Xue Yao

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Academic Appointments

Delft University of Technology Oct. 2025 – Present

Postdoctoral Researcher, Transport & Planning
Project: AI Learning Initiative for Multi-modal Traffic and Transportation Management (AiMTT)
Research: AI-enabled traffic management and Active Inference

University of California, Berkeley Aug. 2026 – present

Visiting Scholar, CITRIS and the Banatao Institute
Host PI: Prof. Alexandre M. Bayen
Research: AI-advanced traffic-flow theory

Education

Delft University of Technology Jan. 2026

PhD, Transport & Planning
Dissertation: *Driving Heterogeneity in Traffic Flow Theory*.
Promotor: Prof. Serge P. Hoogendoorn; co-promotor: Dr. Simeon C. Calvert.
Doctoral research period: Jan. 2022 – Jul. 2025.

Delft University of Technology Feb. 2022 – Jan. 2024

Dutch engineering title (Ir.), recognized by DUO, the Netherlands.

Southwest Jiaotong University Sep. 2019 – Dec. 2021

Master's degree, Traffic and Transportation Engineering

Shandong University of Technology Sep. 2015 – Jun. 2019

Bachelor's degree, Traffic Engineering

RESEARCH INTERESTS

- **Data-Driven and AI-Enabled Traffic Management** – Integrating traffic data, predictive modeling, and explainable AI to support adaptive, cooperative, and resilient multimodal traffic management.
- **Mixed Autonomy and Cooperative Traffic Systems** – Modeling interactions between human-driven and automated vehicles, and developing cooperative decision-making and control strategies to improve traffic efficiency, stability, and safety.
- **Active Inference and Intelligent Decision-Making** – Advancing Active Inference as a unified framework for behavior modeling, learning, and decentralized decision-making and control across microscopic and macroscopic traffic systems.
- **Driving Behavior and Behavioral Heterogeneity** – Understanding human driving behavior, decision-making, and adaptation through data-driven modeling of inter- and intra-driver variability.
- **Traffic Flow Theory and Collective Dynamics** – Investigating how microscopic driving behaviors and interactions give rise to macroscopic traffic phenomena, including traffic instability, congestion propagation, and network performance.

Research Outputs

Journal Publications

- **Yao, X*.**, Calvert, S. C. and Hoogendoorn, S. P. (2025). A Novel Framework for Understanding and Identifying Driving Heterogeneity Through Action Patterns. *IEEE Transactions on Intelligent Transportation Systems*, doi: 10.1109/TITS.2025.3560509.
- **Yao, X*.**, Calvert, S. C. and Hoogendoorn, S. P. (2025). Driving Heterogeneity Identification Using Machine Learning: A Review and Framework for Analysis. *Transportation Research Interdisciplinary Perspectives*, 32: 101511.
- **Yao, X.**, Du, Z., Sun, Z*., Calvert, S. C., and Ji, A. (2024). Cooperative Lane-Changing in Mixed Traffic: A Deep Reinforcement Learning Approach. *Transportmetrica A: Transport Science*, 1-23.
- **Yao, X*.**, Yan, Q., Sun, Z., Calvert, S. C., and Hoogendoorn, S. P. (2024). Investigation on Car-Following Heterogeneity and Its Impacts on Traffic Safety and Sustainability. *Transportmetrica A: Transport Science*, 1-25.
- Sun, Z*., **Yao, X.**, Qin, Z., Zhang, P., and Yang, Z. (2021). Modeling Car-Following Heterogeneities by Considering Leader–Follower Compositions and Driving Style Differences. *Transportation Research Record*, 2675 (11), 851-864.

Manuscripts Under Review and Revision

- **Yao, X*.**, Bagaev, D., Xin, Y., van Lint, J. W. C., de Vries, B., and Hoogendoorn, S. P. (2026). Active Inference for Adaptive Traffic Management: A Unified Framework for Route Choice and Signal Control, Manuscript under review at *Transportation Research Part C: Emerging Technologies*.
- **Yao, X*.**, Calvert, S. C., Bayen, A. M., and Hoogendoorn, S. P. (2026). A Pattern-based Framework for Modelling Driving Heterogeneity and Traffic Flow Simulation, Manuscript under review at *Transportation Science*.
- **Yao, X*.**, Qin, Z., Calvert, S. C. and Hoogendoorn, S. P. (2025). Human Driving Patterns: A Knowledge-Enhanced Deep Learning Approach for Behavior Modeling. Manuscript in second-round revision at *IEEE Transactions on Intelligent Transportation Systems*.

Doctoral Dissertation

- **Yao, X.** (2026). *Driving Heterogeneity in Traffic Flow Theory: An Action-based Framework for Identification, Modelling, and Simulation*. Doctoral dissertation, Delft University of Technology.

Magazine Contributions

- **Yao, X.**, and Wang, Z*. (2025). [ITS Ph.D.s]. *IEEE Intelligent Transportation Systems Magazine*, 17(6), 124–126. doi: 10.1109/MITS.2025.3606735.

Conference Papers

- **Yao, X*.**, Bagaev, D., Xin, Y., de Vries, B., van Lint, J. W. C., and Hoogendoorn, S. P. (2026). Why Active Inference for Decentralised Traffic Coordination? A Route-Choice Demonstration, *7th International Workshop on Active Inference (IWAI2026)*, Madrid, Spain.
- **Yao, X*.**, Calvert, S. C., and Hoogendoorn, S. P. (2026). A Pattern-based Framework for Modelling Driving Heterogeneity and Traffic Flow Simulation. Oral presentation at *Proceedings of the 105th Annual Meeting of Transportation Research Board (TRB2026)*, Washington, D.C. USA.
- **Yao, X.***, Qin, Z., Calvert, S. C., and Hoogendoorn, S. P. (2025). Action Pattern Prediction with Knowledge-enhanced Attention LSTM. *Proceedings of the 104th Annual Meeting of Transportation Research Board (TRB2025)*, Washington, D.C. USA.
- Qin, Z*., **Yao, X.**, Wei, C., Ji, A., Wu, G., and Sun, Z. (2025). Contextual-Personalized Adaptive Cruise Control via Fine-Tuned Large Language Models. In IEEE/CVF International Conference on Computer Vision (pp. 1754-1762).

- **Yao, X*.**, Calvert, S. C., and Hoogendoorn, S. P. (2024). A Novel Framework for Understanding and Identifying Driving Heterogeneity Through Action Patterns. *TRAIL PhD Congress 2024*, Utrecht, the Netherlands.
- Qin, Z., **Yao, X*.**, Wu, G., Sun, Z., and Barth, M. J. (2024). Where do Vulnerable Road Users Go at Automated Unsignalized Intersections? An Analysis of Interactions. *TRC-30: 30th Anniversary of Transportation Research Part C*, Crete, Greece.
- **Yao, X*.**, Calvert, S. C., Hoogendoorn, S. P. (2024). Action Pattern Recognition based on Action Phases Clustering. *12th Symposium of the European Association for Research in Transportation (hEART2024)*, Helsinki, Finland.
- **Yao, X*.**, Calvert, S. C., Hoogendoorn, S. P. (2024). Driving Pattern Interpretation based on Action Phases. *Proceedings of the 103rd Annual Meeting of Transportation Research Board (TRB2024)*, Washington, D.C. USA.
- **Yao, X*.**, Calvert, S. C., and Hoogendoorn, S. P. (2023). Identification of Driving Heterogeneity with Machine Learning: A Literature Review and Future Perspectives. *TRAIL PhD Congress 2023*, Utrecht, the Netherlands.
- **Yao, X*.**, Calvert, S. C., and Hoogendoorn, S. P. (2023). Identification of Driving Heterogeneity using Action-chains. *IEEE 26th International Conference on Intelligent Transportation Systems (ITSC2023)*, Bilbao, Spain.
- **Yao, X*.**, Hou, S., Hoogendoorn, S. P., and Calvert, S. C. (2023). Performance Comparison of Deep RL Algorithms for Mixed Traffic Cooperative Lane-Changing. *Proceedings of the 102nd Transportation Research Board Annual Meeting (TRB2023)*, Washington D.C., USA.
- **Yao, X*.**, Sun, Z., Yan, Q. (2023). Performance Comparison of Multi-class SVM and S3VM for Driving Style Classification. *Proceedings of the 102nd Transportation Research Board Annual Meeting (TRB2023)*, Washington D.C., USA.
- **Yao, X*.**, Calvert, S. C., and Hoogendoorn, S. P. (2022). Traffic Heterogeneity with Connectivity and Connected Automated Vehicles. *TRAIL PhD Congress 2022*, Utrecht, the Netherlands.
- **Yao, X*.**, Du, Z., Sun, Z. (2022). Cooperative Lane-changing in Mixed Traffic: A Deep Reinforcement Learning Approach. *Proceedings of the 101st Transportation Research Board Annual Meeting (TRB2022)*, Washington D.C., USA.
- Sun, Z*., **Yao, X.** (2021). Modeling Car-Following Heterogeneities by Considering Leader-follower Compositions and Driving Style Differences. *Proceedings of the 100th Transportation Research Board Annual Meeting (TRB2021)*, Washington D.C., USA.

Teaching Experience

- **Lecturer**, Delft University of Technology
  - CTB3395 AI in Traffic and Transport Engineering 2026/27 (Q1)
- **Teaching Assistant**, Delft University of Technology
  - CIEM6110 Methods in Traffic and Transport Engineering 2022/23, 2023/24, 2024/25 (Q3)
  - TIL6022 Transport, Infrastructure, and Logistics – Python Programming 2024/25 (Q1)

Academic Training and Exchanges

Research Training

- hEART PhD School, Helsinki, Finland June 2024
- TRAIL International Summer School on Automated Driving, Delft, the Netherlands Sep. 2022
- Advanced Course on Data Science & Machine Learning (ACDL), Tuscany, Italy August 2022

International Exchanges

- Sungkyunkwan University, South Korea: engineering exchange Dec. 2018 – Jan. 2019
- China–Japan Youth Friendship Exchange Program: student representative October 2017

Academic Service and Leadership

Leadership and Professional Service

- Vice Chair, IEEE ITSS Benelux Chapter, 2025-2026.
- Communication Chair, IEEE Intelligent Transportation Systems Society (ITSS) Benelux Chapter, 2026-present.
- Associate Editor, IEEE International Conference on Vehicular Electronics and Safety (ICVES), 2026.
- Volunteer, TRB ACP50 CAV Traffic Flow Subcommittee.

Funding and Event Organization

- Secured IEEE ITSS Young Professionals (YP) funding for Benelux Chapter student/YP activities.
- Organized IEEE ITSS Benelux Chapter student/YP events (2025):
  - Industry–Academia Collaboration & Networking, Delft, 20 March 2025.
  - Exploring Innovation: Industry Excursions to ITS Companies in the Netherlands, Rotterdam, 21 May 2025.

Professional Memberships

- Member, Institute of Electrical and Electronics Engineers (IEEE).
- Member, IEEE Intelligent Transportation Systems Society (ITSS).
- Friend, TRB ACP30, ACP50, and ACP80 Committees.

Peer Reviewer for Journals

- Transportation Research Part C: Emerging Technologies
- Transportation Science
- IEEE Transactions on Intelligent Transportation Systems
- Transportation Research Part D: Transport and Environment
- Transportmetrica A: Transport Science
- Transportmetrica B: Transport Dynamics

Peer Reviewer for Conferences

- IEEE Intelligent Transportation Systems Conference (ITSC)
- IEEE Intelligent Vehicles Symposium (IV)
- IEEE Forum for Innovative Sustainable Transportation Systems (FISTS)
- Transportation Research Board Annual Meeting (TRB)
- International Workshop on Active Inference (IWAI)

Additional Information

Languages

Chinese (native) English (proficient) Dutch (basic)

Hobbies

- Snowboarding and skiing: certified snowboarding instructor.
- Outdoors: Hiking, cycling, camping, and climbing.
- Baking and culinary arts.
- Psychology: Certified International Psychological Consultant (CIPC).