

Zhanhong Cheng

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EDUCATION

McGill University

Ph.D. in Transportation

Montreal, Canada

Jan 2019–Oct 2022

- Advisor: Prof. [Lijun Sun](#) (McGill, main) & Prof. [Martin Trépanier](#) (PolyMtl, co-supervisor)
- Thesis: “Travel-Behavior-Based Inference and Forecasting Methods in Metro System”

Harbin Institute of Technology

M.S. in Transportation Planning and Management

Harbin, China

Sep 2016–Jul 2018

- Advisor: Prof. [Jia Yao](#)
- Thesis: “An Analysis of Two Hybrid Route Choice Models in Stochastic Assignment Paradox”

Harbin Institute of Technology

B.Eng. in Traffic Engineering

Weihai, China

Aug 2012–Jul 2016

- Thesis: “Design of a Traffic Data Management and Analysis Software”

RESEARCH INTERESTS

- **Spatiotemporal data modeling:** probabilistic forecasting, large-scale real-time demand forecasting & management, land-use/network/time series representation learning, travel behavior pattern mining.
- **Sustainable transportation:** public transit, electric vehicles, smart charging programs, shared mobility, bike sharing, automated vehicles, urban planning, smart & sustainable cities.
- **Methodology:** Gaussian processes, probabilistic models, machine learning & deep-learning (RNN, Transformer, deep generative models, graph neural network), time series forecasting, matrix/tensor factorization, GIS, data visualization, discrete choice models, traffic simulation, traffic flow theory, network analysis, Bayesian optimization, convex optimization.

EXPERIENCE

McGill University

Postdoctoral Researcher

Montreal, Canada

Aug 2022–Current

- Advisor: Prof. [Lijun Sun](#)

ExPretio

Research fellow

Montreal, Canada

Sep 2022–Current

- NSERC Alliance project with [ExPretio](#) and Mitacs: “Probabilistic forecasting of train ticket booking demand with hierarchical correlations”

Exo

Intern

Montreal, Canada

Feb 2019–Feb 2022

- Mitacs project: “Spatiotemporal travel behavior modeling and analysis for better public transport systems”

Wenzhou Urban Planning and Design Institution

Intern

Wenzhou, China

Summer 2016

- Residential area parking spaces renovation project

Weihai Traffic Engineering Research Institute
Research Assistant

Weihai, China
May 2015–Jun 2016

- Weihai traffic signal system optimization project
- Traffic impact analysis

AWARDS AND SCHOLARSHIPS

- Second-best Paper Award at the 15th CASPT and 8th TransitData. 2022
- CIRRELT Excellence Scholarship (Doctoral Rédaction) 2020
- McGill Engineering Doctoral Award (International) 2019–2021
- Excellent Graduate Thesis of HIT 2018
- First Level Scholarship of HIT 2016, 2017
- Excellent Graduate of Shandong Province 2016
- Third Prize of National Competition of Transport Science and Technology 2015
- First Prize of China Undergraduate Mathematical Contest in Modeling (team leader) 2014

TEACHING

- **Instructor** at McGill University Fall 2023
Spatiotemporal Data Mining (CIVE 650)
- **Guest Lecturer** at McGill University Winter 2023
Transportation Network Analysis (CIVE 542)
- **Teaching Assistant** at McGill University Fall 2022
Spatiotemporal Data Mining (CIVE 650)
- **Teaching Assistant** at McGill University Winter 2021
Traffic Engineering & Simulation (CIVE 440)
- **Teaching Assistant** at McGill University Winter 2021
Sustainable project management (CIVE 324)
- **Teaching Assistant** at McGill University Fall 2021
Traffic Engineering & Simulation (CIVE 440)

STUDENTS MENTORING

- Xiaoxu Chen (Ph.D. student at McGill University) 2021–Current
 - Topic: Probabilistic forecasting for bus travel time and passenger occupancy
 - Role: Mentor/Collaborator
- Zixu Zhuang (Undergraduate at Harbin Institute of Technology) 2017–2018
 - Topic: Bus travel time reliability
 - Role: Bachelor thesis mentorship

- [1] X. Chen, C. Zhang, **Z. Cheng**, Y. Hou, and L. Sun, “A bayesian gaussian mixture model for probabilistic modeling of car-following behaviors”, *IEEE Transactions on Intelligent Transportation Systems*, 2023 (accepted).
- [2] H. Cai, F. Wu, **Z. Cheng**, B. Li, and J. Wang, “A large-scale empirical study on impacting factors of taxi charging station utilization”, *Transportation Research Part D: Transport and Environment*, vol. 118, p. 103687, 2023. DOI: [10.1016/j.trd.2023.103687](https://doi.org/10.1016/j.trd.2023.103687).
- [3] X. Chen, **Z. Cheng**, J. Jin, M. Trépanier, and L. Sun, “Probabilistic forecasting of bus travel time with a bayesian gaussian mixture model”, *Transportation Science*, 2023. DOI: [10.1287/trsc.2022.0214](https://doi.org/10.1287/trsc.2022.0214).
- [4] **Z. Cheng**, M. Trépanier, and L. Sun, “Real-time forecasting of metro origin-destination matrices with high-order weighted dynamic mode decomposition”, *Transportation Science*, vol. 56, no. 4, pp. 904–918, 2022. DOI: [10.1287/trsc.2022.1128](https://doi.org/10.1287/trsc.2022.1128).
- [5] **Z. Cheng**, X. Wang, X. Chen, M. Trépanier, and L. Sun, “Bayesian calibration of traffic flow fundamental diagrams using gaussian processes”, *IEEE Open Journal of Intelligent Transportation Systems*, 2022. DOI: [10.1109/OJITS.2022.3220926](https://doi.org/10.1109/OJITS.2022.3220926).
- [6] F. Wu, H. Chen, K. Hou, **Z. Cheng**, and T. Z. Qiu, “Adaptive pushbutton control for signalized pedestrian midblock crossings”, *Journal of Transportation Engineering, Part A: Systems*, vol. 148, no. 4, p. 04022011, 2022. DOI: [10.1061/JTEPBS.0000659](https://doi.org/10.1061/JTEPBS.0000659).
- [7] J. Yao, H. Yuan, Y. Jiang, S. An, and **Z. Cheng**, “Effect of route overlapping feature on stochastic assignment paradox”, *Transportation Letters*, pp. 1–11, 2022. DOI: [10.1080/19427867.2022.2159058](https://doi.org/10.1080/19427867.2022.2159058).
- [8] K. Zhu, **Z. Cheng**, J. Wu, F. Yuan, and L. Sun, “Quantifying out-of-station waiting time in oversaturated urban metro systems”, *Communications in Transportation Research*, vol. 2, p. 100052, 2022. DOI: [10.1016/j.commtr.2022.100052](https://doi.org/10.1016/j.commtr.2022.100052).
- [9] Z. Zhuang, **Z. Cheng**, J. Yao, J. Wang, and S. An, “Bus travel time reliability incorporating stop waiting time and in-vehicle travel time with avl data”, *International Journal of Coal Science & Technology*, vol. 9, no. 1, p. 71, 2022. DOI: [10.1007/s40789-022-00544-7](https://doi.org/10.1007/s40789-022-00544-7).
- [10] **Z. Cheng**, M. Trépanier, and L. Sun, “Incorporating travel behavior regularity into passenger flow forecasting”, *Transportation Research Part C: Emerging Technologies*, vol. 128, p. 103200, 2021. DOI: [10.1016/j.trc.2021.103200](https://doi.org/10.1016/j.trc.2021.103200).
- [11] **Z. Cheng**, J. Yao, A. Chen, and S. An, “Analysis of a multiplicative hybrid route choice model in stochastic assignment paradox”, *Transportmetrica A: Transport Science*, pp. 1–25, 2021. DOI: [10.1080/23249935.2021.1953189](https://doi.org/10.1080/23249935.2021.1953189).
- [12] X. Wang, **Z. Cheng**, M. Trépanier, and L. Sun, “Modeling bike-sharing demand using a regression model with spatially varying coefficients”, *Journal of Transport Geography*, vol. 93, p. 103059, 2021. DOI: [10.1016/j.jtrangeo.2021.103059](https://doi.org/10.1016/j.jtrangeo.2021.103059).
- [13] **Z. Cheng**, M. Trépanier, and L. Sun, “Probabilistic model for destination inference and travel pattern mining from smart card data”, *Transportation*, pp. 1–19, 2020. DOI: [10.1007/s11116-020-10120-0](https://doi.org/10.1007/s11116-020-10120-0).
- [14] J. Yao, **Z. Cheng**, J. Dai, A. Chen, and S. An, “Traffic assignment paradox incorporating congestion and stochastic perceived error simultaneously”, *Transportmetrica A: Transport Science*, vol. 15, no. 2, pp. 307–325, 2019. DOI: [10.1080/23249935.2018.1474962](https://doi.org/10.1080/23249935.2018.1474962).
- [15] J. Yao, W. Huang, A. Chen, **Z. Cheng**, S. An, and G. Xu, “Paradox links can improve system efficiency: An illustration in traffic assignment problem”, *Transportation Research Part B: Methodological*, vol. 129, pp. 35–49, 2019. DOI: [10.1016/j.trb.2019.07.018](https://doi.org/10.1016/j.trb.2019.07.018).

- [16] J. Yao, **Z. Cheng**, F. Shi, S. An, and J. Wang, “Evaluation of exclusive bus lanes in a tri-modal road network incorporating carpooling behavior”, *Transport Policy*, vol. 68, pp. 130–141, 2018. DOI: [10.1016/j.tranpol.2018.05.001](https://doi.org/10.1016/j.tranpol.2018.05.001).

PREPRINTS

- [1] F. Wu, **Z. Cheng**, H. Chen, T. Z. Qiu, and L. Sun, “Traffic state estimation with anisotropic gaussian processes from vehicle trajectories”, 2023. arXiv: [2303.02311](https://arxiv.org/abs/2303.02311).
- [2] X. Chen, **Z. Cheng**, and L. Sun, “Bayesian inference for link travel time correlation of a bus route”, 2022. arXiv: [2202.09485](https://arxiv.org/abs/2202.09485).
- [3] X. Chen, **Z. Cheng**, N. Saunier, and L. Sun, “Laplacian convolutional representation for traffic time series imputation”, 2022. arXiv: [2212.01529](https://arxiv.org/abs/2212.01529).
- [4] Y. Wu, **Z. Cheng**, and L. Sun, “Individual mobility prediction via attentive marked temporal point processes”, 2021. arXiv: [2109.02715](https://arxiv.org/abs/2109.02715).

CONFERENCES

- [1] X. Chen, **Z. Cheng**, A. M. Schmidt, and L. Sun, “Probabilistic forecasting of bus travel time and passenger occupancy with bayesian time-dependent continuous density hidden markov model”, in *Transportation Research Board 103th Annual Meeting*, Washington, D.C., 2024.
- [2] X. Chen, **Z. Cheng**, C. Zhang, L. Sun, and S. Nicolas, “Memory-efficient hankel tensor factorization for extreme missing traffic data imputation”, in *Transportation Research Board 103th Annual Meeting*, Washington, D.C., 2024.
- [3] F. Wu, **Z. Cheng**, H. Chen, T. Z. Qiu, and L. Sun, “Traffic state estimation with anisotropic gaussian processes from vehicle trajectories”, in *Transportation Research Board 103th Annual Meeting*, Washington, D.C., 2024.
- [4] H. Cai, F. Wu, **Z. Cheng**, B. Li, and J. Wang, “A large-scale empirical study on impacting factors of taxi charging station utilization using random forest and shapley value method”, in *Transportation Research Board 102th Annual Meeting*, Washington, D.C., 2023.
- [5] **Z. Cheng**, X. Wang, X. Chen, M. Trépanier, and L. Sun, “Bayesian calibration of traffic flow fundamental diagrams using gaussian processes”, in *Transportation Research Board 102th Annual Meeting*, Washington, D.C., 2023.
- [6] X. Chen, **Z. Cheng**, and L. Sun, “Bayesian inference for link travel time correlation of a bus route”, in *Conference on Advanced Systems in Public Transport (CASPT) and TransitData 2022*, Tel Aviv, 2022.
- [7] **Z. Cheng**, M. Trépanier, and L. Sun, “Real-time forecasting of metro origin-destination matrices with high-order weighted dynamic mode decomposition”, in *Conference on Advanced Systems in Public Transport (CASPT) and TransitData 2022*, Tel Aviv, 2022.
- [8] X. Wang, **Z. Cheng**, M. Trépanier, and L. Sun, “Modeling bike-sharing demand using a regression model with spatially varying coefficients”, in *Transportation Research Board 100th Annual Meeting*, Washington, D.C. (virtual), 2021.
- [9] **Z. Cheng**, H. Alizadeh, M. Nazem, M. Trépanier, and L. Sun, “Long-term ridership forecast using heuristic, SARIMA and random forest methods”, in *TransitData 2020*, Toronto (virtual), 2020.
- [10] **Z. Cheng**, M. Trépanier, and L. Sun, “Integrating travel behavior regularity into passenger flow prediction”, in *TransitData 2020*, Toronto (virtual), 2020.

- [11] **Z. Cheng**, M. Trépanier, and L. Sun, “Inferring trip destinations in transit smart card data using a probabilistic topic model”, in *TransitData 2019*, Paris, 2019.
- [12] Z. Zhuang, **Z. Cheng**, J. Yao, J. Wang, and S. An, “Bus travel time reliability incorporating in-stop waiting time and in-vehicle travel time with AVL data”, in *Transportation Research Board 98th Annual Meeting*, Washington, D.C., 2019.
- [13] J. Yao, **Z. Cheng**, S. An, and A. Chen, “Analysis of a multiplicative hybrid route choice model in stochastic assignment paradox”, in *Transportation Research Board 97th Annual Meeting*, Washington, D.C., 2018.
- [14] J. Yao, J. Dai, A. Chen, **Z. Cheng**, and S. An, “Traffic assignment paradox incorporating congestion and stochastic perceived error simultaneously”, in *Transportation Research Board 97th Annual Meeting*, Washington, D.C., 2018.

PROJECTS AND GRANTS

- Probabilistic Forecasting of Train Ticket Booking Demand with Hierarchical Correlations Aug 2022–Current
 - NSERC Alliance project with Mitacs and [ExPretio Inc.](#) CAD 240,000
 - Role: Grant Writer & Investigator
- Enhancing Transit Service by Intelligent Trip Inference and Recommendation System Nov 2021–Aug 2022
 - NSERC Alliance project with [Transit.app](#) CAD 30,000
 - Role: Grant Writer & Investigator
- Spatiotemporal Travel Behavior Modeling and Analysis for Better Public Transport Systems 2019–2022
 - Mitacs Accelerate project with [exo](#) CAD 160,000
 - Role: Grant Writer & Fellow
- Research on Spatiotemporal Characteristics of Travel Route Selection Based on Big Data 2018–2019
 - GAIA collaborative research funds for young scholars with [DiDi Global Inc.](#) RMB 150,000
 - Role: Grant Writer & Fellow
- Research on the Characteristics of Traffic Paradox in Random Route Choice Model 2016–2018
 - National Natural Science Foundation of China RMB 207,200
 - Role: Fellow

INVITED TALKS

- [1] “Deep probabilistic forecasting of zero-inflated count data”, ExPretio, Montreal, Canada, Oct. 31, 2023.
- [2] “The regularity, predictability, and travel behavior in urban transit mobility”, University of Toronto Institute of Transportation Engineers (UT-ITE) Student Chapter, Toronto, Canada, Oct. 27, 2023.
- [3] “Real-time forecasting of metro origin-destination matrices with high-order weighted dynamic mode decomposition”, ExPretio, Montreal, Canada, Dec. 15, 2022.
- [4] “Travel-behavior-based inference and forecasting methods in metro systems”, School of Economics and Management, Dalian University of Technology, Dalian, China (virtual), Nov. 26, 2022.
- [5] “Probabilistic model for destination inference and travel pattern mining from smart card data”, Zooming in on collaborative digital intelligence, Montreal, Canada (virtual), Apr. 21, 2021. [Online]. Available: https://youtu.be/xLuYrb_mmdM.

PROFESSIONAL SERVICE

Journal Reviewer

- Reviewer of Transportation Research Part C: Emerging Technologies
- Reviewer of IEEE Transactions on Intelligent Transportation Systems
- Reviewer of Journal of Advanced Transportation
- Reviewer of Public Transport
- Reviewer of Transport Policy
- Reviewer of Sustainability

Conference Reviewer

- IEEE International Conference on Intelligent Transportation Systems (ITSC), 2020, 2021, 2022
- Reviewer of Transportation Research Board (TRB) Annual Meeting, 2020-2024
- Reviewer of Association for the Advancement of Artificial Intelligence (AAAI), 2022, 2024
- COTA International Conference of Transportation Professionals, 2021, 2022, 2023

Member

- Member of IEEE, 2022–Current
- Student member of Chinese Overseas Transportation Association (COTA) 2020–2022
- Student member of Interuniversity Research Centre on Enterprise Networks, Logistics and Transportation (CIRRELT), 2019–Current
- Friend member of TRB Standing Committee on Urban Transportation Data and Information Systems (AED20), 2021–Current
- Friend member of TRB Standing Committee on Public Transport Planning and Development (AP025), 2021–Current
- Student member of McGill Sustainability Systems Initiative (MSSI), 2021–2022

REFERENCES

- Prof. Lijun Sun, McGill University, lijun.sun@mcgill.ca
- Prof. Martin Trépanier, Polytechnique Montréal, mtrepanier@polymtl.ca
- Prof. Jia Yao, Dalian University of Technology, yaojia@dlut.edu.cn