CURRICULUM VITAE

Songhua Hu
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EDUCATION

Ph.D. Civil & Environmental Engineering (Transportation), 2019~2023
University of Maryland, College Park, MD, USA

Dissertation: "A big-data-driven framework for spatiotemporal travel demand estimation and prediction"

M.S. Transportation Engineering, 2016~2019
Tongji University, Shanghai, China

Thesis: "Promoting electric vehicle utilization in large-scale carsharing systems: Factors analysis and relocation simulation"

B.S. Civil & Environmental Engineering (Transportation), 2012~2016
Huazhong University of Science & Technology, Wuhan, Hubei, China

Thesis: "Simulation of pedestrian flow in metro systems: a dynamic floor-field cellular automata approach"

RESEARCH INTERESTS

- Urban Mobility Sensing and Computing
- Spatio-temporal Data Mining and Network Analysis
- Disaster Response and Community Resilience
- Computational Epidemiology and Health Geography
- Mobility as a Service (MaaS) and Shared Mobility

RESEARCH EXPERIENCE

Postdoctoral Research Fellow, 06/2023~Present
Massachusetts Institute of Technology, Senseable City Lab (PI's: Paolo Santi, Carlo Ratti)

- GEMINI: Digital Twin for Emission Monitoring and Prediction – Kista Case
- Visual AI Emission: Reconstruct Citywide Traffic Flow and Emission via Traffic Camera

Graduate Research Assistant, 09/2019~06/2023
University of Maryland, College Park (PI's: Paul Schonfeld, Chenfeng Xiong)

- INFORM AFRICA: Integrated Modeling of Mobility and Epidemiology in South Africa and Nigeria, 2021~2022 (NIH)
- Next Generation National Household Travel Survey Origin-Destination Data Program, 2021~2022 (FHWA)
- ATCMTD: Deployment of Personalized and Dynamic Travel Demand Management Technology in the Washington D.C.-Baltimore, MD-Richmond, VA Megaregion,

2020~Present (USDOT)

- University of Maryland COVID-19 Impact Analysis Platform (data.covid.umd.edu), 2020~2021 (USDOT, NSF)
- Evaluate the Impact of Express Toll Lanes in Maryland with Advanced Travel Demand and Dynamic Traffic Assignment Models, 2019~2020 (MDOT SHA)
- incenTrip APP: Personalized and Real-Time Traveler Incentives (incentrip.org), 2019~Present (USDOE, USDOT, MDOT)

Graduate Research Assistant, 09/2016~06/2019
Tongji University (PI's: Xiaohong Chen, Hangfei Lin)

- A Data-Driven Framework for Station Site Selection, Fleet Management, and Operation Optimization in Large-Scale Electric Carsharing Systems (Evcard), 2018~2019
- Shenzhen Waterlogging Detection Platform Using Traffic Flow Information, 2018
- Agent-based Pedestrian Flow Simulation in Subway Systems, 2017
- Shanghai Intelligent Transportation Information Platform, 2017
- Bus Lane Performance Evaluation Using Micro Traffic Simulation, 2016~2017

Research Assistant, 09/2015~06/2016
Huazhong University of Science & Technology

- Pedestrian Flow Simulation Based on the Floor Field Cellular Automata Model for Turnstiles Deployment Optimization in Subway Systems, 2015~2016

SELECTED JOURNAL PUBLICATIONS (*corresponding author)

1. **Hu, S.,** Xiong, C., Chen, P., Schonfeld, P. (2023). "Examining nonlinearity in population inflow estimation using big data: An empirical comparison of explainable machine learning models." Transportation Research Part A: Policy and Practice, 174, 103743.
2. **Hu, S.,** & Xiong, C. (2023). High-dimensional population inflow time series forecasting via an interpretable hierarchical transformer. Transportation research part C: emerging technologies, 146, 103962.
3. **Hu, S. *,** Xiong, C., Zhao, Y., Yuan, X., & Wang, X. (2023). Vaccination, human mobility, and COVID-19 health outcomes: Empirical comparison before and during the outbreak of SARS‐Cov-2 B. 1.1. 529 (Omicron) variant. Vaccine.
4. Wei, R., Zhang, Y., Gao, S., Brown, B. J., **Hu, S.**, & Link, B. G. (2023). Health disparity in the spread of COVID-19: Evidence from social distancing, risk of interactions, and access to testing. Health & place, 82, 103031.
5. Yang, M., Luo, W., Ashoori, M., Mahmoudi, J., Xiong, C., Lu, J., ... **Hu, S.**, & Ji, Y. (2023). Big-Data Driven Framework to Estimate Vehicle Volume Based on Mobile Device Location Data. Transportation Research Record, 03611981231174240.
6. **Hu, S.,** Xiong, C., Li, Q., Wang, Z., & Jiang, Y. (2022). COVID-19 vaccine hesitancy cannot fully explain disparities in vaccination coverage across the contiguous United States. Vaccine, 40(37), 5471-5482.
7. **Hu, S.,** Chen, M., Jiang, Y., Sun, W., & Xiong, C. (2022). Examining factors associated with bike-and-ride (BnR) activities around metro stations in large-scale dockless bikesharing systems.

Journal of Transport Geography, 98, 103271.

8. **Hu, S.,** Xiong, C., Younes, H., Yang, M., Darzi, A., & Jin, Z. C. (2022). Examining spatiotemporal evolution of racial/ethnic disparities in human mobility and COVID-19 health outcomes: Evidence from the contiguous United States. Sustainable Cities and Society, 76, 103506.
9. **Hu, S.,** Luo, W., Darzi, A., Pan, Y., Zhao, G., Liu, Y., & Xiong, C. (2021). Do racial and ethnic disparities in following stay-at-home orders influence COVID-19 health outcomes? A mediation analysis approach. PloS one, 16(11), e0259803.
10. **Hu, S.,** Chen, P., & Chen, X. (2021). Do personalized economic incentives work in promoting shared mobility? Examining customer churn using a time-varying Cox model. Transportation Research Part C: Emerging Technologies, 128, 103224.
11. **Hu, S.,** Xiong, C., Liu, Z., & Zhang, L. (2021). Examining spatiotemporal changing patterns of bike-sharing usage during COVID-19 pandemic. Journal of transport geography, 91, 102997.
12. **Hu, S.,** Xiong, C., Yang, M., Younes, H., Luo, W., & Zhang, L. (2021). A big-data driven approach to analyzing and modeling human mobility trend under non-pharmaceutical interventions during COVID-19 pandemic. Transportation Research Part C: Emerging Technologies, 124, 102955.
13. **Hu, S.,** & Chen, P. (2021). Who left riding transit? Examining socioeconomic disparities in the impact of COVID-19 on ridership. Transportation Research Part D: Transport and Environment, 90, 102654.
14. Zhang, L., Darzi, A., Ghader, S., Pack, M. L., Xiong, C., Yang, M., ... & **Hu, S.** (2021). Interactive COVID-19 mobility impact and social distancing analysis platform. Transportation research record, 2677(4), 168-180.
15. Luo, W., Guo, W., **Hu, S.**, Yang, M., Hu, X., & Xiong, C. (2021). Flatten the curve: Empirical evidence on how non-pharmaceutical interventions substituted pharmaceutical treatments during COVID-19 pandemic. Plos one, 16(10), e0258379.
16. Xiong, C., **Hu, S.,** Yang, M., Luo, W., & Zhang, L. (2020). Mobile device data reveal the dynamics in a positive relationship between human mobility and COVID-19 infections. Proceedings of the National Academy of Sciences, 117(44), 27087-27089.
17. Xiong, C., **Hu, S.,** Yang, M., Younes, H., Luo, W., Ghader, S., & Zhang, L. (2020). Mobile device location data reveal human mobility response to state-level stay-at-home orders during the COVID-19 pandemic in the USA. Journal of the Royal Society Interface, 17(173), 20200344.
18. Wang, T., **Hu, S. *,** & Jiang, Y. (2020). Predicting shared-car use and examining nonlinear effects using gradient boosting regression trees. International Journal of Sustainable Transportation, 15(12), 893-907.
19. **Hu, S.,** Lin, H., Chen, X., Xie, K., & Shan, X. (2020). Modeling usage frequencies and vehicle preferences in a large-scale electric vehicle sharing system. IEEE Intelligent Transportation Systems Magazine, 14(1), 74-86.
20. **Hu, S.,** Chen, P., Xin, F., & Xie, C. (2019). Exploring the effect of battery capacity on electric vehicle sharing programs using a simulation approach. Transportation Research Part D: Transport and Environment, 77, 164-177.
21. Chen, P., **Hu, S. *,** Shen, Q., Lin, H., & Xie, C. (2019). Estimating traffic volume for local streets with imbalanced data. Transportation research record, 2673(3), 598-610.
22. **Hu, S.,** Chen, P., Lin, H., Xie, C., & Chen, X. (2018). Promoting carsharing attractiveness and

efficiency: An exploratory analysis. Transportation Research Part D: Transport and Environment, 65, 229-243.

SELECTED PRESENTATIONS/POSTERS

1. **Hu, S.**, Xiong, C., Ya, J., and Schonfeld, P. Understanding factors influencing user engagement in incentive-based travel demand management program, Transportation Research Board 103rd Annual Meeting (2024), Washington DC.
2. **Hu, S.**, Wang, K., Li, L., Zhao, Y., He, Z., Zhang, Y. Multimodal Data Fusion for Evaluating the Resilience of Link-level Road Traffic to Extreme Weather Events, Transportation Research Board 103rd Annual Meeting (2024), Washington DC.
3. Zhao, Y., **Hu, S.**, Zhang, M. Evaluating Equitable Transit-Oriented Development (TOD) via an Extended Node-Place-Vulnerability Model, Transportation Research Board 103rd Annual Meeting (2024), Washington DC.
4. Li, W., He, Y., **Hu, S.**, He, Z. Planning dynamic wireless charging infrastructure for battery electric bus systems with the joint optimization of charging scheduling, Transportation Research Board 103rd Annual Meeting (2024), Washington DC.
5. **Hu, S.**, Xiong, C., Chen, P., and Schonfeld, P. Revisiting travel demand using big data: an empirical comparison of explainable machine learning models, Transportation Research Board 102nd Annual Meeting (2023), Washington DC.
6. **Hu, S.**, Xiong, C. High-dimensional population flow time series forecasting via an interpretable hierarchical transformer, Transportation Research Board 102nd Annual Meeting (2023), Washington DC.
7. **Hu, S.**, Xiong, C., Yuan, X., and Wang, X. Vaccination, Mobility, and COVID-19 Health Outcomes: Empirical Comparison Before and During the Outbreak of Omicron Variant, Transportation Research Board 102nd Annual Meeting (2023), Washington DC.
8. Chen, P., Yang, X., Zhang, Y., and **Hu, S**. The Renaissance of Transit and Ridesharing: From Pandemic Towards the New Normal, Transportation Research Board 102nd Annual Meeting (2023), Washington DC.
9. Sun, Q., Pan, Y., Zhou, W., Kabiri, A., Yang, M., Zhao, G., **Hu, S.**, Ashoori, M., Namadi, S., and Darzi, A. National truck travel demand estimation using GPS data, Transportation Research Board 102nd Annual Meeting (2023), Washington DC.
10. **Hu, S.**, Luo, W., Darzi, A., Pan, Y., Zhao, G., Liu, Y., and Xiong, C. Do Racial and Ethnic Disparities in Maintaining Social distancing Influence COVID-19 Health Outcomes? A Mediation Analysis Approach, Transportation Research Board 101st Annual Meeting (2022), Washington DC.
11. **Hu, S.**, Xiong, C., Younes, H., Yang, M., Darzi, A., and Jin, Z. Examining spatiotemporal evolution of racial/ethnic disparities in human mobility and COVID-19 health outcomes: Evidence from the contiguous United States, Transportation Research Board 101st Annual Meeting (2022), Washington DC.
12. Xiong, C., **Hu, S.**, Yang, M., Younes, H., Luo, W., Ghader, S., and Zhang, L. Mobile device location data reveal human mobility response to state-level stay-at-home orders during the COVID-19 pandemic in the USA, Transportation Research Board 100th Annual Meeting (2021), Washington DC.
13. **Hu, S.**, Xiong, C., Yang, M., Younes, H., Luo, W., and Zhang, L. A big-data driven approach to

analyzing and modeling human mobility trend under non-pharmaceutical interventions during COVID-19 pandemic, Transportation Research Board 100th Annual Meeting (2021), Washington DC.

14. Jing, Y., **Hu, S.**, and Lin, H. Estimating Traffic Volume with Limited Observations: A Combination of Sampling Expansion and Geographically Weighted Poisson Regression, Transportation Research Board 100th Annual Meeting (2021), Washington DC.
15. Jing, Y., **Hu, S.**, and Lin, H. Joint Analysis of Scooter Sharing and Bikesharing Usage: A Structural Equation Modeling Approach, Transportation Research Board 100th Annual Meeting (2021), Washington DC.
16. **Hu, S.**, Chen, P., and Chen, X. Do Personalized Economic Incentives Work in Promoting Shared Mobility? Examining Customer Churn Using a Time-Varying Cox Model, Transportation Research Board 99th Annual Meeting (2020), Washington DC.
17. **Hu, S.**, Chen, P., Xin, F., and Xie, C. Exploring the effect of battery capacity on electric vehicle sharing programs using a simulation approach, Transportation Research Board 99th Annual Meeting (2020), Washington DC.
18. Chen, P., **Hu, S.**, Shen, Q., Lin, H., and Xie, C. Estimating traffic volume for local streets with imbalanced data, Transportation Research Board 98th Annual Meeting (2019), Washington DC.
19. **Hu, S.,** Lin, H., Xie, K., Chen, X., and Hongjie Shi. Modeling users' vehicles selection behavior in urban carsharing program, 21st IEEE International Conference on Intelligent Transportation Systems (2018).
20. **Hu, S.**, Lin, H., Xie, K., Dai, J., and Qui, J. Impacts of rain and waterlogging on traffic speed and volume on urban roads, 21st IEEE International Conference on Intelligent Transportation Systems (2018).

UNDER REVIEW

1. Multimodal Data Fusion for Evaluating the Resilience of Link-level Road Traffic to Extreme Weather Events. **Hu, S.**, Wang, K., Li, L., Zhao, Y., He, Z., Zhang, Y., 2023 (Under review at Transportation Research Part C: Emerging Technologies)
2. Understanding Factors Influencing User Engagement in Incentive-Based Travel Demand Management Program. **Hu, S.**, Xiong, C., Ya, J., Schonfeld, P., 2023 (Under review at Transportation Research Part A: Policy and Practice)
3. Multi-ATGCN: A Multi-Graph Multi-Head Adaptive Temporal Graph Convolutional Network for Multivariable Crowd Inflow Forecasting. **Hu, S.**, Xie, Y., Xiong, C., Schonfeld, P., 2023 (Under review at AAAI 2024)
4. Evaluating Equitable Transit-Oriented Development (TOD) via an Extended Node-Place-Vulnerability Model. Zhao, Y., **Hu, S.**, Zhang, M. 2023 (Under review at Transportation Research Part A: Policy and Practice)
5. Evaluating Travel Behavior Resilience across Urban and Rural Areas during the COVID-19 Pandemic: Contributions of Vaccination and Epidemiological Indicators. Xi, H., Nelson, J., Hensher, D., **Hu, S.**, Shao, X., Xie, C., 2023 (Under review at Transportation Research Part A: Policy and Practice)
6. Planning Dynamic Wireless Charging Infrastructure for Battery Electric Bus Systems with the Joint Optimization of Charging Scheduling. Li, W., He, Y., **Hu, S.**, He, Z., 2023 (Under review at Transportation Research Part C: Emerging Technologies)

TEACHING EXPERIENCE

Teaching Assistant

- Massachusetts Institute of Technology, Cambridge, MA, USA
  MIT Undergraduate Research Opportunities Program (UROP), Fall 2023
- University of Maryland, College Park, MD, USA
  Introduction to Transportation Engineering and Planning, Fall 2022
- Tongji University, Shanghai, China
  Sustainable Transportation, Fall 2018
  Travel Behavior Analysis and Discrete Choice Models, Spring 2019

AWARDS AND HONORS

- University of Maryland, College Park: CEE Best Doctoral Research Award, 2023
- Outstanding Reviewer, Transportation Research Part D: Transport and Environment, 2023
- University of Maryland, College Park: Outstanding Graduate Assistant (top 2%), 2021
- University of Maryland, College Park: CEE Summer Research Fellowship, 2020
- University of Maryland, College Park: The Graduate School's Dean's Fellowship, 2019
- Tongji University: Graduate Merit Scholarship, 2018
- Huazhong University of Science & Technology: Outstanding Graduates, 2016
- Huazhong University of Science & Technology: Undergraduate Merit Scholarship, 2015
- Huazhong University of Science & Technology: National Scholarship, 2013~2015

SERVICE TO PROFESSION

Journal Article Reviewer

- **Transportation**: Accident Analysis and Prevention; IEEE Transactions on Intelligent Transportation Systems; International Journal of Transportation Science and Technology; Journal of Transport Geography; Journal of Public Transportation; Journal of Transport and Land Use; Journal of Advanced Transportation; Transportation Research Part B: Methodological; Transportation Research Part D: Transport and Environment; Transport Policy; Traffic Injury Prevention; Travel Behavior and Society; Transportation Letters; Transportation Research Record; Transportation Research Interdisciplinary Perspectives.
- **Planning and GIS**: Cambridge Journal of Regions, Economy and Society; Cities; Computational Urban Science; Geo-spatial Information Science; Journal of Planning Education and Research; Journal of Urban Technology; Regional Studies; Sustainable Cities and Society.
- **Public Health**: AIMS Public Health; Biosafety and Health; Health Data Science; The Lancet Regional Health - Western Pacific.
- **Multidisciplinary**: Cogent Engineering; IEEE Access; Nature Cities; Scientific Reports; PLOS One.

Conference Proceeding Reviewer

- TRB Transportation Research Board Annual Meeting
- COTA International Conference of Transportation Professionals

- IACP International Association of China Planning
- IEEE Intelligent Transportation Systems Society Conference Management System

ADDITIONAL EXPERIENCE

Research Scientist Intern, 09/2018 ~02/2019

Shanghai Electric Vehicle Public Data Collecting, Monitoring, and Research Center, Shanghai, China

Research Scientist Intern, 11/2017~06/2018

Evcard, Shanghai International Automobile City (Group) Co., Ltd., Shanghai, China

Traffic Engineer Intern, 08/2017~10/2017

Shenzhen Urban Transport Planning Center Co., Ltd., Shenzhen, China

SKILLS

Programming:

Python (pandas, ultralytics, opencv, pytorch, sklearn, pymc), R (dplyr, car, lavaan, mgcv, spdep), SQL (MySQL, pgAdmin, Impala, Oracle), Cloud Computing (PySpark, EMR), Matlab, Git, Bash, Java, HTML.

Statistics:

Causal inference (DID, 2SLS, SEM (Mediation analysis, Path analysis), BSTS), Time series (ARIMA, SARIMA), Survival analysis (Cox, Time-varying Cox), Regression (Generalized linear models (Poisson, NB, Zero-Inflated), Generalized additive (mixed) models, PLS, Lasso/Ridge/ElasticNet), Spatial econometrics (SER, SLR, SDR, GWR, GTWR), Discrete choice model (Multinomial, Mixed, Nested).

Deep learning/Machine learning:

Time series forecasting (CNN, LSTM, GRU, Transformer), Graph neural network (STGCN), Computer vision (Vehicle/Pedestrian Detection, Tracking, Segmentation), Natural language processing (Text mining, Topic modeling, Sentiment analysis, LLM), Tree models (RF, XGBoost, LightGBM, CatBoost), Explainable AI (SHAP, PDP, ALE)

Traffic Simulation:

Micro (Vissim, Sumo), Agent (MATSim, DTALite, AnyLogic), Macro (TransCAD, Visum)

(Spatiotemporal) Network Analysis:

ArcGIS, QGIS, Geopandas, NetworkX, igraph, OSMnx

Updated by 09/2023