Xinyu Chen (Ph.D.)

Last update on June 18, 2025

Current Research Interests

- ❒ Machine Learning & Data Science
- ❒ Data Standardization & Valorization
- ❒ Transportation & Human Mobility Networks
- ❒ Spatiotemporal Data Computing
- ❒ Optimization & Decision Making
- ❒ Intelligent & Sustainable Urban Systems

Contact Information

chenxy346@gmail.com (primary) or xinychen@mit.edu (official)

https://xinychen.github.io (primary)

https://sites.mit.edu/xinychen (official)

https://github.com/xinychen

Google Scholar 1,621 citations (h-index: 14 & i10-index: 15)

Experience

Postdoctoral Associate 2024.04 – now
***Massachusetts Institute of Technology* (MIT)** Cambridge, USA

- Tensor decomposition for machine learning problems in urban systems (e.g., mobility networks, passenger flow) and climate systems.
- Mathematical programming and interpretable machine learning for periodicity quantification of urban mobility and climate time series data.
- Machine learning and causal inference from spatiotemporal system data. (Part of the Mens, Manus, and Machina (M3S) project and the US Department of Energy (DOE) project)
- Advisor: Jinhua Zhao (Full Professor at MIT)

Education

PhD in Civil Engineering (Transportation) 2023.12
Polytechnique Montreal (School of Engineering), ***University of Montreal*** Montreal, Canada

IVADO PhD Excellence Scholarship & CIRRELT PhD Excellence Scholarship

- Thesis: *Matrix and Tensor Models for Spatiotemporal Traffic Data Imputation and Forecasting*
- Advisor: Nicolas Saunier (Full Professor at Polytechnique Montreal)

Master's degree in Traffic Information Engineering & Control 2019.06
Sun Yat-Sen University Guangzhou, China

- Thesis: *Imputing Spatiotemporal Missing Traffic Data by Bayesian Tensor Factorization Models*

Bachelor's degree in Traffic Engineering 2016.06
Guangzhou University Guangzhou, China

- Thesis: *Modeling Vehicles' Time Headway with Log-Normal and Power-Law Distribution*

Honours and Awards

CIRRELT PhD Excellence Scholarship ($5,000) 2021.12
IVADO PhD Excellence Scholarship ($100,000 by Institute for Data Valorisation) 2020.04
National Scholarship (by Ministry of Education of China) 2018.11

Refereed Journal Papers

Google Scholar: https://scholar.google.com/citations?user=mCrW04wAAAAJ&hl

Publication metrics: 18 publications (13 first-author) with 1,600+ citations in total (1,300+ citations on first-author papers). These first-author papers have been published in top-tier Computer Science journals such as **IEEE TPAMI** (2 papers) and **IEEE TKDE** (3 papers); Management Science journals such as **IJOC** (on the UTD-24 list, 1 paper) and **TS** (1 paper); Transportation Engineering journals such as **TRC** (5 papers) and **IEEE TITS** (1 paper).

◆ **First-author papers** (6 papers cited above 100 times)

13. Xinyu Chen, Dingyi Zhuang, HanQin Cai, Shenhao Wang, Jinhua Zhao (2025). **Dynamic autoregressive tensor factorization for pattern discovery of spatiotemporal systems**. *IEEE Transactions on Pattern Analysis and Machine Intelligence*.

https://doi.org/10.1109/TPAMI.2025.3576719

12. Xinyu Chen, HanQin Cai, Fuqiang Liu, Jinhua Zhao (2025). **Correlating time series with interpretable convolutional kernels**. *IEEE Transactions on Knowledge and Data Engineering*. 37 (6): 3272–3283.

https://doi.org/10.1109/TKDE.2025.3550877

11. Xinyu Chen (✉), Chengyuan Zhang, Xi-Le Zhao, Nicolas Saunier, Lijun Sun (2025). **Forecasting sparse movement speed of urban road networks with nonstationary temporal matrix factorization**. *Transportation Science*.

https://pubsonline.informs.org/doi/abs/10.1287/trsc.2024.0629

10. Xinyu Chen, Xi-Le Zhao, Chun Cheng (2024). **Forecasting urban traffic states with sparse data using Hankel temporal matrix factorization**. *INFORMS Journal on Computing*.

https://doi.org/10.1287/ijoc.2022.0197

9. Xinyu Chen, Zhanhong Cheng, HanQin Cai, Nicolas Saunier, Lijun Sun (2024). **Laplacian convolutional representation for traffic time series imputation**. *IEEE Transactions on Knowledge and Data Engineering*. 36 (11): 6490–6502.

https://doi.org/10.1109/TKDE.2024.3419698

8. Xinyu Chen, Chengyuan Zhang, Xiaoxu Chen, Nicolas Saunier, Lijun Sun (2024). **Discovering dynamic patterns from spatiotemporal data with time-varying low-rank autoregression**. *IEEE Transactions on Knowledge and Data Engineering*. 36 (2): 504–517.

https://doi.org/10.1109/TKDE.2023.3294440

7. Xinyu Chen, Lijun Sun (2022). **Bayesian temporal factorization for multidimensional time series prediction**. *IEEE Transactions on Pattern Analysis and Machine Intelligence*. 44 (9): 4659–4673.

https://doi.org/10.1109/TPAMI.2021.3066551 200+ citations ESI highly cited paper

6. Xinyu Chen, Mengying Lei, Nicolas Saunier, Lijun Sun (2022). **Low-rank autoregressive tensor completion for spatiotemporal traffic data imputation**. *IEEE Transactions on Intelligent Transportation Systems*. 23 (8): 12301–12310.

https://doi.org/10.1109/TITS.2021.3113608 100+ citations

5. Xinyu Chen, Yixian Chen, Nicolas Saunier, Lijun Sun (2021). **Scalable low-rank tensor learning for spatiotemporal traffic data imputation**. *Transportation Research Part C: Emerging Technologies*. 129: 103226.

https://doi.org/10.1016/j.trc.2021.103226

4. Xinyu Chen, Jinming Yang, Lijun Sun (2020). **A nonconvex low-rank tensor completion model for spatiotemporal traffic data imputation**. *Transportation Research Part C: Emerging Technologies*. 117: 102673.

https://doi.org/10.1016/j.trc.2020.102673 100+ citations

3. Xinyu Chen, Zhaocheng He, Yixian Chen, Yuhuan Lu, Jiawei Wang (2019). **Missing traffic data imputation and pattern discovery with a Bayesian augmented tensor factorization model**. *Transportation Research Part C: Emerging Technologies*. 104: 66–77.

https://doi.org/10.1016/j.trc.2019.03.003 100+ citations

2. Xinyu Chen, Zhaocheng He, Lijun Sun (2019). **A Bayesian tensor decomposition approach for spatiotemporal traffic data imputation**. *Transportation Research Part C: Emerging Technologies*. 98: 73–84.

https://doi.org/10.1016/j.trc.2018.11.003 300+ citations ESI highly cited paper

1. Xinyu Chen, Zhaocheng He, Jiawei Wang (2018). **Spatial-temporal traffic speed patterns discovery and incomplete data recovery via SVD-combined tensor decomposition**. *Transportation Research Part C: Emerging Technologies*. 86: 59–77.

https://doi.org/10.1016/j.trc.2017.10.023 100+ citations

◆ **Co-authored papers**

5. Sheng Liu, Xi-Le Zhao, Jinsong Leng, Ben-Zheng Li, Jing-Hua Yang, Xinyu Chen (2024). **Revisiting high-order tensor singular value decomposition from basic element perspective**. *IEEE Transactions on Signal Processing*. 72: 4589–4603.

https://doi.org/10.1109/TSP.2024.3454115

4. Ben-Zheng Li, Xi-Le Zhao, Xiongjun Zhang, Teng-Yu Ji, Xinyu Chen, Michael K. Ng (2023). **A learnable group-tube transform induced tensor nuclear norm and its application for tensor completion**. *SIAM Journal on Imaging Sciences*. 16 (3): 1370–1397.

http://dx.doi.org/10.1137/22M1531907

3. Lijun Sun, Xinyu Chen, Zhaocheng He, Luis F. Miranda-Moreno (2021). **Routine pattern discovery and anomaly detection in individual travel behavior**. *Networks and Spatial Economics*. 35.

http://dx.doi.org/10.1007/s11067-021-09542-9

2. Pu Ren, Xinyu Chen, Lijun Sun, Hao Sun (2021). **Incremental Bayesian matrix/tensor learning for structural monitoring data imputation and response forecasting**. *Mechanical System and Signal Processing*. 158: 107734. https://doi.org/10.1016/j.ymssp.2021.107734

1. Zhaocheng He, Kaiying Chen, Xinyu Chen (2018). **A collaborative method for route discovery using taxi drivers' experience and preferences**. *IEEE Transactions on Intelligent Transportation Systems*. 19 (8): 2505–2514. http://doi.org/10.1109/TITS.2017.2753468

Conference Papers

TRB 2024: Xinyu Chen, Zhanhong Cheng, Chengyuan Zhang, Lijun Sun, Nicolas Saunier (2023). **Memory-efficient Hankel tensor factorization for extreme missing traffic data imputation** (presentation only). *The 103rd Annual Meeting of Transportation Research Board*.

WCTR 2023: Xinyu Chen, Zhanhong Cheng, Nicolas Saunier, Lijun Sun (2023). **Laplacian convolutional representation for traffic time series imputation** (presentation only). *Proceedings of the World Conference of Transport Research*.

TRB 2023: Xinyu Chen, Chengyuan Zhang, Lijun Sun, Nicolas Saunier (2023). **Nonstationary temporal matrix factorization for sparse traffic time series forecasting** (presentation only). *The 102nd Annual Meeting of Transportation Research Board*.

KDD Time Series Workshop: Xinyu Chen, Mengying Lei, Nicolas Saunier, Lijun Sun (2021). **Low-rank autoregressive tensor completion for spatiotemporal traffic data imputation** (presentation only). *The 7th SIGKDD Workshop on Mining and Learning from Time Series (MiLeTS)*.

Submitted Papers

1. Xinyu Chen, Vassilis Digalakis Jr, Lijun Ding, Dingyi Zhuang, Jinhua Zhao (2025). **Interpretable time series autoregression for periodicity quantification**.

   IEEE Transactions on Pattern Analysis and Machine Intelligence — Submitted

Academic Funding

1. **City-scale traffic data imputation and forecasting with tensor learning**
   - **Authors**: Xinyu Chen, Nicolas Saunier (advisor)
   - **Link**: https://ivado.ca/en/scholarships-and-grants/phd-excellence-scholarships/

   IVADO PhD Excellence Scholarship — $100,000 — September 1, 2020

Seminar Services

Experiences for organizing research seminar/meeting/workshop/conference.

- Role: **Co-chair**. Invited Session at 2025 INFORMS Annual Meeting, Atlanta, USA [October 26, 2025 (incoming event)]
  - Title: Recent advances in tensor decomposition and completion algorithms and their applications
  - Session chairs: Dr. Mehrdad Ghadiri, Dr. Xinyu Chen
- Role: **Host**. Invited Session at 2024 INFORMS Annual Meeting, Seattle, USA [October 21, 2024]
  - Title: Simulation and learning from smart transportation systems
  - Session chairs: Prof. Li Jin, Prof. Shenhao Wang
- Role: **Host**. Senior Researcher Seminar at MIT Urban Mobility Lab, Cambridge, USA
  - Every Wednesday morning from September 18 to December 11, 2024
  - Guest speakers: Prof. Vassilis Digalakis Jr. (Assistant Professor at HEC Paris), Prof. Qiusheng Wu (Associate Professor at the University of Tennessee, Knoxville), Prof. Filipe Rodrigues (Associate Professor at the Technical University of Denmark), Dr. Konstantin Rusch (Postdoc at MIT CSAIL Lab), and Dr. Mehrdad Ghadiri (Postdoc at MIT Sloan School of Management)
- Role: **Host**. JTL Research Seminar at MIT Urban Mobility Lab, Cambridge, USA
  - Every Thursday morning from February 6 to July 10, 2025
  - Guest speakers: Dr. Jiacheng Zhu (Postdoc at MIT CSAIL Lab), Chengyuan Zhang (PhD candidate at McGill), Prof. Xiaowen Dong (Associate Professor at Oxford University), Prof. Ryan Qi Wang (Associate Professor at Northeastern University), Nick Zolman (PhD Candidate at the University of Washington), Dr. Frederike Dümbgen (Researcher at Inria Paris), Prof. Jakob Runge (Full Professor at the Technical University of Dresden)
  - Seminar website: https://sites.mit.edu/jtl-seminar/

Reviewing Activities I am serving as a reviewer for several scientific journals.

- **Computing**: Applied Mathematical Modeling; IEEE Open Journal of Signal Processing; IEEE Transactions on Image Processing (TIP); IEEE Transactions on Knowledge and Data Engineering (TKDE); Signal Processing.
- **Engineering**: Accident Analysis and Prevention; Expert Systems with Applications; IEEE Intelligent Transportation Systems Magazines; IEEE Transactions on Intelligent Transportation Systems; Mechanical System and Signal Processing; Transportation Research Part B: Methodological; Transportation Research Part C: Emerging Technologies; Transportation Research Part E: Logistics and Transportation Review.
- **Management Science**: INFORMS Journal on Computing (IJOC); Service Science; Transportation Science
- **Social Science**: Cities

Professional Memberships

❒ Interuniversity Research Centre on Enterprise Networks, Logistics and Transportation (**CIRRELT**) — **Student Member** — 2021 – 2023

❒ Institute of Electrical and Electronics Engineers (**IEEE**) — **Student Member** — 2022 – 2023

Open-Source Projects I am a strong advocate of open science and leading some innovative projects on GitHub (**5,000+** stars & **600+** followers).

◆ **Selected repositories**

transdim: Python codes for spatiotemporal data imputation and prediction using a variety of state-of-the-art machine learning (mainly including low-rank matrix and tensor methods) and deep learning. 2018.09 - present

`xinychen/transdim` ☆ 1,300+ stars

awesome-LaTeX-drawing: Drawing Bayesian networks, graphical models, tensor structures, and technical frameworks in LaTeX. 2019.06 - present

`xinychen/awesome-latex-drawing` ☆ 1,700+ stars

LaTeX-cookbook: Academic writing with LaTeX: A tutorial (in Chinese). Published in *Tsinghua University Press*. 2021.05 - present

`xinychen/latex-cookbook` ☆ 1,400+ stars

Tensor4ML: Tensor decomposition for machine learning with Python implementation. 2019.06 - present

`xinychen/Tensor4ML` ☆ 200+ stars

tracebase: Multivariate time series forecasting on high-dimensional and sparse Uber movement speed data. 2020.11 - present

`xinychen/tracebase` ☆ 50+ stars

Spatiotemporal data modeling: This project aims at supporting research for all aspects of spatiotemporal data modeling with machine learning and addressing many scientific, mathematical, industrial, and engineering problems in urban systems, optimization & decision-making, signal processing, and network science. 2023.11 - present

`https://spatiotemporal-data.github.io` (4,000+ visitors)

Presentation & Talk

❒ Machine learning and optimization for understanding spatiotemporal systems. 2025.05
- Artificial Intelligence (AI) Initiative, University of Central Florida (UCF), Orlando, USA

❒ Machine learning and optimization for data-driven transportation analytics and beyond. 2025.02
- Department of Industrial & Systems Engineering (ISE), University of Tennessee, Knoxville (UTK), Knoxville, USA

❒ Machine learning and optimization for data-driven transportation analytics. 2024.12
- School of Management, Technical University of Munich (TUM), Heilbronn, Germany
- Machine Learning for Smart Mobility (MLSM) Group, Technical University of Denmark (DTU), Denmark

❒ Modeling urban traffic data with matrix and tensor approaches. 2024.10
- 2024 INFORMS Annual Meeting (INFORMS 2024), Seattle, USA
- Slides: `https://xinychen.github.io/slides/informs24.pdf`

❒ Laplacian convolutional representation for traffic data imputation. 2024.07
- Dalian University of Technology (DUT), Dalian, China
- Slides: https://xinychen.github.io/slides/LCR24.pdf

❒ Modeling temporal correlations and dynamics in spatiotemporal data systems. 2024.05
- Northeastern University (NEU), Boston, USA
- Slides: https://xinychen.github.io/slides/temporal_modeling.pdf

❒ Matrix and tensor models for spatiotemporal traffic data imputation and forecasting. 2023.12
- PhD Research Defense, Montreal, Canada
- Slides: https://xinychen.github.io/slides/defense.pdf

❒ Laplacian convolutional representation for traffic data imputation. 2023.07
- World Conference of Transport Research (WCTR 2023), Montreal, Canada
- Slides: https://xinychen.github.io/slides/LCR.pdf

❒ Low-rank matrix and tensor methods for spatiotemporal traffic data modeling. 2023.05
- Southern University of Science and Technology (SUSTech), Shenzhen, China
- Slides: https://xinychen.github.io/slides/traffic_data_modeling_v1.pdf

❒ Low-rank matrix and tensor methods for spatiotemporal traffic data modeling. 2023.05
- MIT JTL Urban Mobility Lab, Massachusetts Institute of Technology, USA
- Slides: https://xinychen.github.io/slides/traffic_data_modeling.pdf

❒ Low-rank matrix and tensor methods for spatiotemporal data modeling. 2023.04
- Sichuan University (SCU), Chengdu, China
- University of Electronic Science and Technology of China (UESTC), Chengdu, China
- Slides: https://xinychen.github.io/slides/stdata_modeling.pdf

❒ Low-rank matrix and tensor factorization for speed field reconstruction. 2023.03
- Research Group of Transport, Polytechnique Montreal, Montreal, Canada
- Slides: https://xinychen.github.io/slides/MF_TF_SFR.pdf

❒ Spatiotemporal traffic data imputation and forecasting with tensor learning. 2022.05
- IVADO Project Workshop, Montreal, Canada
- Slides: https://xinychen.github.io/slides/phd_project_22summer.pdf

❒ Nonstationary temporal matrix factorization for multivariate time series forecasting. 2022.05
- Hong Kong Machine Learning Meetup
- Slides: https://xinychen.github.io/slides/notmf.pdf

❒ Bayesian temporal factorization for multidimensional time series prediction. 2021.03
- IFT 6760A Course (*Matrix and tensor factorization techniques for machine learning*)
- University of Montreal, Montreal, Canada
- Slides: https://doi.org/10.5281/zenodo.4693404

Supervision

- **PhD student**: Nina Cao (2025.03 –, Mechanical Engineering at MIT)
- **Master student**: Donghang Li (2024.09 –, MIT)

Skills

❒ **Language**: Chinese (native) & English (fluent)

❒ **Expertise**: Python/Matlab/Julia/R/Java; NumPy/PyTorch/CuPy; Jupyter Notebook; LaTeX; CSS/HTML.