Hyunsoo Yun

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Education

Ph.D., Civil and Environmental Engineering — **Seoul, South Korea**
Seoul National University (Advisor: Prof. Dong-Kyu Kim) — *Mar. 2020 – Feb. 2025*

Dissertation: Real-Time System Optimal Route Guidance Considering Demand Uncertainty and Compliance Rate

B.S., Civil Engineering — **Yongin, South Korea**
Kyung Hee University — *Mar. 2016 – Feb. 2020*

Research Interests

- **Transportation Planning**: Travel Demand Modeling, Network Modeling, Traffic Assignment
- **Methodological Focus**: Dynamic Programming, Reinforcement Learning, Generative Models, Causal Discovery

Experience

Postdoctoral Research Associate, Purdue University — West Lafayette, IN, USA · Jun. 2026 – Present
- Digital Twin Lab, advised by Prof. Ziran Wang.

Postdoctoral Researcher, Seoul National University — Seoul, South Korea · Mar. 2025 – May 2026
- BK21 Program for InfraSPHERE; Institute of Construction & Environmental Engineering.
- Fulfilling mandatory national service through a research-based alternative military service program.

Graduate Research Assistant, Seoul National University — Seoul, South Korea · Mar. 2020 – Feb. 2025
- Transportation Research Laboratory, advised by Prof. Dong-Kyu Kim.

Guest Lecturer, Ajou University — Suwon, South Korea · Mar. 2025 – Feb. 2026
- Transportation Network Theory
- Transportation Seminar III

Research Internship, Data Intelligence Team, Kakao Mobility — Seongnam, South Korea · Aug. 2021 – Nov. 2021
- Dynamic pricing and short-term demand prediction for shared mobility services. Advised by Dr. Dominic Jung-min Kim.

Publications

Selected Publications

- **Yun, H.**, Kim, E. J., Ham, S. W., & Kim, D. K. (2024). Navigating the Non-Compliance Effects on System Optimal Route Guidance Using Reinforcement Learning. *Transportation Research Part C: Emerging Technologies*.
- Lim, S. Y.[†], **Yun, H.**[†], Bansal, P., Kim, D. K.,& Kim, E. J. (2026). A Large Language Model for Feasible and Diverse Population Synthesis. *Transportation Research Part C: Emerging Technologies*.

Other Publications

- **Yun, H.** & Lee, E. H. (2025). Party politics in transport policy with a large language model. *Transport Policy*.
- Kim, P., **Yun, H.**, Kim, J., & Kim, D. K. (2025). Scalable Link Cost Learning for Real-Time Route Guidance Systems. *Transportation Research Part C: Emerging Technologies*.
- Lee, E. H., **Yun, H.**, Cho, S. H., & Lee, E. (2025). Aggressive driving in ride-hailing: Work hours and road conditions. *Journal of Transportation Safety & Security*.
- Min, D., **Yun, H.**, Kim, D. K., & Ham, S. W. (2025). Dynamic Origin-Destination Matrix Estimation Using Metamodel-Based Model Predictive Control for Real Time Application. *Transportation Research Record*.
- Min, D., **Yun, H.**, Ham, S. W., & Kim, D. K. (2024). Real-time Estimation of Origin-Destination Matrices Using a Deep Neural Network for Digital Twins. *Transportation Research Record*.
- **Yun, H.**, Kim, E. J., Ham, S. W., & Kim, D. K. (2023). Price Incentive Strategy for the E-scooter Sharing Service Using Deep Reinforcement Learning. *Journal of Intelligent Transportation Systems*.

- **Yun, H.**, Lee, E. H., Moon, S., & Kim, D. K. (2023). Data-driven Approach for Measuring and Managing Physical Distancing in Subways During Pandemic Conditions. *Transportation Research Record*.
- **Yun, H.**, Lee, E. H., Kim, D. K., & Cho, S. H. (2021). Development of Estimating Methodology for Transit Accessibility Using Smart Card Data. *Transportation Research Record*.

Ongoing Works

- Kim, J.T., Kim, D. K., & **Yun, H.** Gradient-Based Calibration of Volume Delay Functions in Static Traffic Assignment via Implicit Differentiation. (Under review in *Transportation Research Part E: Logistics and Transportation Review*)
- Kim, P., **Yun, H.**, & Kim, D. K. Modeling Unmet Bus Demand with Passenger Reneging Behavior in a City-wide Bus Network. (Under review in *Journal of Public Transportation*)
- Kim, P., **Yun, H.**, & Kim, D. K. Two-phase Clustering for Behavior-adaptive Route Guidance Systems. (Under review in *Travel Behaviour and Society*)
- Lee, E. H., Cho, J. H., Tu, Z., & **Yun, H.** DeciGen: Generative Multi-Criteria Decision Making in Transportation Planning. (Under revision in *IEEE Transactions on Intelligent Transportation Systems*)
- Choi, S., Choi, J., Kim, D. K., & **Yun, H.** A Two-Stage Framework for Anomaly Detection and Classification in Loop Detector Data. (Under review in *Journal of Intelligent Transportation Systems*)
- Lee, S. H., **Yun, H.**, Ham, S. W., & Kim, D. K. Impact of Traffic Management Center Functionality on Speed Harmonization in Urban Networks under Mixed Traffic Environments. (Under revision in *Transportation Research Part A: Policy and Practice*)

† These authors contributed equally as co-first authors.

Conferences

- Lim, S. Y.†, **Yun, H.**†, Bansal, P., & Kim, E. J. A Large Language Model for Feasible and Diverse Population Synthesis. (2026). *TRB 105th Annual Meeting*
- Lee, E. H., Lee, E., Lee, Y.-I., **Yun, H.**, Yun, H.-R., Lee, G., & Lee, T. (2026). Fare-free Subway and Senior Delivery Work in Seoul. *TRB 105th Annual Meeting*
- Kim, J.T., Kim, D. K., & **Yun, H.** (2026). Gradient-Based Calibration of Volume Delay Functions in Static Traffic Assignment via Implicit Differentiation. *TRB 105th Annual Meeting*
- Lee, E.H., **Yun, H.**, & Tu, Z. (2026). A Generative Multi-Criteria Decision-Making Framework for Evaluating Transportation Systems: A Case Study of Texas. *TRB 105th Annual Meeting*
- **Yun, H.**, Kim, E. J.,& Kim, D. K. (2025). The Potential of Large-Language Models as Regularizers in Deep Generative Models for Population Synthesis. *ITS Asia Pacific Forum*
- **Yun, H.**, Kim, D. J., & Kim, D. K. (2024). Managing Supply-Demand Imbalance in Shared Mobility Services Through Spatiotemporal Pricing. *Transportation Research Symposium 2025*
- Min, D., **Yun, H.**, Ham, S. W., & Kim, D. K. (2025). Real-time Dynamic Origin-Destination Matrix Estimation Using Metamodel-based Model Predictive Control. *TRB 104th Annual Meeting*
- Lee, S. H., Ham, S. W., **Yun, H.**, & Kim, D. K. (2025). Speed Harmonization Based on Multi-agent Reinforcement Learning for Mitigating Traffic Congestion under Mixed Traffic Environment. *TRB 104th Annual Meeting*
- Min, D., **Yun, H.**, Ham, S. W., & Kim, D. K.(2024). Real-time Estimation of Origin-Destination Matrices Using a Deep Neural Network for Digital Twins. *TRB 103rd Annual Meeting*
- **Yun, H.**, Lee, E. H., Moon, S., & Kim, D. K. (2023). Analysis of Subway Passenger's Physical Distancing Before and After the Outbreak of COVID-19. *TRB 102nd Annual Meeting*
- Min, D., **Yun, H.**, & Kim, D. K.(2023). Developing Lane-changing Strategy of Autonomous Vehicles Based on Deep Reinforcement Learning Using Long-range Information for Mitigating Traffic Congestion. *The 15th International Conference of EASTS*

Research Projects

Understanding and Shaping Driver Behavior and Public Perception at Reduced Conflict Intersections (RCIs) (2026 – Present)

- Funded by the Indiana Department of Transportation (INDOT).

- Conducting driver surveys and field observations, including vehicle trajectory extraction from drone footage, to analyze driver behavior and public perception of RCIs.

Developing Imputation Methods for Missing Traffic Data (2021 – 2026)

- Funded by the Korean National Police Agency.
- Designed deep learning models (multimodal learning models and GAN) to impute missing traffic data.
- Models implemented in the traffic monitoring system of the Korean National Police Agency.

Modeling Urban Digital Twins for Testing Network Control Strategies (2022 – 2026)

- Funded by the National Research Foundation of Korea.
- Developed a framework to calibrate real-time traffic data for microscopic simulation.
- Designed control strategies including congestion pricing, routing, and speed harmonization.

Dynamic Modeling and Assignment in Traffic Networks (2022 – 2023)

- Selected as a principal investigator in a program funded by the National Research Foundation of Korea for doctoral students.
- Developed a dynamic traffic assignment model for mixed traffic of human-driven and automated vehicles.
- Designed real-time system optimal routing strategies.

Measuring Optimal Density of Shared E-scooter Systems (2021)

- Funded by Deer Corporation.
- Optimized the regional allocation of fleets and developed price incentive strategies to address supply-demand imbalance.

Urban Rail Network Planning (2020 – 2022)

- Funded by Gyeongsangnam-do Province.
- Participated in urban rail network projects, performed assignment and economic analysis for new transit lines.

Honors and Awards

- Excellent Paper Award, Korean Society of Transportation. 2025, 2026
- Brain Korea 21 Future Innovative Talent. 2024
- Excellence Award, Smart City Hackathon, Seoul National University. 2023
- Brain Korea 21 Scholarship. 2023, 2024
- Best Paper Award for Technological Innovation, 15th International Conference of EASTS. 2023
- Excellent Paper Award, The Korea Institute of Intelligent Transportation Systems. 2021, 2022, 2023(2)
- Research Subsidies for Ph.D. Candidates, National Research Foundation of Korea. 2022

Academic Services

- **Conference Reviewer**: Transportation Research Board; ITS World Congress; IEEE ITSC; AAAI.
- **Journal Reviewer**: IEEE Transactions on Intelligent Transportation Systems; Transportation Research Record; Journal of Intelligent Transportation Systems; International Journal of Urban Sciences; Knowledge and Information Systems; Expert Systems; Transportation Research Interdisciplinary Perspectives; Scientific Reports.
- **Workshop Organizer**: Workshop on Internet of Things in Intelligent Transportation Systems, IEEE ITSC 2026.
- **Program Assistant**: NSF International Research Experiences for Students (IRES), 2024 – Present.

Invited Talks

- AI-Driven Approaches of Mobility Systems. *Kyungil University*, May 18, 2026
- Smart Mobility in Future Cities: Status and Vision. *Department of Civil and Environmental Engineering, Seoul National University*, May 12, 2026
- Introduction to Transportation Systems Design. *Department of Civil and Environmental Engineering, Seoul National University*, December 5, 2025
- Optimizing Departure Time Distributions under Staggered Work Hours for Congestion Mitigation. *Kakao Mobility*, November 25, 2025
- Real-time Routing for System Optimal Flows under Uncertainty. *Studio Galilei*, September 10, 2025
- A Reinforcement Learning Framework for Traffic Assignment. *Myongji University*, June 12, 2025

- Developing Urban Digital Twins as a Platform for Testing Network Control Strategies. *The Korean Society of Intelligent Transport Systems*, October 24, 2024
- Towards Real-Time Operation of System Optimal Route Guidance. *University of Seoul*, August 29, 2024
- System Optimal Assignment and User Non-compliance Effects. *National University of Singapore and Seoul National University*, June 5, 2024

References

- **Prof. Ziran Wang**, Assistant Professor, Purdue University (Postdoctoral Advisor)
  Email: ziran@purdue.edu
- **Prof. Dong-Kyu Kim**, Professor, Seoul National University (Ph.D. Advisor)
  Email: dongkyukim@snu.ac.kr
- **Prof. Eui-Jin Kim**, Assistant Professor, Ajou University
  Email: euijin@ajou.ac.kr