

Haoyu He

✉ he.haoyu1@northeastern.edu

🔗 he-h.github.io

in haoyu-he

🎓 Haoyu He

Education

Northeastern University

May 2023 – Present

Ph.D. in Civil and Environmental Engineering

Boston, MA

Advisor: Dr. Qi Ryan Wang

Rensselaer Polytechnic Institute (RPI)

Aug. 2018 – Dec. 2021

B.S. in Computer Science & Mathematics

Troy, NY

GPA: 3.86/4.00 (Magna Cum Laude)

Research interest: Urban Computing, Human Mobility, Large Language Models, Spatio-Temporal Data Mining, Network Science

Research Experience

Research Assistant

May 2023 – Present

Urban Informatics and Resilience Lab, Northeastern University

- Developed an agent-based human mobility foundation model (HMFm) with dynamic memory editing capabilities, enabling adaptive pattern retention and refinement for trajectory forecasting across sparse urban datasets
- Integrated LLM-enhanced reasoning modules with spatial-temporal graph networks, employing causal memory manipulation to improve interpretability of mobility decisions in complex urban scenarios
- Designed disaster response simulation protocols leveraging HMFm's editable memory states, allowing controlled analysis of evacuation behaviors under data scarcity constraints

Research Assistant

Aug. 2022 – May 2023

Khoury College of Computer Science, Northeastern University

- Sparsified graphs utilizing effective resistance inspired from electric network to sample essential edges to the graph so that can maintain spectral property of the graph (largest singular value)
- Speeded up the Graph Neural Networks (GNNs) training process with and achieved faster performance compared with same models without sparsification
- Harnessed ensemble learning to train multiple sparsified versions of a graph and beat the benchmark accuracy by 3% with significant less time

Undergraduate Research Assistant

May 2021 – May 2022

Center for Network Science and Technology, RPI

- Developed temporal hierarchical mobility network model for COVID-19 spread analysis (Philosophical Transactions A)
- Reduced US mobility network analysis time from 10hr to 30min through algorithmic optimization
- Identified critical bottlenecks in national mobility networks for pandemic containment strategies

Publications

Network-Driven Insights into the 3D Geometry of Urban Morphology

Haoyu He, Weiyu Li, Qi Ryan Wang

In preparation

Socio-Spatially Aware Mobility Optimization Through Bipartite Graph

Haoyu He, Weiyu Li, Qi Ryan Wang

In preparation

ST-MoE-BERT: Spatial-Temporal Mixture-of-Experts Framework for Long-Term Cross-City Mobility Prediction

Oct. 2024

Haoyu He, Haozheng Luo, Qi Ryan Wang

HuMob@SIGSPATIAL '24

<https://dl.acm.org/doi/10.1145/3681771.3699910> 

Pretrained Mobility Transformer: A Foundation Model for Human Mobility

Oct. 2024

Xinhua Wu, *Haoyu He*, Yanchao Wang, Qi Ryan Wang

<https://arxiv.org/pdf/2406.02578> 

Forecasting Urban Mobility using Sparse Data: A Gradient Boosted Fusion Tree Approach

Nov. 2023

Haoyu He, Xinhua Wu, Qi Ryan Wang

HuMob@SIGSPATIAL '23

<https://dl.acm.org/doi/10.1145/3615894.3628507> 

Percolation of Temporal Hierarchical Mobility Networks during COVID-19

Jan. 2022

Haoyu He, Hengfang Deng, Qi Ryan Wang, Jianxi Gao

Philosophical Transactions of the Royal Society A

<https://doi.org/10.1098/rsta.2021.0438> 

Technical Skills

Machine Learning Frameworks: PyTorch, TensorFlow, PyTorch-Geometric, Hugging Face

Programming: Python, Java, MATLAB, C++

Tools: AWS, Git, LaTeX

Honors & Awards

- PhD Outstanding Research Award, College of Engineering, Northeastern University (2025)
- 1st Place, Human Mobility Prediction Challenge (ACM SIGSPATIAL 2024)
- Top 10, Human Mobility Prediction Challenge (ACM SIGSPATIAL 2023)
- NSF Travel Grant Recipient (ACM SIGSPATIAL 2023)
- Magna Cum Laude, Rensselaer Polytechnic Institute (2022)

Professional Service

- Reviewer: AISTATS 2023, WSDM 2023
- Teaching Assistant: Machine Learning & Data Mining (DS 4400), Northeastern University
- Mentor: Foundations of Computer Science (CSCI 2200), RPI