Chenxiang Ma

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EDUCATION

Southeast University Nanjing, China

M.S., Traffic and Transportation Engineering Sep 2023 - Jun 2026 (expected)

- GPA: **3.92/4.0**; Rank: **2/72 (Major), 4/276 (Overall in the School)**
- Advisor: Prof. *Chengcheng Xu*
- Main Courses: Traffic Engineering Theory (100), Data analysis and modeling (96).

B.S., Traffic Engineering (Mao Yisheng Class) Sep 2019 - Jun 2023

- GPA: **3.93/4.0**; Rank: **2/96**
- Main Courses: Linear Algebra (99), College Physics (99), Advanced Mathematics (98), Probability Theory and Mathematical Statistics (98), Programming and Algorithmic Language (97).

RESEARCH INTERESTS

Generative and Embodied Artificial Intelligence for intelligent transportation systems, focusing on generative AI-based intelligent civil infrastructure management, learning-based quadruped robotic control for highway maintenance and graph-based transportation modeling.

SELECTED PUBLICATIONS

Journal & Conference Papers

[1] **Ma, C.**, Xu, C.*, Wang, F. (2026). Full-Scale Autonomous Highway Inspection with Quadruped Robot: Multi-Level Locomotion Learning in Complex Environments. *2026 IEEE Conference on Robotics and Automation (ICRA 2026)*, accepted. [**Top Robotics Conference**]

[2] **Ma, C.**, Xu, C.*, Liu, P., Huang J. (2026). Graph Neural Network-Based Generalized Graph Partitioning for Accelerated Large-Scale Microscopic Traffic Parallel Simulation. *Transportation Research Part E: Logistics and Transportation Review*, 206, 104586. [doi] [**IF 8.8, JCR Q1**]

[3] **Ma, C.**, Xu, C.* (2025). Objective-Directed Deep Graph Generative Model for Automatic and Intelligent Highway Interchange Design. *Automation in Construction*, 171, 105982. [doi] [**IF 11.5, JCR Q1**]

[4] Xu, C.*, Shao, Y., **Ma, C.**, Han, M., Tong, H., Peng, C. (2025). A Geometric Deep Learning Approach to Traffic Flow Shockwave Prediction on Freeways Using Vehicle Trajectory Data and HD Map. *IEEE Transactions on Intelligent Transportation Systems*, 26, 9907-9917. [doi] [**IF 8.4, JCR Q1**]

Conference Presentations

[5] **Ma, C.**, Xu, C.* (2026). Autonomous Inspection of Complex Highway Environments Using Quadruped Robot with Multi-Level Locomotion Learning. Presented at *105th Transportation Research Board Annual Meeting*, Washington, DC. [Link] [**Top Transportation Conference**]

[6] **Ma, C.**, Xu, C.* (2025). A Generalized Graph Partitioning-Based Microscopic Traffic Parallel Simulation Framework Using Hierarchical Graph Neural Network. Presented at *104th Transportation Research Board Annual Meeting*, Washington, DC. [Link] [**Top Transportation Conference**]

[7] **Ma, C.**, Xu, C.* (2025). Graph-Based Generative Model for Automatic Intelligent Highway Interchange Design. Presented at *104th Transportation Research Board Annual Meeting*, Washington, DC. [Link] [**Top Transportation Conference**]

Patents

[8] Xu, C., **Ma, C.**, Gu, X., Liu, P. (2025). Generative AI-Based Embodied Intelligent Controller Construction Method for Highway Inspection. Chinese Invention Patent, CN121232811A, filed on September 12, 2025. Patent Pending. [Link]

[9] Xu, C., **Ma, C.**, Wan, H., Liu, P. (2025). Interchange Design Method Driven by Generated Artificial Intelligence. Chinese Invention Patent, CN120805261A, filed on July 7, 2025. Patent Pending. [Link]

[10] Xu, C., **Ma, C.**, Chen, Y. (2024). A Design Method of Intelligent Connected Vehicle Lane Based on Mixed Flow Capacity. Chinese Invention Patent, CN116665442B, issued on May 10, 2024. [Link]

[11] Xu, C., **Ma, C.**, Chen, Y. (2023). Speed Coordination and Merging Combined Control in Mixed Flow Scene. Chinese Invention Patent, CN116758739A, filed on June 7, 2023. Patent Pending. [Link]

RESEARCH EXPERIENCE

Autonomous Inspection of Complex Highway Environments Using Quadruped Robot
Group Leader | Advisor: Prof. *Chengcheng Xu* Sep 2024 - Present

- **Role:** Proposed a quadrupedal multi-level locomotion framework based on reinforcement learning for autonomous highway inspection, combining locomotion control and coverage path planning.
- **Impact:** Implemented five distinct agile locomotion gaits. Developed four specialized multiple inspection skills. Achieved 100% coverage of 14,400 m² highway environment in 0.4 h. Accepted by *ICRA 2026* and *105th TRB Annual Meeting*. Began real-world deployment.
- **Expertise:** Legged robotic control; coverage path planning; deep reinforcement learning; critical thinking; interdisciplinary problem-solving.

Generalized Graph Partitioning for Accelerated Large-Scale Traffic Parallel Simulation
Group Leader | Advisor: Prof. *Chengcheng Xu* Feb 2024 - Aug 2024

- **Role:** Developed a traffic parallel simulation framework based on hierarchical graph neural networks for generalized graph partitioning.
- **Impact:** Achieved 13.23 times acceleration on a provincial highway network with more than 98% accuracy. Applied in Henan highway simulation platform. Presented at *104th TRB Annual Meeting*. Published in *Transportation Research Part E* (IF 8.8, JCR Q1).
- **Expertise:** Traffic simulation; graph neural network; parallel computing; real-world application.

Graph-Based Generative Model for Automatic Intelligent Highway Interchange Design
Group Leader | Advisor: Prof. *Chengcheng Xu* Sep 2023 - Aug 2024

- **Role:** Developed an objective-directed graph generative approach to automate highway interchange design and replace experience-driven manual workflows.
- **Impact:** Cut design time from days to sub-second. Improved throughput by 5.67% and reduced cost by 27.63%. Presented at *104th TRB Annual Meeting* and awarded Best Paper at the *16th National Youth Conference on Transportation*. Published in *Automation in Construction* (IF 11.5, JCR Q1).
- **Expertise:** Deep generative model; automatic design; data-driven modeling; algorithmic innovation; academic presentation; scholarly writing and publication.

Geometric Deep Learning Approach to Traffic Flow Shockwave Prediction on Freeways
Main Member | Advisor: Prof. *Chengcheng Xu* Sep 2023 - Jun 2024

- **Role:** Built a geometric deep learning framework that fuses vehicle trajectories and HD-map features for trajectory and shockwave prediction, capturing vehicle-roadway interactions.
- **Impact:** Reduced trajectory error by 9.5% and achieved 93.5% shockwave prediction accuracy. Published in *IEEE Transactions on Intelligent Transportation Systems* (IF: 8.4, JCR Q1).
- **Expertise:** Deep learning integration; spatiotemporal modeling; theoretical and practical integration.

AWARDS & HONORS

- China National Scholarship (**twice, top 3%**), Ministry of Education, China 2024, 2025
- Outstanding Graduate Student Cadre (**only 2 recipients**), Southeast University 2024
- Graduate 1st-Class Study Scholarship (**twice, top 10%**), Southeast University 2024, 2023
- Outstanding Graduate (**top 4%**), Southeast University 2023
- President's Scholarship (**highest undergraduate honor**), Southeast University 2021
- Education Hope Award (**only 3 recipients**), Mao Yisheng Education Foundation, China 2021

SKILLS

- **Software & Tools:** Linux, LaTeX, Unitree SDK2, Blender, SUMO, MPI.
- **Programming:** Python, C++, PyTorch, TensorFlow, PyBullet, OpenAI Gym, NetworkX.
- **Methods:** Deep learning, reinforcement learning, GenAI, robotics, traffic theory, traffic simulation.
- **Languages:** English (TOEFL 103), Chinese (native).

LEADERSHIP & SERVICE

Standing Committee Member, Student Union of Southeast University Sep 2022 - Sep 2023
President, Student Union, School of Transportation, Southeast University Sep 2021 - Sep 2022