Xinyu Chen (PhD Candidate)

Last update on August 8, 2023

Current Research Interests

- ❒ Machine Learning
- ❒ Matrix/Tensor Computations
- ❒ Low-Rank Models
- ❒ Spatiotemporal Data Modeling
- ❒ Missing Data Imputation
- ❒ Time Series Analysis
- ❒ Intelligent Transportation
- ❒ Smart Cities
- ❒ Human Mobility

Contact Information

chenxy346@gmail.com
https://xinychen.github.io (homepage)
xinychen
chenxy346
Google Scholar 813 citations (h-index: 10 & i10-index: 10)

Biography

In Summer 2023, I will finish my PhD from University of Montreal (UdeM), with support from the IVADO PhD Excellence Scholarship and the CIRRELT PhD Excellence Scholarship. My PhD research focuses on machine learning, spatiotemporal data modeling, and intelligent transportation systems.

Education

PhD in Civil Engineering (Transportation) 2020.08 - 2023.09 (expected)
Polytechnique Montreal, ***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*
- Advisor: Zhaocheng He (full professor)

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*
- Advisor: Xiaodong Zang (full professor)

Honours and Awards

- *CIRRELT PhD Excellence Scholarship* ($5,000) 2021.12
- *IVADO PhD Excellence Scholarship* ($100,000, by Institute for Data Valorisation) 2020.04
- *Outstanding Thesis Award* (by Sun Yat-Sen University) 2019.06
- *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** (3 papers cited above 100 times)

8. Xinyu Chen, Chengyuan Zhang, Xiaoxu Chen, Nicolas Saunier, Lijun Sun (2023). **Discovering dynamic patterns from spatiotemporal data with time-varying low-rank autoregression**. *IEEE Transactions on Knowledge and Data Engineering*. Early access.

   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
   IF: 23.6 top-tier 100+ citations
   ESI hot paper (top 0.1%) ESI highly cited paper (top 1%)

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
ESI hot paper (top 0.1%)

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

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

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
200+ citations ESI highly cited paper (top 1%)

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-author papers**

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

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)*.

Preprint and Submitted Papers

4. Xinyu Chen, Zhanhong Cheng, Chengyuan Zhang, Lijun Sun, Nicolas Saunier (2023). **Memory-efficient Hankel tensor factorization for extreme missing traffic data imputation**.
   IEEE Transactions on Signal Processing under review (1st round)

3. Xinyu Chen, Zhanhong Cheng, Nicolas Saunier, Lijun Sun (2022). **Laplacian convolutional representation for traffic time series imputation**. arXiv: 2212.01529.
   IEEE Transactions on Signal Processing under review (1st round)

2. Xinyu Chen, Chengyuan Zhang, Xi-Le Zhao, Nicolas Saunier, Lijun Sun (2022). **Nonstationary temporal matrix factorization for multivariate time series forecasting**. arXiv: 2203.10651.
   Transportation Research Part C: Emerging Technologies under review (2nd round)

1. Xinyu Chen, Lijun Sun (2020). **Low-rank autoregressive tensor completion for multivariate time series forecasting**. arXiv: 2006.10436.

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

Reviewing Activities

I am serving as a reviewer for **10+** scientific journals.

- Applied Intelligence
- Big Data Research
- Expert Systems with Applications
- IEEE Intelligent Transportation Systems Magazines
- IEEE Open Journal of Signal Processing
- IEEE Sensors Journal
- IEEE Transactions on Intelligent Transportation Systems
- IEEE Transactions on Knowledge and Data Engineering
- INFORMS Journal on Computing
- Scientific Reports
- Transportmetrica B: Transport Dynamics
- Transportation Research Part B: Methodological
- Transportation Research Part C: Emerging Technologies

Professional Memberships

❒ Interuniversity Research Centre on Enterprise Networks, Logistics and Transportation (**CIRRELT**)	**Student Member**	2021 - present
❒ Institute of Electrical and Electronics Engineers (**IEEE**)	**Student Member**	2022 - present

Open-Source Projects

I am leading some innovative projects on GitHub (**3.3k+** stars & **600+** forks & **450+** 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 models. 2018.09 - present
  `xinychen/transdim` ☆ 1k+ stars
- **awesome-LaTeX-drawing**: Drawing Bayesian networks, graphical models, tensor structures, and technical frameworks in LaTeX. (Most examples are from our research papers.) 2019.06 - present
  `xinychen/awesome-latex-drawing` ☆ 1k+ stars
- **LaTeX-cookbook**: Academic writing with LaTeX: A tutorial (in Chinese). 2021.05 - present
  `xinychen/latex-cookbook` ☆ 700+ stars
- **awesome-beamer**: Creating presentation slides by using Beamer in LaTeX. (Most examples are from our research.) 2020.11 - present
  `xinychen/awesome-beamer` ☆ 60+ stars
- **tracebase**: Multivariate time series forecasting on high-dimensional and sparse Uber movement speed data. 2020.11 - present
  `xinychen/tracebase` ☆ 30+ stars
- **geotensor**: Geometric low-rank tensor completion for color image inpainting. 2019.10 - 2022.01
  `xinychen/geotensor` ☆ 30+ stars

Presentation & Talk

❒ 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)
- 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*)
- Slides: https://doi.org/10.5281/zenodo.4693404

Blog Posts I enjoy writing some blog posts about my research (**30+** posts & **75k+** views & **330+** followers on Medium). https://medium.com/@xinyu.chen

◆ **Selected posts**

5.	Temporal matrix factorization for multivariate time series forecasting.	5k+ views	2022.03.20
4.	Reduced-rank vector autoregressive model for high-dimensional time series forecasting.	4k+ views	2021.10.16
3.	Dynamic mode decomposition for multivariate time series forecasting.	16k+ views	2021.10.10
2.	Matrix autoregressive model for multidimensional time series forecasting.	8k+ views	2021.10.03
1.	Intuitive understanding of randomized singular value decomposition.	10k+ views	2020.07.01

Skills

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

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

References Please reach out to request a reference letter.

Prof. Nicolas Saunier (advisor)

- Full Professor
- Département des génies civil, géologique et des mines (CGM)
- Polytechnique Montréal
- CIRRELT, RRSR, CIRODD & IVADO
- Homepage: http://n.saunier.free.fr/saunier/
- Email: nicolas.saunier@polymtl.ca

Prof. Lijun Sun (co-advisor)

- Associate Professor
- Department of Civil Engineering
- McGill University
- Homepage: https://lijunsun.github.io
- Email: lijun.sun@mcgill.ca

Prof. Xi-Le Zhao (collaborator)

- Full Professor
- School of Mathematical Science
- University of Electronic Science and Technology of China
- Homepage: https://zhaoxile.github.io
- Email: xlzhao122003@163.com