

Yonghui Liu

Ph.D. Candidate, KAIST

liuil@kaist.ac.kr | lyh360121.github.io

Education

KAIST Ph.D. candidate, Cho Chun Shik Graduate School of Mobility; advisor: Prof. Inhi Kim	Aug 2023 - Present
Zhejiang University (ZJU) M.S., Ocean Engineering	Sep 2018 - Mar 2021
Nanchang University (NCU) B.S., Physics	Sep 2014 - May 2018

Research Experience

Doctoral Research, KAIST Aug 2023 - Present
Research on trajectory observation-reconstruction co-design, with published studies in trajectory modeling and road-network representation learning.

Efficient trajectory modeling

- **ProChunkFormer**. Developed a progressive chunked Transformer for sparse GPS reconstruction. On Porto taxi data at 240-second sampling intervals, reduced runtime by 20.7% and road-network MAE by 25.1% versus an autoregressive Transformer. [2]
- **SDA**. Designed a controlled-gating protocol to quantify history, state, and goal-prior contributions in LSTM/Transformer forecasting on Porto taxi and ETH pedestrian data. [1]

Representation learning with language and graph models

- **Road-network representations**. Combined LLM-derived semantics with heterogeneous graph learning. Achieved 0.6766 F1 in Porto-to-Lisbon transfer without retraining, versus 0.6968 F1 for a Lisbon-trained model. [6]
- **Cross-taxonomy alignment**. Combined LLM pseudo-labels with structural embeddings. With 1% human-labeled data, achieved 51.3% accuracy versus 40.0% for direct supervised training. [5]

Selected Funded Research Projects

Development of a Physical AI and Infrastructure-Centric AV Control Framework for Mixed-Autonomy Traffic Environments

Research Team Member | Funder: NRF

Project scope: Infrastructure-guided AV coordination, mixed-traffic modeling, and digital-twin scenario validation.

Development of Virtual Environment and Demonstration Technology for Automated Driving based on Metaverse

Research Team Member | Funder: MOLIT

Project scope: Dynamic-object behavior models and data-linked virtual environments for automated-driving validation.

Road Traffic Digital Twin Development Using Autonomous Driving Lv.4/4+ Big Data

Research Team Member | Funder: MOLIT

Project scope: Deep-learning traffic analysis and prediction, mobility-data fusion, and network-level simulation.

Shared Mobility-Mass Transit Operational Plan for Preparing the Next Pandemic

Research Team Member | Funder: NRF

Project scope: Shared-mobility demand forecasting and operational planning across shared transport and mass transit.

Development of evolving agent-based mobility planners in autonomous driving era using LLM

Research Team Member

Project scope: Using large language models for evolving agent-based mobility planners in autonomous-driving applications.

Independent Research Prototypes

Route-Conditioned Traffic Simulation

Ongoing research

- Training path-encoding and FiLM conditioning modules on a frozen pretrained SMART motion model for route-conditioned traffic generation.
- Implemented recorded-scene data adapters and closed-loop evaluation; policy-optimization experiments for route following are ongoing.

Autonomous Traffic Sensor Web (ATSW)

Working research prototype

- Implemented a source-receiver replay system with adaptive GPS reporting and Kalman estimation, supporting policy comparison using position error and report counts.
- Built a FastAPI backend and React/TypeScript interface for inspecting receiver trajectories, reporting decisions, and historical reconstruction.

Publications

Journal Articles

1. **Yonghui Liu** and Inhi Kim. Sequential decomposition and attribution for trajectory forecasting. *Knowledge-Based Systems*, 335:115204, 2026.
2. **Yonghui Liu**, Qian Li and Inhi Kim. Enhanced trajectory reconstruction from sparse and noisy GPS data: A progressive chunked transformer approach. *Communications in Transportation Research*, 5:100200, 2025.
3. Hulong Zeng, Pengcheng Jiao, **Yonghui Liu**, Ujjwal Karki and Fang Z. Peng. Analytical modeling of resonant converters in frequency domain for wireless power transfer: Continuous current mode (CCM) operation. *Energy*, 246:123371, 2022.
4. Thomas Pätz, **Yonghui Liu**, Yuezhang Xia, Peng Hu, Zhiguo He and Katharina Tholen. Unified model of sediment transport threshold and rate across weak and intense subaqueous bedload, windblown sand, and windblown snow. *Journal of Geophysical Research: Earth Surface*, 126(4):e2020JF005859, 2021.

Conference Papers

5. **Yonghui Liu** and Inhi Kim. Cross-Taxonomy Label Alignment in Transportation Networks With Prompt-Driven Large Language Models. *2025 IEEE 28th International Conference on Intelligent Transportation Systems (ITSC)*, pp. 1724-1729, 2025.
6. **Yonghui Liu** and Inhi Kim. A Generalizable Semantic Graph Learning Framework for Road Network Representation. *2025 IEEE 28th International Conference on Intelligent Transportation Systems (ITSC)*, pp. 720-725, 2025.

Selected Conference Presentations

Enhanced Trajectory Reconstruction from Sparse and Noisy GPS Data: A Progressive Chunked Transformer (ProChunkFormer) Approach

15th Asia-Pacific Conference on Transportation and the Environment (APTE). Presentation | July 2026 | Jeju, South Korea.

Cross-Taxonomy Label Alignment Across Transportation Datasets Using Prompts with Large Language Models

29th International Conference of Hong Kong Society for Transportation Studies (HKSTS). Poster | December 9, 2025 | Hong Kong.

Generalizable Semantic-aware Road Network Representation Learning

20th ITS Asia-Pacific Forum. E-poster | May 2025 | Suwon, South Korea.

Enhancing Trajectory Recovery for Long Interval Time: A Hierarchical Transformer Approach

2024 Fall Conference of the Korean Society of Intelligent Transport Systems (KITS). Oral presentation | October 2024 | Gangneung, South Korea.

Shortest Path Enhanced Trajectory Recovery from Trip Across Long Interval Time

2024 Spring Conference of the Korean Society of Intelligent Transport Systems (KITS). Presentation | April 26, 2024 | Jeju, South Korea.

Investigation of Personal Mobility Trip Characteristics Using Operational Data: Focusing on Sejong City

2023 Fall Conference of the Korean Society of Intelligent Transport Systems (KITS). Coauthored presentation | November 2023 | Jeju, South Korea.
Presented by a coauthor.

Analytical Modeling of Resonant Converters in Frequency Domain for Wireless Power Transfer

Joint Conference of the Korean Society of Transportation and Korea Planning Association. Oral presentation | October 12, 2023 | Busan, South Korea.

Professional Experience

Software Engineer May 2021 - Aug 2023
Meituan

AI Research Intern Apr 2020 - Oct 2020
Advanced Institute of Information Technology, Peking University

Technical Skills

Programming Languages: Python, C, JavaScript, TypeScript, MATLAB.

Machine Learning: PyTorch, Deep Learning, Transformers, Graph Neural Networks.

Model Development: Data Preprocessing, Model Training, Experimental Evaluation.

Software Engineering: API Development (FastAPI), Reproducible Experiment Pipelines.

Languages

Chinese: Native; **English:** Fluent; **Korean:** Basic