

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 (primary) or xinyuchen@mit.edu (official)

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

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

🌐 <https://github.com/xinyuchen>

🔍 Google Scholar 📄 1,360 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

- 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>

Publication metrics: 16 publications (10 first-author) with 1,300+ citations in total (1,200+ citations on first-author papers). These first-author papers have been published in top-tier Computer Science journals such as **IEEE TPAMI** (1 paper) and **IEEE TKDE** (2 papers); Management Science journal **IJOC** (1 paper); Transportation Science/Engineering journals such as **TR-C** (5 papers) and **IEEE TITS** (1 paper).

◆ **First-author papers** (6 papers cited above 100 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.
doi <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.
doi <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.
doi <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.
doi <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.
doi <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.
doi <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.
doi <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.
doi <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.
doi <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*. 72: 4589–4603.
doi <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*. 25 (11): 18847–18860.
doi <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	Experiences for organizing research seminar/meeting/workshop/conference. <ul style="list-style-type: none"> • Role: Host. Invited Session at 2024 INFORMS Annual Meeting, Seattle, USA <ul style="list-style-type: none"> ◦ Title: Simulation and learning from smart transportation systems, October 21, 2024 ◦ Session chairs: Prof. Li Jin, Prof. Shenhao Wang • Role: Host. Senior Researcher Seminar of MIT Urban Mobility Lab, Cambridge, USA <ul style="list-style-type: none"> ◦ 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), Prof. Filipe Rodrigues (Technical University of Denmark), Dr. Konstantin Rusch (Postdoc at MIT CSAIL Lab)
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REVIEWING ACTIVITIES	I am serving as a reviewer for some scientific journals. <ul style="list-style-type: none"> • 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
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PROFESSIONAL MEMBERSHIPS	<input type="checkbox"/> Interuniversity Research Centre on Enterprise Networks, Logistics and Transportation (CIRRELT)	Student Member	2021 – 2023
	<input type="checkbox"/> 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 (4.7k+ stars & 500+ followers). <ul style="list-style-type: none"> ◆ Selected repositories <ul style="list-style-type: none"> 📄 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 ⭐ 1.2k stars 📄 awesome-Latex-drawing: Drawing Bayesian networks, graphical models, tensor structures, and technical frameworks in LaTeX. 2019.06 - present 🔗 xinychen/awesome-latex-drawing ⭐ 1.3k stars 📄 LaTeX-cookbook: Academic writing with LaTeX: A tutorial (in Chinese). Published in <i>Tsinghua University Press</i>. 2021.05 - present 🔗 xinychen/latex-cookbook ⭐ 1.4k stars
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-  **Tensor4ML**: Tensor decomposition for machine learning with Python implementation. 2019.06 - present
 [xinychen/Tensor4ML](https://github.com/xinychen/Tensor4ML)  200+ stars
-  **tracebase**: Multivariate time series forecasting on high-dimensional and sparse Uber movement speed data. 2020.11 - present
 [xinychen/tracebase](https://github.com/xinychen/tracebase)  40+ stars
-  **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> (1.9k+ visitors)

**PRESENTATION
& TALK**

- ☐ Machine learning and optimization for data-driven transportation analytics. 2024.12
 - Technical University of Munich (TUM), Heilbronn, Germany
- ☐ 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
- ☐ 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 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 (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>

SUPERVISION

- **PhD student:** Yuhan Tang (MIT)
- **Master student:** Donghang Li (MIT)
- **Undergraduate student:** Jinming Yang (SYSU)

SKILLS

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