Yuankai Wu, Ph.D.

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Research Interests

1 Spatiotemporal data modeling,

2 Machine learning,

3 Intelligent decision-making & control.

Employment History

Mar. 2022 – · · · · **Research Professor (the same level as a full Professor), Sichuan University,** Department of Computer Science.

Dec. 2019 – Feb. 2022 **Postdoc Researcher, McGill University,** Department of Civil Engineering.
Advisors: *Prof. Lijun Sun & Aurelie labbe (HEC Montreal)*

Education

2015 – 2019 **Ph.D., Beijing Institute of Technology**, Vehicle Operation Engineering.
Thesis title: *A high dimensional traffic state processing method based on tensorial model.*
Advisor: *Prof. Hongwen He.*

2016 – 2017 **Visiting Ph.D., University of Wisconsin-Madison**, Department of Civil & Environmental Engineering.
Advisor: *Prof. Bin Ran.*

2012 – 2015 **Master., Beijing Institute of Technology**, Transportation Engineering.
Thesis title: *Short-term traffic prediction based on dynamic tensor completion.*
Advisor: *Prof. Huachun Tan.*

2008 – 2012 **Bachelor., Shanghai Ocean University**, Mechanical Engineering.

Selected Research Publications

1689 Google scholar citations; h-index 17; i10-index 24.
*: corresponding author.

Journal Articles

1. Lei, M., Labbe, A., **Wu, Yuankai**, & Sun, L. (2022). Bayesian kernelized matrix factorization for spatiotemporal traffic data imputation and kriging. *IEEE Transactions on Intelligent Transportation Systems*.

2. Dong, H., Ding, F., Tan, H., **Wu, Yuankai**, Li, Q., & Ran, B. (2021). Rail transit od-matrix completion via manifold regularized tensor factorisation. *IET Intelligent Transport Systems*.

3. Fan, C., Peng, Y., Peng, S., Zhang, H., **Wu, Yuankai**, & Kwong, S. (2021). Detection of train driver fatigue and distraction based on forehead eeg: A time-series ensemble learning method. *IEEE Transactions on Intelligent Transportation Systems*.

4. **Wu, Yuankai**, Teufel, B., Sushama, L., Belair, S., & Sun, L. (2021). Deep learning-based super-resolution climate simulator-emulator framework for urban heat studies. *Geophysical Research Letters*, *48*(19), e2021GL094737.

5. Li, Q., Tan, H., Jiang, Z., **Wu, Yuankai**, & Ye, L. (2020). Nonrecurrent traffic congestion detection with a coupled scalable bayesian robust tensor factorization model. *Neurocomputing*.

6. Li, Q., Tan, H., **Wu, Yuankai***, Ye, L., & Ding, F. (2020). Traffic flow prediction with missing data imputed by tensor completion methods. *IEEE Access*, *8*, 63188–63201.
7. Lian, R., Peng, J., **Wu, Yuankai***, Tan, H., & Zhang, H. (2020). Rule-interposing deep reinforcement learning based energy management strategy for power-split hybrid electric vehicle. *Energy*, 117297.
8. Lian, R., Tan, H., Jiankun, P., Li, Q., & **Wu, Yuankai***. (2020). Cross type transfer for deep reinforcement learning based hybrid electric vehicle energy management. *IEEE Transactions on Vehicular Technology*.
9. **Wu, Yuankai**, Tan, H., Qin, L., & Ran, B. (2020). Differential variable speed limits control for freeway recurrent bottlenecks via deep actor-critic algorithm. *Transportation Research Part C: Emerging Technologies*, *117*, 102649.
10. Wang, Y., Tan, H., **Wu, Yuankai***, & Peng, J. (2020). Hybrid electric vehicle energy management with computer vision and deep reinforcement learning. *IEEE Transactions on Industrial Informatics*.
11. Zhang, H., **Wu, Yuankai***, Tan, H., Dong, H., Ding, F., & Ran, B. (2020). Understanding and modeling urban mobility dynamics via disentangled representation learning. *IEEE Transactions on Intelligent Transportation Systems*.
12. Tan, H., Zhang, H., Peng, J., Jiang, Z., & **Wu, Yuankai**. (2019). Energy management of hybrid electric bus based on deep reinforcement learning in continuous state and action space. *Energy Conversion and Management*, *195*, 548–560.
13. **Wu, Yuankai**, Tan, H., Chen, X., & Ran, B. (2019). Memory, attention and prediction: A deep learning architecture for car-following. *Transportmetrica B: Transport Dynamics*, *7*(1), 1553–1571.
14. **Wu, Yuankai**, Tan, H., Peng, J., Zhang, H., & He, H. (2019). Deep reinforcement learning of energy management with continuous control strategy and traffic information for a series-parallel plug-in hybrid electric bus. *Applied Energy*, *247*, 454–466.
15. **Wu, Yuankai**, Tan, H., Li, Y., Zhang, J., & Chen, X. (2018). A fused cp factorization method for incomplete tensors. *IEEE transactions on neural networks and learning systems*, *30*(3), 751–764.
16. **Wu, Yuankai**, Tan, H., Qin, L., Ran, B., & Jiang, Z. (2018). A hybrid deep learning based traffic flow prediction method and its understanding. *Transportation Research Part C: Emerging Technologies*, *90*, 166–180 **(Most Cited Paper since 2018)**.
17. **Wu, Yuankai**, Tan, H., Li, Y., Li, F., & He, H. (2017). Robust tensor decomposition based on cauchy distribution and its applications. *Neurocomputing*, *223*, 107–117.
18. Ran, B., Tan, H., **Wu, Yuankai**, & Jin, P. J. (2016). Tensor based missing traffic data completion with spatial–temporal correlation. *Physica A: Statistical Mechanics and its Applications*, *446*, 54–63.
19. Tan, H., **Wu, Yuankai**, Shen, B., Jin, P. J., & Ran, B. (2016). Short-term traffic prediction based on dynamic tensor completion. *IEEE Transactions on Intelligent Transportation Systems*, *17*(8), 2123–2133.

Conference Proceedings

1. **Wu, Yuankai**, Zhuang, D., Labbe, A., & Sun, L. (2021). Inductive graph neural networks for spatiotemporal kriging, In *Proceedings of the aaai conference on artificial intelligence*.
2. Wang, Y., **Wu, Yuankai**, Peng, J., Tan, H., Zeng, D., & He, H. (2019). Vision-aided deep reinforcement learning for energy management of hybrid electric vehicles, In *Icae 2019, the 11th international conference on applied energy*.
3. Tan, H., **Wu, Yuankai**, Feng, J., Wang, W., & Ran, B. (2014). Traffic missing data completion with spatial-temporal correlations, In *93rd annual meeting of the transportation research board, washington, dc*.

Preprint Articles

1. **Wu, Yuankai**, Cheng, Z., & Sun, L. (2021). *Individual mobility prediction via attentive marked temporal point processes*.
2. **Wu, Yuankai**, Zhuang, D., Lei, M., Labbe, A., & Sun, L. (2021). *Spatial aggregation and temporal convolution networks for real-time kriging*.
3. **Wu, Yuankai**, Tan, H., Jiang, Z., & Ran, B. (2019). *Es-ctc: A deep neuroevolution model for cooperative intelligent freeway traffic control*.
4. **Wu, Yuankai**, & Tan, H. (2016). *Short-term traffic flow forecasting with spatial-temporal correlation in a hybrid deep learning framework*.

Patents

Patents

1. Ran, B., Cheng, Y., Li, S., Zhang, Z., Ding, F., Tan, H., **Wu, Yuankai**, Dong, S., Ye, L., Li, X. Et al. (2020). Intelligent road infrastructure system (iris): Systems and methods [US Patent App. 16/776,846].
2. Ran, B., Cheng, Y., Li, S., Zhang, Z., Ding, F., Tan, H., **Wu, Yuankai**, Dong, S., Ye, L., Li, X. Et al. (2019). Intelligent road infrastructure system (iris): Systems and methods [US Patent App. 16/135,916].
3. Cheng, Y., Ran, B., Li, S., Zhong, G., Wang, C., **Wu, Yuankai**, Dong, S., & Ye, L. (2019). Connected automated vehicle highway systems and methods for shared mobility [US Patent App. 16/267,800].
4. Chen, Y., Ran, B., Li, S., Tan, H., Chen, Z., **Wu, Yuankai**, Lin, P., He, S., Gang, Z. Et al. (2018). Intelligent network connection traffic management system facing mobile sharing [Chinese Patent App. 201810818222].
5. Ran, B., Tan, H., Chen, Y., Chen, Z., Lin, P., Li, S., Zhang, Z., Ding, F., **Wu, Yuankai** Et al. (2018). Intelligent road facility system and control method thereof [Chinese Patent App. 201810287873].
6. Tan, H., Zhou, Y., He, H., Zhong, Z., Li, Q., & **Wu, Yuankai**. (2017). Method and system for preventing tramcars from collision at intersection [Chinese Patent App. 201710247951].

Projects Experience

JUl.2022 — · · · · **Young Talents Plan of China Association for Science and Technology, (Role: PI. Award ¥50,000)**, A Survey for Deep Learning Methods for Intelligent Transportation Systems.

Mar.2022 — · · · · **Fundamental Research Funds for the Central Universities, (Role: PI. Award ¥500,000)**, Spatiotemporal Data-driven Safe and Intelligent Air Traffic Management System.

Feb.2020 — Feb.2022 **Ivado Postdoc Funding, (Role: PI. Award CAD $ 140,000)**, Deep Spatiotemporal Modeling for Urban Traffic Data.

Apr.2021 — Feb.2022 **Canada Space Agency Earth System Science Data Analyses, Role: Investigator**, Dynamic flood inundation modeling in regional earth system models guided by space-based observation and machine learning.

Dec.2019 — Feb.2022 **Mitacs Canada and Fundway Technology Inc, Role: Investigator**, Develop reinforcement learning platform for traffic signal control based on real-world traffic data and scenarios.

Jan.2018 — Aug.2019 **National Natural Science Foundation of China, key project, Role: Investigator**, Multi-tensor networks for coupled high-dimensional multi-modal big data and its empirical study.

Sep.2012 — Dec.2016 **National Natural Science Foundation of China, Role: Investigator**, Multi-dimensional traffic data completion.

Projects Experience (continued)

Jun.2018 — Aug.2019	**National Natural Science Foundation of China, Role: Investigator**, Deep reinforcement learning based energy management strategy for plug-in hybrid electric vehicles.
Dec.2016 — Aug.2019	**Research in TOPS lab, University of Wisconsin, Madison, Role: Investigator**, Design and evaluation of Connected and Automated Vehicle & Highway systems.
Jan.2016 — Dec.2017	**SAIC MOTOR open funding, Role: Investigator**, Big data platform for key technologies of electric vehicles.
Jan.2014 — Dec.2015	**Open Fund of State Key Laboratory of Automotive Safety and Energy, Role: Investigator**, Research on anti collision system of vehicle based on video processing.
Jul.2014 — Oct.2014	**Tencent computer system Co. Ltd., Role: Research Internship**, Development of a traffic state prediction method using sparse floating car data.

Honors and Awards

2019	**Second Prize of Chinese Institute of Electronics (ranked 6/10)**.
Nov.2017	**China National Scholarships for PhD student**
Jul.2016	**China Scholarship Council (CSC) scholarships**
Dec.2014	**Best paper reward of the 12th academic conference of Beijing Institute of Technology**

Talks and Presentations

Jul. 2022	Machine learning based spatiotemporal analysis for traffic data, big data mining and analysis in transportation session in 22nd COTA conference.
Jun. 2022	Machine learning for spatiotemporal modeling, University of Electronic Science and Technology of China, Chengdu, China.
Oct. 2021	Graph Neural Networks for Real time Kriging, IVADO Digital October, Remote talk.
Apr. 2021	Deep Reinforcement Learning and its Applications to Energy Management, Sichuan University, Remote lecture.
Feb. 2021	Inductive Graph Neural Networks for Kriging, Virtual AAAI 2021 conference.
Oct. 2020	Tensor decomposition for spatiotemporal modeling, Shenzen University, Remote lecture.
May. 2020	Deep learning for spatiotemporal modeling, Chengdu Normal University, Remote lecture.
Oct. 2019	Control methods for connected automated vehicle & highway systems, Hunan University, Changsha, China.
Jun. 2019	Tensor decomposition and its application on traffic data analysis, Tongji University, Shanghai, China.
	A deep reinforcement learning based car following model for electric vehicle, Proceedings of the 2019 World Transport Convention, Beijing, China
May. 2019	Traffic data analysis and data-driven control for connected and automated vehicle & highway systems, Central South University, Changsha, China.
Jun. 2018	A hybrid deep learning based traffic flow prediction method and its understanding, Central South University, Changsha, China
Apr. 2018	Deep learning method and its application on transportation systems, Beijing Jiaotong University, Beijing, China.
Aug. 2015	Short-term traffic flow prediction based on multilinear analysis and k-nearest neighbor regression, CICTP2015, Beijing, China.

Talks and Presentations (continued)

Jan. 2015	Freeway short-term travel time prediction based on dynamic tensor completion, 94th TRB annual meeting, Washington DC, USA.
Nov. 2014	Robust Missing Traffic Flow Imputation Considering Nonnegativity and Road-capacity, Beijing Institute of Technology, Beijing, China.
Jan. 2014	Traffic Missing Data Completion with Spatial–Temporal Correlations, 93rd TRB annual meeting, Washington DC, USA.
Aug. 2013	A new traffic prediction method based on dynamic tensor completion, CICTP2013, Shenzeng, China.

Tools

- Tensor Decomposition and Completion Tools (28 stars)
- Inductive Graph Neural Networks for Kriging (53 stars)
- Differential Variable Speed Limits Simulation (19 stars)
- Deep Reinforcement Learning for Energy Management System(67 stars)

Mentorship

Apr.2022 — · · · ·	**Wang Lei**, Ph.D. candidate at Sichuan University
Apr.2020 — Aug. 2021	**Zhuang Dingyi**, Master Student at McGill University, (Ph.D. candidate at MIT)
Feb.2020 — Sep. 2021	**Shi Tianyu**, Master Student at McGill University, (Ph.D. candidate at Toronto University)
Dec.2017 — Jun.2019	**Li Qin**, Ph.D. Student at Beijing Institute of Technology, (Assistant professor at Guangxi University)
Sep.2018 — Jun.2019	**Lian Renzong**, Master Student at Beijing Institute of Technology, (Ph.D. candidate at Tsinghua University)
	Wang Yong, Master Student at Beijing Institute of Technology, (Ph.D. candidate at Beijing Institute of Technology)

Professional Services

Editor

• Early Career Editorial Advisory Board, Advanced Engineering Sciences (Chinese), • Special Issue "Advanced Intelligent Transportation Systems and Automated Vehicles in Smart Cities", Electronics, • Special Issue "AI+ Traffic Analysis and Control", Journal of Railway Science and Engineering (Chinese), • Special Issue "Machine Learning for Intelligent Transportation Systems", Journal of Transportation Engineering and Information (Chinese)

Reviewer

• AAAI-22 AI for Social Impact Track • Transportation Research Part B: Methodological, • Transportation Research Part C: Emerging Technologies, • IEEE Transactions on Intelligent Transportation Systems, • IEEE Transactions on Industry Informatics, • IEEE Transactions on Multimedia, • IEEE Transactions on Systems, Man, and Cybernetics: Systems, • IEEE Internet of Things Journal, • IEEE Transactions on Big Data, • IEEE Transactions on Artrificial Intelligence, • Artificial Intelligence in Medicine, • Transactions in GIS, • Journal of Cleaner Production, • IEEE Intelligent Systems, • Applied soft computing, • Computers and Operations Research, • International Journal of Electrical Power Energy Systems, • Journal of Advanced Transportation, • IEEE Sensors Journal, • Neurocomputing, • ASME Journal of Dynamic Systems, Measurement, and

Control, ● IEEE Access, ● Physica A: Statistical Mechanics and its Applications, ● Sensors, ● Energy Reports, ● Wireless Sensor Network, ● Wireless Communications and Mobile Computing, ● Mobile Information Systems, ● IEEE/CAA Journal of Automatica Sinica, ● SN Applied Sciences (SNAS), ● Machine Learning and Knowledge Extraction, ● World Electric Vehicle Journal, ● Electronics, ● Energy and AI, ● TRB Annual Meeting - Transportation Research Board, ● IEEE International Intelligent Transportation Systems Conference, ● CICTP.

Member

● Chinese Association for Artificial Intelligence (CAAI), ● Chinese Society of Aeronautics and Astronautics, ● IVADO: The institute for data valorization, ● Program Committee Member for the AI for Social Impact track at AAAI-22, ● IEEE ● Mitacs, ● China Highway and Transportation Society, ● World Transport Convention Standing Committee on Public Transportation Management.

Academic referee

● Academic title reviewer for Southern Medical University