





CURRENT  
RESEARCH  
INTERESTS



- ☐ Machine Learning
- ☐ AI for Science
- ☐ Matrix/Tensor Computations
- ☐ Data Science
- ☐ Signal Processing
- ☐ Spatiotemporal Data Modeling
- ☐ Transport & Smart Cities
- ☐ Urban Human Mobility
- ☐ Optimization & Decision Making


CONTACT  [chenxy346@gmail.com](mailto:chenxy346@gmail.com) (primary) or [xinyuchen@mit.edu](mailto:xinyuchen@mit.edu) (official)


INFORMATION  <https://xinyuchen.github.io> (homepage)

 <https://sites.mit.edu/xinyuchen> (MIT sites)

 [xinyuchen](#)


 Google Scholar  1,304 citations (h-index: 13 & i10-index: 13)

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). Project website: <https://sites.mit.edu/tensor4ml>
- Interpretable machine learning in computational social science 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's Department of Urban Studies and Planning)


EDUCATION  **PhD in Civil Engineering (Transportation)** 2020.08 – 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)
- Co-advisor: Lijun Sun (associate professor at McGill University)

 **Master's degree in Traffic Information Engineering & Control** 2016.08 – 2019.06

 *Sun Yat-Sen University* Guangzhou, China


 *Outstanding Thesis Award (top 2% in total)*


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


 **Bachelor's degree in Traffic Engineering** 2012.09 – 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>















◆ First-author papers (6 papers cited above 100 times & 2 papers cited above 200 times)

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
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
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

6. 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*. Early Access.  
 <https://doi.org/10.1109/TSP.2024.3454115>
5. Ben-Zheng Li, Xi-Le Zhao, Xinyu Chen, Meng Ding, Ryan Wen Liu (2024). **Convolutional low-rank tensor representation for structural missing traffic data imputation.** *IEEE Transactions on Intelligent Transportation Systems*. Early Access.  
 <https://doi.org/10.1109/TITS.2024.3430039>
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**
3. Xinyu Chen, Dingyi Zhuang, HanQin Cai, Shenhao Wang, Jinhua Zhao (2024). **Dynamic autoregressive tensor factorization for pattern discovery of spatiotemporal systems**.  
 *IEEE Transactions on Pattern Analysis and Machine Intelligence*     under review (1st round)
  2. Xinyu Chen, HanQin Cai, Fuqiang Liu, Jinhua Zhao (2024). **Correlating time series with interpretable convolutional kernels**. arXiv:2409.01362.  
 *IEEE Transactions on Knowledge and Data Engineering*     under review (1st round)
  1. Xinyu Chen, Chengyuan Zhang, Xi-Le Zhao, Nicolas Saunier, Lijun Sun (2024). **Forecasting sparse movement speed of urban road networks with nonstationary temporal matrix factorization**.  
 *Transportation Science*     under review (2nd round)

**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/MEETING SERVICES**

I am serving as a host for some seminars, meetings, and conferences.

- Invited Session at 2024 INFORMS Annual Meeting, Seattle, USA
  - Title: Simulation and learning from smart transportation systems, October 21, 2024
  - Session chair: Prof. Li Jin, Prof. Shenhao Wang

- Senior Researcher Breakfast (SRB) Seminar of MIT Urban Mobility Lab, Cambridge, USA
  - Every Wednesday morning from September 18 to December 11, 2024
  - Guest speakers: Prof. Vassilis Digalakis Jr. (HEC Paris), Prof. Qiusheng Wu (University of Tennessee, Knoxville)

#### REVIEWING ACTIVITIES

I am serving as a reviewer for some scientific journals.

- Accident Analysis and Prevention
- Applied Mathematical Modeling
- Cities
- Expert Systems with Applications
- IEEE Intelligent Transportation Systems Magazines
- IEEE Open Journal of Signal Processing
- IEEE Transactions on Intelligent Transportation Systems
- IEEE Transactions on Knowledge and Data Engineering
- INFORMS Journal on Computing
- Mechanical System and Signal Processing
- Scientific Reports
- Signal Processing
- Transportation Research Part B: Methodological
- Transportation Research Part C: Emerging Technologies
- Transportation Research Part E: Logistics and Transportation Review
- Transportation Science
















#### PROFES- SIONAL MEMBER- SHIPS

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|--|-----------------------|-------------|
| <input type="checkbox"/> Interuniversity Research Centre on Enterprise Networks, Logistics and Transportation ( <b>CIRRELT</b> ) | <b>Student Member</b> | 2021 – 2023 |
| <input type="checkbox"/> Institute of Electrical and Electronics Engineers ( <b>IEEE</b> )                                       | <b>Student Member</b> | 2022 – 2023 |

#### OPEN- SOURCE PROJECTS

I am a strong advocate of open science and leading some innovative projects on GitHub (**4.6k+** stars & **500+** followers).

##### ◆ Selected repositories

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|--|-------------------|
|  <b>transdim</b> : 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 |
|  <a href="#">xinychen/transdim</a>  <b>1.2k+ stars</b>   |                   |
|  <b>awesome-Latex-drawing</b> : Drawing Bayesian networks, graphical models, tensor structures, and technical frameworks in LaTeX.  | 2019.06 - present |
|  <a href="#">xinychen/awesome-latex-drawing</a>  <b>1.2k+ stars</b>  |                   |
|  <b>LaTeX-cookbook</b> : Academic writing with LaTeX: A tutorial (in Chinese). Published in <i>Tsinghua University Press</i> .  | 2021.05 - present |
|  <a href="#">xinychen/latex-cookbook</a>  <b>1.3k+ stars</b>   |                   |
|  <b>Tensor4ML</b> : Tensor decomposition for machine learning with Python implementation.   | 2019.06 - present |
|  <a href="#">xinychen/Tensor4ML</a>  <b>200+ stars</b>   |                   |
|  <b>tracebase</b> : Multivariate time series forecasting on high-dimensional and sparse Uber movement speed data.   | 2020.11 - present |
|  <a href="#">xinychen/tracebase</a>  <b>40+ stars</b>  |                   |

- 📍 **spatiotemporal-data:** 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> (1.6k+ visitors)

## PRESENTATION & TALK

- ❑ 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
- ❑ 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](https://xinychen.github.io/slides/traffic_data_modeling_v1.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](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](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](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 (virtual)
  - 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>

## SKILLS

- ❑ **Language:** Chinese (native) & English (fluent)
- ❑ **Expertise:** Python/Matlab/Julia/R/Java; NumPy/PyTorch/CuPy; Jupyter Notebook; LaTeX; CSS/HTML.