Xiangyu Li

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Education

Northwestern University — Evanston, IL, USA
Ph.D. student in Transportation Systems Analysis & Planning — Sep.2023 – Present
Master of Science in Computer Engineering — Mar.2024 – Jun.2025 (Expected)

- GPA: **3.8/4.0**
- Core Courses: Deep Reinforcement Learning (4.0/4.0), Deep Learning: Foundations, Applications, and Algorithms (4.0/4.0), Transportation Systems Analysis (4.0/4.0, rank 1/20), Transportation Systems Operations (4.0/4.0), Transportation Systems Planning and Management (4.0/4.0), Travel Demand Analysis and Forecasting (4.0/4.0), Infrastructure System Analysis (4.0/4.0), Introduction to Applied Econometrics (4.0/4.0)

University of California, Berkeley — Berkeley, CA, USA
Master of Transportation Engineering — Aug.2022 – Jul.2023

- GPA: **3.81/4.0**
- Core Courses: Operation of Transportation Facilities (4.0/4.0, rank 1/50), Behavioral Modeling for Planning and Policy (4.0/4.0), System Analysis in Transportation (96/100)

Beijing Jiaotong University — Beijing, China
Bachelor of Transportation Engineering — Aug.2018 – Jul.2022

- GPA: **3.86/4.0** (Top **2%**)
- Core Courses: Operational Research in Management (95/100), Traffic Safety Engineering (97/100), Urban Public Transportation (95/100), Traffic Management and Control (92/100), System Engineering (4.0/4.0)

Publications & Manuscripts

[1] **Li, X.Y.**, Liu, P.Y., Mahmassani, H.S., & Chen, Y. An Adaptive Longitudinal Driving Assistance System (ALDAS) with Reinforcement Learning. *IEEE Transactions on Intelligent Transportation Systems* (Under review).[PDF][Code]

[2] **Li, X.Y.**, Cheng, X., Chen, Y., & Zhu, Q. Large Language Model-Enhanced Multi-Level Feature Fusion Network for Autonomous Driving Behavior Classification. *IEEE Transactions on Intelligent Transportation Systems* (Under review). [PDF] [Code]

[3] **Li, X.Y.**, Yin, Z.W., Luo, S.D., & Hansen, M. Impact of Intracity Traffic Congestion on People's Choices of Housing, Workplace and Commute: Social Optimal Parsimonious Continuum Approach. *Transportation Research Part E: Logistics and Transportation Review* (Under review). [PDF]

[4] **Li, X.Y.**, Jiao, R.C., Shi, X.Y., & Zhu, Q. Reinforcement Learning-Enhanced Simulated Driving Strategies with Large Language Model. *Working Paper*. [Report] [Code]

[5] **Li, X.Y.**, Gomes, G., & Wu, Y.Z. Collaborative Traffic Signal Control and Path Recommendations Considering PM2.5 Exposure Using Reinforcement Learning. *Working Paper*. [Report] [Code]

[6] Luo, S.D., **Li, X.Y.**, Wu, X.Y., Yin, Z.W., Xu, S., & Kang, L.J. (2022). Modeling Resident Choices of Residence, Work Locations and Commutes in a Two-city System for Optimal Urban Design. *Journal of Tsinghua University (Science and Technology)*, 62(7), 1186-1194. [PDF]

[7] **Li, X.Y.** Finite Element Optimization Analysis of CFRP Reinforced Box Girder Bridge Under Traffic Load. In *2021 4th International Symposium on Traffic Transportation and Civil Architecture* (pp. 89-94). IEEE. [PDF]

[8] **Li, X.Y.**, & Xie, M. Short-term passenger volume forecast and model analysis of Beijing public transport. In *Fifth International Conference on Traffic Engineering and Transportation System (ICTETS 2021)* (Vol. 12058, pp. 1423-1429). SPIE. [PDF]

Awards

2023	McCormick Fellowships (Full-tuition scholarship and stipend)	Northwestern University
2022	Departmental Scholarship (15000 dollars)	University of California, Berkeley
2021	Excellent Scholarship for Undergraduate Discipline Competition	Beijing Jiaotong University
2021	Second Prize, 16th National Competition of Transport Science and Technology	China Communications and Transportation of Association
2021	University-Level Merit Scholarship	Beijing Jiaotong University
2020	University-Level Merit Scholarship	Beijing Jiaotong University
2019	University-Level Merit Scholarship	Beijing Jiaotong University

Research Experience

Northwestern University, Dept. of Electrical and Computer Engineering Evanston, IL, USA
Research Assistant to **Professor Qi Zhu** *Jun. 2024 – Present*
Project: LLM-Enhanced Multi-Level Feature Fusion Network for Autonomous Driving Behavior Classification

- Defined 30+ features from time-series autonomous driving data to characterize the driving behavior.
- Utilized GPT-4 with dedicated prompt based on extracted features to obtain summary texts of driving behavior.
- Encoded summary texts with the RoBERT model to obtain its embedding.
- Obtained time-series driving behavior image embeddings using a multi-scale dilated convolutional network.
- Fused text and image embeddings into a multimodal feature vector using a weighted attention mechanism.
- Outperformed benchmark models (e.g., GAF-ViT) by 2% in accuracy and 5% in F1-score

Project: Enhancing CAD Generation Accuracy Using LLMs with RAG and Multi-Modal Data Integration

- Designed a CAD file generation system using LLMs based on manual input text.
- Leveraged Vision-Language Models (VLMs) alongside LLMs to generate precise captions of CAD files.
- Incorporated Retrieval-Augmented Generation (RAG) to extract similar existing CAD files to help generation.
- Created a paired dataset to train and fine-tune LLMs with high-quality data collected from other companies.

Northwestern University, Transportation Center Evanston, IL, USA
Research Assistant to **Professor Hani S Mahmassani** *Nov. 2023 – Jul. 2024*
Project: An Adaptive Longitudinal Driving Assistance System based on Reinforcement Learning

- Built a cyber-physical system to train an autonomous driving strategy that aligns with human preferences.
- Used the Deep Deterministic Policy Gradient (DDPG) algorithm to train car-following strategies.
- Collected the desired car-following patterns of 13 drivers to guide DDPG's reward function.
- The trained DDPG model outperformed LSTM, RNN, and CACC in efficiency, comfort, and fuel consumption.
- The DDPG model significantly decreases human takeover time during the testing driving experiment.

University of California, Berkeley, Dept. of Mechanical Engineering Berkeley, CA, USA
Research Assistant to **Professor Gabriel Gomes** *Aug. 2022 – May. 2023*
Project: Collaborative Traffic Lights Control and Path Recommendations Using Reinforcement Learning

- Built a city-scale simulation platform based on simulation of urban mobility (SUMO).
- Proposed a traffic light control algorithm using deep Q-learning network (DQN) and Actor-to-critic (A2C).
- Proposed a real-time path recommendation algorithm for commuters using A2C.
- Collaboratively trained two agents to minimize generalized system cost incorporating PM2.5 exposure.

University of California, Berkeley, Institute of Transportation Studies Berkeley, CA, USA
Research Assistant to **Professor Mark Hansen** *Jan. 2021 – Feb. 2023*
Project: Game Theoretical Analysis for a Two-city Economic System

- Designed a system composed of two ring-radial cities connected by a high-speed rail with changing congestion.
- Derived the Nash Equilibrium (NE) state of people's work and commute pattern distributions.
- Proved that no big city residents will choose to work in the small city under the NE.
- Derived optimal government interventions on population size control to maximize social welfare.
- Two first-authored papers with one submitted to Transportation Research Part E and another published in Journal of Tsinghua University.

Beijing Jiaotong University, Dept. of Transportation Engineering Beijing, China
Research Assistant to **Professor Yizheng Wu** *Sep. 2021 – May. 2022*
Project: Individual Particulate Matter Exposure for Urban Commuters

- Collected inhaled PM2.5 per second with a portable monitor under different travel modes (over 100 hours).
- Quantified the relationship between inhaled PM2.5 and external factors (e.g., gender, age, respiration rate).
- Quantified impacts of PM2.5 on population mortality rate and disability adjusted life year for different regions.
- Built an inhaled PM2.5 prediction model based on travel characteristics and simulated the PM2.5 exposure.
- Wrote a thesis and obtained Outstanding Undergraduate Graduation Thesis Award (top 5%).

Computer Skills

Proficient: Python, PyTorch, TensorFlow, Pandas, Numpy, SUMO, MATLAB, Carla, Vissim, ArcGIS, Synchro
Familiar: C/C++, Stata, R