Yuan Liao

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in Mobility Data Science
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PROFESSIONAL APPOINTMENTS

2024– **Visiting postdoc**, Department of Applied Mathematics and Computer Science, Technical University of Denmark, Denmark

Project: Understanding social segregation through the lens of big data on human mobility [Link] (VR International postdoc grant, 2022-06215, 3,200,000 SEK)

In collaboration with Department of Space, Earth and Environment & Department of Architecture and Civil Engineering, Chalmers University of Technology, Sweden

Contribution: As the principal investigator and grantee, I oversee all aspects of the project, including budget allocation, funding management, and data curation. I coordinate meetings with our four collaborators to ensure smooth progression. My role involves leading the design and execution of our research series. At present, I have one review article undergoing peer review and another manuscript in the pipeline for submission.

2021– **Postdoc**, Department of Space, Earth and Environment, Chalmers University of Technology, Sweden

Project: A Synthetic Sweden Decision Supporting Tool for Future Urban Mobility – Autonomous and Electromobility Infrastructure Planning [Link]

In collaboration with the Department of Computer Science, University of Virginia, Charlottesville, United States

Contribution: I specialize in transport agent-based simulations, crafting and conducting studies that employ simulated agents to analyze the demand for charging infrastructure. This resulted in a journal article and two open data repositories as the first author. I'm also a co-supervisor to a PhD student, from which I have a paper currently under review stemming from my supervisory role.

2016–2017 **Project Assistant**, Department of Computer Science and Engineering, Chalmers University of Technology, Sweden

Project: Integrated In-Vehicle Information Providing to Support Safe Trucking, Department of Computer Science and Engineering, Chalmers University of Technology, Sweden

In collaboration with Volvo Trucks, Sweden

Contribution: I led the research on truck drivers' demand for in-vehicle information design, publishing two journal articles and two conference papers, as the first author on three of these contributions.

2014 **Intern Researcher**, Nissan Motor Corporation, Japan

Contribution: As the intern researcher, I analyzed naturalistic driving data from 100 drivers, using data mining to identify distinct driving signatures and define key autonomous driving parameters.

EDUCATION

2017–2021 **PhD in Energy and Environment**, Department of Space, Earth and Environment, Chalmers University of Technology, Sweden

Project: Making Cities More Sustainable: Using Big and Continuous Data to Understand Urban Mobility and Congestions [Link] (Formas 2016-01326)

Contribution: As a doctoral researcher, I delved into the challenges and opportunities presented by big mobility data in travel demand modeling and understanding transport modal disparities. My research was published in five journal articles and one conference paper, with first authorship on each and including a journal paper I authored independently. One of these papers has been cited nearly 100 times.

2013–2016 **MSc in Mechanical Engineering**, School of Vehicle and Mobility (formerly Department of Automotive Engineering), Tsinghua University, China

Project: Study on Driver Distractions Indicated by Driving Performance and Eye Movement: from Feature Extraction to Real-time Detection

Contribution: During my master's studies, I oversaw a driving simulator, designed and executed driver experiments, analyzed the data, and authored my thesis. This project led to the publication of two journal articles and one conference paper, with me as the first author. One journal article from this project has been cited over 100 times.

2009–2013 **BE in Mechanical Engineering**, School of Vehicle and Mobility (formerly Department of Automotive Engineering), Tsinghua University, China

Project: Chinese Driver Behaviour Analysis in Typical Driving Scenarios

In collaboration with Toyota Motor Corporation, Japan

Contribution: During my bachelor thesis project, I designed and executed driver experiments, analyzed the data, and authored my thesis. This project led to the publication of two journal articles.

OTHER ACADEMIC PROJECTS

2023– Electric Multimodal Transport Systems for Enhancing Urban Accessibility and Connectivity (eMATS) [Link]

In collaboration with Department of Architecture and Civil Engineering, Chalmers University of Technology, Sweden

Contribution: I do agent-based simulations focusing on the potential integration of e-scooters into Sweden's existing mobility patterns. My role encompasses enhancing accessibility evaluations and managing comprehensive analyses of movement patterns.

2023– Lifestyle enclaves

In collaboration with Institute of Analytical Sociology (IAS), Linköping University

Contribution: I bring specialized knowledge in the analysis of extensive geolocation data, contributing to the development of concepts related to socio-spatial segregation and everyday human mobility. I actively engage in frequent discussions, offering insights and feedback on the continuous advancements.

2023– Decarbonizing Urban Transportation through Behaviour Change? A Novel Incentive Approach

In collaboration with Department of Transportation Engineering, Beihang University, Beijing, China

Contribution: I offer expertise in analyzing large-scale geolocation data and help form ideas for sustainable urban mobility. I participate in regular meetings to discuss and provide feedback on ongoing progress.

2023–2024 Integrated Agent-based Modelling and Simulation of Transportation Demand and Mobility Patterns in Sweden

In collaboration with RISE (El för ännu fler, P119643)

Contribution: as the leading researcher, I did agent-based simulations for Swedish car users and prepared a data repository with source code for public use.

HIGHLIGHTED PUBLICATIONS

2024 **Liao, Y**, Yeh, S, Gil, J, Pereira, RHM, Alessandretti, L. Socio-spatial segregation and human mobility: A review of empirical evidence. *arXiv preprint arXiv:2403.06641*. doi:10.48550/arXiv.2403.06641.

2023 **Liao, Y**, Tozluoğlu, Ç, Sprei, F, Yeh, S, Dhamal, S. Impacts of charging behavior on BEV charging infrastructure needs and energy use. *Transportation Research Part D: Transport and Environment*. doi:10.1016/j.trd.2023.103645.

2022 **Liao, Y**, Ek, K, Wennerberg, E, Yeh, S, Gil, J. A Mobility Model for Synthetic Travel Demand from Sparse Traces. *IEEE Open Journal of Intelligent Transportation Systems*. doi:10.1109/OJITS.2022.3209907.

2021 **Liao, Y**. Ride-sourcing compared to its public-transit alternative using big trip data. *Journal of Transport Geography*. doi:10.1016/j.jtrangeo.2021.103135.

2021 **Liao, Y**, Yeh, S, Gil, J. Feasibility of estimating travel demand using social media data. *Transportation*. doi:10.1007/s11116-021-10171-x.

2020 **Liao, Y**, Gil, J, Pereira, RHM, Yeh, S, Verendel, V. Disparities in travel times between car and transit: Spatiotemporal patterns in cities. *Scientific Reports*. doi:10.1038/s41598-020-61077-0.

OTHER PUBLICATIONS

PEER-REVIEWED

2023 Tozluoğlu, Ç, Dhamal, S, Yeh, S, Sprei, F, **Liao, Y**, Dubhashi, D, Marathe, M, Barrett, C. A synthetic population of Sweden: datasets of agents, households, and activity-travel patterns. *Data in Brief*. doi:10.2139/ssrn.4386866.

2022 Yeh, S, Gil, J, Kyle, P, Kishimoto, P, Cazzola, P, Craglia, M, Edelenbosch, O, Fragkos, P, Fulton, L, **Liao, Y**, Martinez, L, , Miller, J, Pereira, RHM, Teter, J. Improving future travel demand projections: a pathway with an open science interdisciplinary approach. *Progress in Energy*. doi:10.1088/2516-1083/ac86b5.

2021 Li, G, **Liao, Y**, Guo, Q, Shen, C, Lai, W. Traffic Crash Characteristics in Shenzhen, China from 2014 to 2016. *International Journal of Environmental Research and Public Health*. doi:10.3390/ijerph18031176.

2019 **Liao, Y**, Yeh, S, Jeuken, GS. From individual to collective behaviours: exploring population heterogeneity of human mobility based on social media data. *EPJ Data Science*. doi:10.1140/epjds/s13688-019-0212-x.

2019 Li, G, Li, SE, Zou, R, **Liao, Y**, Cheng, B. Detection of road traffic participants using cost-effective arrayed ultrasonic sensors in low-speed traffic situations. *Mechanical Systems and Signal Processing*. doi:10.1016/j.ymssp.2019.07.009.

2019 Wang, M, **Liao, Y**, Lyckvi, SL, Chen, F. How drivers respond to visual vs. auditory information in advisory traffic information systems. *Behaviour & Information Technology*. doi:10.1080/0144929X.2019.1667439.

2018 **Liao, Y**, Wang, M, Duan, L, Chen, F. Cross-regional driver–vehicle interaction design: an interview study on driving risk perceptions, decisions, and ADAS function preferences. *IET Intelligent Transport Systems*. doi:10.1049/iet-its.2017.0241.

2018 **Liao, Y**, Li, G, Li, SE, Cheng, B, Green, P. Understanding driver response patterns to mental workload increase in typical driving scenarios. *IEEE Access*. doi:10.1109/ACCESS.2018.2851309.

2017 Hu, M, **Liao, Y**, Wang, W, Li, G, Cheng, B, Chen, F. Decision tree-based maneuver prediction for driver rear-end risk-avoidance behaviors in cut-in scenarios. *Journal of Advanced Transportation*. doi:10.1155/2017/7170358.

2016 **Liao, Y**, Li, SE, Wang, W, Wang, Y, Li, G, Cheng, B. Detection of driver cognitive distraction: A comparison study of stop-controlled intersection and speed-limited highway. *IEEE Transactions on Intelligent Transportation Systems*. doi:10.1109/TITS.2015.2506602.

PEER-REVIEWED CONFERENCE PROCEEDINGS

2018 **Liao, Y**, Yeh, S. Predictability in Human Mobility based on Geographical-boundary-free and Long-time Social Media Data. *2018 21st International Conference on Intelligent Transportation Systems (ITSC)*. doi:10.1109/ITSC.2018.8569770.

2017 **Liao, Y**, Li, G, Chen, F. Context-adaptive support information for truck drivers: an interview study on its contents priority. *2017 IEEE Intelligent Vehicles Symposium (IV)*. doi:10.1109/IVS.2017.7995886.

2017 **Liao, Y**, Duan, L, Wang, M, Chen, F. Cross-regional study on driver response behavior patterns and system acceptance with triggered forward collision warning. *2017 IEEE Intelligent Vehicles Symposium (IV)*. doi:10.1109/IVS.2017.7995778.

2016 **Liao, Y**, Li, SE, Li, G, Wang, W, Cheng, B, Chen, F. Detection of driver cognitive distraction: an SVM based real-time algorithm and its comparison study in typical driving scenarios. *2016 IEEE Intelligent Vehicles Symposium (IV)*. doi:10.1109/IVS.2016.7535416.

2015 Li, G, Li, SE, **Liao, Y**, Wang, W, Cheng, B, Chen, F. Lane change maneuver recognition via vehicle state and driver operation signals—Results from naturalistic driving data. *2015 IEEE Intelligent Vehicles Symposium (IV)*. doi:10.1109/IVS.2015.7225793.

2015 **Liao, Y**, Li, SE, Wang, W, Wang, Y, Li, G, Cheng, B. The impact of driver cognitive distraction on vehicle performance at stop-controlled intersections. *2015 IEEE Intelligent Vehicles Symposium (IV)*. doi:10.1109/IVS.2015.7225806.

THESIS

2021 **Liao, Y**. Understanding Mobility and Transport Modal Disparities Using Emerging Data Sources: Modelling Potentials and Limitations. Doctoral thesis. Chalmers University of Technology. `research.chalmers.se/en/publication/523982`.

MANUSCRIPTS UNDER REVIEW

2024 **Liao, Y**, Yeh, S, Gil, J, Pereira, RHM, Alessandretti, L. Socio-spatial segregation and human mobility: A review of empirical evidence.

2024 Tozluoğlu, Ç, **Liao, Y**, Sprei, F. Potential of E-bikes to Reduce Greenhouse Gas Emissions from Private Cars.

2024 Yan, H, Ma, X, **Liao, Y**, Ma, Z. Improving Multi-modal Transportation Recommendation Systems through Contrastive De-biased Heterogenous Graph Neural Networks.

2024 Gao, K, Jia, R, **Liao, Y**, Liu, Y, Najafi, A, Attard, M. Big Data-Driven Approach and Scalable Analysis on Sustainability of Shared Micromobility from Trip to City Level Analysis.

MANUSCRIPTS IN PREPARATION

2024 **Liao, Y**, Yeh, S, Gil, J, Pereira, RHM, Alessandretti, L. Nativity Segregation and its Link with Mobility Revealed by Big Geolocation Data in Sweden.

PRESENTATIONS

2023 **Liao, Y**. Geolocation Data helps us understand segregation (Geolocation Data hjälper oss förstå segregation), *Urban Lunch-time #89 by Urban Futures, Center for Sustainable Urban Development (Centrum för Hållbar Stadsutveckling)*, Gothenburg, Sweden.

2023 **Liao, Y**. Exploring urban income segregation with big geolocation data on human mobility, *9th International Conference on Computational Social Science*, Copenhagen, Denmark.

2022 **Liao, Y**. On the impact of EV charging behaviours: Spatiotemporal patterns of demand from user perspective using agent-based modelling, *Hybrid Symposium on Applied Urban Modelling (AUM) 2022*, Cambridge, UK.

Liao, Y. Mobility Data Science: Research framework, examples, and outlook, *Group Meeting at the Research Unit of Cognitive Systems, Department of Applied Mathematics and Computer Science, Technical University of Denmark*, Lyngby, Denmark.

Liao, Y. Synthetic Sweden Mobility Model (SySMo): Optimal charging infrastructure for 100% EV adoption, *MATSim User Meeting 2022*, KU Leuven, Belgium.

2020 **Liao, Y**, Yeh, S. Private Car vs. Public Transit: Spatiotemporal Variations of Travel Time in Cities using Emerging Data Sources, *The Transportation Research Board (TRB) 99th Annual Meeting*, Washington DC, USA.

2019 **Liao, Y**, Yeh, S. Using geotagged tweets to assess human mobility: a comparison with travel survey and GPS log data, *8th Symposium of the European Association for Research in Transportation (hEART)*, Budapest, Hungary.

Liao, Y. Private Car vs. Public Transit: Spatiotemporal Variations of Travel Time in Cities using Emerging Data Sources, *K2 | The Swedish Knowledge Centre for Public Transport, Seminar*, Lund, Sweden.

Liao, Y. Human mobility through the lens of geotagged tweets, *SMoG-group seminar, Department of Architecture and Civil Engineering, Chalmers University of Technology*, Gothenburg, Sweden.

2018 **Liao, Y**. Predictability in Human Mobility based on Geographical-boundary-free and Long-time Social Media Data, *The 21st IEEE International Conference on Intelligent Transportation Systems*, Maui, Hawaii, USA.

Liao, Y. From Individual to Collective Behaviours: Exploring Variations of Human Mobility in Space and Time based on Social Media Data, *International Energy Workshop 2018*, Gothenburg, Sweden.

2017 **Liao, Y**. Exploring the Patterns of Human Movement Using Twitter Data, *Fulbright Day*, Gothenburg, Sweden.

2016 **Liao, Y**. Human factors in intelligent vehicles: Research methods for driver behaviors, workload assessment, and HMI design, *Shenzhen University*, Shenzhen, China.

Liao, Y. Driving safety status and preferences on V2X-based safety assistance of truck drivers - Some implications for interaction design, *SAFER Lunch Seminar*, Gothenburg, Sweden.

TEACHING ASSISTANCE

2018–2020 FFR170: Sustainable Energy Futures
Department of Space, Earth and Environment, Chalmers University of Technology
Roles: TA, TA manager, and Course Administrator (20% work time)

SUPERVISION

2023 Master thesis: Simulating Mobility of Large Population Using Mobile Application Data
Department of Computer Science and Engineering, Chalmers University of Technology
Role: supervisor

2022 Doctoral thesis: Agent-based Transport Models as a Tool for Evaluating Mobility
Department of Space, Earth and Environment, Chalmers University of Technology
Role: co-supervisor

2022 Master thesis: Flows Generation for Synthetic Travel Demand
Department of Space, Earth and Environment, Chalmers University of Technology
Role: supervisor

2021 Master thesis: Exploring socioeconomic factors' impact on human mobility during the COVID-19 pandemic
Department of Space, Earth and Environment& Department of Computer Science and Engineering, Chalmers University of Technology
Role: co-supervisor

2020 Master thesis: Estimating Travel Demand from Twitter using an Individual Mobility Model
Department of Space, Earth and Environment& Department of Computer Science and Engineering, Chalmers University of Technology
Role: co-supervisor

ACADEMIC SERVICE & AFFILIATIONS

ACADEMIC SERVICE

2023 Impacts of charging behaviors on BEV charging infrastructure needs and energy use

Invited lecture at Department of Architecture and Civil Engineering, Chalmers University of Technology, Sweden

2020 Comparing social media data with NDR as mobility data sources, CALISTA Hackathon 2020, Centre for Applied Spatial Analysis, Uppsala University, Sweden

Contribution: In a week-long Hackathon project, I guided two undergraduate students in utilizing extensive mobile phone GPS data to examine mobility patterns, comparing these findings with results derived from geotagged tweets.

AFFILIATIONS

2015–2021 IEEE Student Member

2018–2020 Vice-chair of IEEE Young Professional Sweden Section

2013–2015 Student mentor of the bachelor students in Class 2011, School of Vehicle and Mobility (formerly Department of Automotive Engineering), Tsinghua University, China

2012–2013 Manager of Tsinghua Bauhinia Econo-power Team, Tsinghua University, China

REVIEWER

PLOS ONE, International Journal of Digital Earth, Frontiers in Built Environment, Complexity, GIScience & Remote Sensing, International Journal of Transportation Science and Technology, Transactions in GIS, IEEE Transactions on Intelligent Transportation Systems, IEEE Access, Transportation, IEEE Intelligent Transportation Systems Magazine, International Journal of Human Factors and Ergonomics, IEEE Transactions on Human-Machine Systems

GRANTS

2023-2026 Swedish Research Council (VR), **International Postdoc grant** (2022-06215), 3 600 000 SEK, Principal Investigator

2018 Chalmers Area of Advance - Energy, **Travel Grant** to present at 21st IEEE International Conference on Intelligent Transportation Systems, November 4-7, 2018, Maui, Hawaii, USA

AWARDS & HONORS

2016 **Excellent Master Thesis** of the Year (TOP 5%), Tsinghua University, China

2016 **Excellent Postgraduate Student** of the Year (TOP 5%), Tsinghua University, China

2014 **First Class Scholarship**, Tsinghua University, China

2013 **Excellent Undergraduate Thesis** of the Year (TOP 5%), Tsinghua University, China

2012 **First Class Scholarship**, Tsinghua University, China

TECHNICAL SKILLS

Data Machine learning, data mining, Python, SQL, R, SPSS, MATLAB, Apache Spark

Mobility Spatial analysis, GIS techniques, ArcMap, QGIS

LANGUAGES

Mandarin Native

English Advanced