisor:  [Zhenliang Mike Ma](#) | Recommendation letter:  [link](#).
Transfer Learning Traffic State Estimation
- 2020 – 2021 | **Game Control for Autonomous Driving via Reinforcement Learning** ↗ Tsinghua University, Beijing
> Propose a game control framework for autonomous driving. The Nash-equilibrium control strategy is obtained by solving coupled HJB equations through model-based RL.
> Self-play training is used. It has good results in the simulated intersections.
Reinforcement Learning Game Theory Autonomous Driving

2019 – 2020

LiDAR Enhancement Based on Images

↗ MePro, Beijing

- > The project aims to densify the LiDAR point cloud in the autonomous driving scenarios. The process flow includes depth estimation, surface reconstruction, pseudo-point cloud correction, etc.
- > Experiments show density is improved significantly, and 3D detection accuracy is also increased.

Computer Vision

LiDAR Enhancement

Point Cloud Densification

 **Competition Awards**

2017 – 2020

ACM-ICPC / CCPC Competitions

🏆 4 Silver Medals, 3 Bronze Medals

- > **Silver medals** : Qinhuangdao site, Harbin site, Xi'an invitation site×2
- > **Bronze medals** : Beijing site, Xuzhou site, Hangzhou site

2024

Wuyue Cup Quantum Computing Competition🏆 Gold Award (1st place)

2019

Lanqiao Cup National Contest, Beijing (C++, A-level)

🏆 First Prize

2019

MCM/ICM Mathematical competition in Modeling

🏆 Honorable Mention

2018

China Mathematical Contest in Modeling, Beijing

🏆 Second Prize

 **Honors & Scholarships**

2020 Zhixing Scholarship (¥20,000, Only 10 Stu.)

2023 RONG Scholarship (¥6,000, 5th place)

2019 Zhixing Minor Scholarship (¥10,000, Only 10 Stu.)

2023 General Scholarship, Second-level (¥5,000)

2020 National Scholarship (¥8,000, Top 1%)

2022 General Scholarship, Second-level (¥5,000)

2019 National Scholarship (¥8,000, Top 1%)

2018 Acad. Scholarship, First-level (¥3,500, Top 2%)

2018 National Scholarship (¥8,000, Top 1%)

2020 Acad. Scholarship, Second-level (¥2,000, Top 2%)

2021 Outstanding Grad., Beijing (Top 5%)

2019 Acad. Scholarship, Second-level (¥2,000, Top 2%)

2020 Outstanding Merit Student (Only 10 Stu.)

2023 Didi Chuxing Scholarship (¥1,500)

2023 Best Oral Pres., PhD Forum (Only 3 Stu.)

2022 Didi Chuxing Scholarship (¥1,500)

 **Core Courses**

Mathematics	Probability & Statistics (100/100)	Discrete Mathematics (100/100)	Geometry & Algebra (98/100)
	General Chemistry (96/100)	Operational Research (96/100)	University Physics (95/100)
	Calculus (92/100)	Numerical Analysis (A-/A+)	Physics Experiment (A-/A)
Computer Science	Machine Learning (98/100)	Database Systems (98/100)	Operating Systems (98/100)
	Data Structures (97/100)	Computer Networks (95/100)	Computing Thinking (A/A)
	Artificial Intelligence (A/A)	Big Data Analytics (A/A)	High-Perf. Computing (A/A)
	Statistical Learning (A/A+)	Deep Learning (A-/A+)	Reinforcement Learning (P/P)
Traffic Engineering	Traffic Engineering (98/100)	Transportation Planning (98/100)	Intell. Trans. Systems (95/100)
	Transportation Network (94/100)	Transportation Facilities (93/100)	Transport. Economics (92/100)
	Railway Operations (90/100)	Road & Railway Design (90/100)	Terminals & Hubs (90/100)
Vehicle Engineering	Self-driving & Intell. Vehicle (P/P)	Vehicle Control Engineering (A/A+)	Modern Optimiz. Method (A/A)
	Modern Control Theories (P/P)		

 **Skills**

Programming :	C/C++, Python, MATLAB, PyTorch
Software & Platform :	Linux, \LaTeX , Git, Simulink, SUMO
Language :	Chinese (native), English (TOEFL 101, GRE 323)
Hobby :	Hiking, Dizi (Chinese bamboo flute)