Eunhan Ka

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Education

Purdue University
United States

Doctor of Philosophy (Ph.D.), Lyles School of Civil Engineering — *Aug. 2020 - present*

- Topic Keywords: Network Traffic Dynamics, Connected and Autonomous Vehicles, Machine Learning, Network Science
- Advisor: Dr. Satish V. Ukkusuri

Seoul National University
South Korea

Master of Science (M.S.), Department of Civil and Environmental Engineering — *Feb. 2018*

- Thesis: A Simulation Study of Demand Responsive Transport for the Disabled to Minimize User Waiting Time
- Advisor: Dr. Chungwon Lee

Seoul National University
South Korea

Bachelor of Science (B.S.), Department of Civil and Environmental Engineering — *Feb. 2016*

Research Experience

Research Assistant
Aug. 2020 - Present

Purdue University

- Develop a novel framework for modeling traffic dynamics with physics-informed deep learning in large-scale urban areas and predict the traffic impact of connected and autonomous vehicles (CAVs) in cyber-physical systems
- Formulate an optimization framework to schedule autonomous trucks considering platooning and speed optimization
- Predict origin-destination (OD) matrices by using mobile location data **(Sponsor: INDOT)**
- Analyze the traffic impact of movable barrier (Alex Fraser Bridge) in Vancouver by leveraging the mobile location data **(Sponsor: Lindsay Corporation)**

Researcher
Mar. 2018 - Aug. 2020

Seoul National University

- Led a study on designing a cluster-based route of multi-capacity vehicles of demand-responsive transport services for the disabled
- Developed optimal operation strategies of Mobility-as-a-Service (MaaS) for the mobility impaired **(Sponsor: National Research Foundation of Korea, South Korea)**
- Modelled lane change behaviors on freeways and gap acceptance behaviors at roundabouts in real driving situations and virtual reality **(Sponsor: Ministry of Land, Infrastructure and Transport, South Korea)**
- Collaborated and coordinated with faculty members, businessmen, researchers, and graduate students at University of Seoul, Radius Corporation, Korea Land & Housing Institute

Research Assistant
Mar. 2016 - Feb. 2018

Seoul National University

- Designed a real-time relocation strategy for one-way car-sharing and developed an event-based simulation for one-way car-sharing services **(Sponsor: National Research Foundation of Korea)**
- Led a study on improving demand-responsive transport services for the disabled with shared mobility in Seoul **(Sponsor: T-Money Welfare Foundation, South Korea)**
- Developed an evaluation method to evaluate drivers' behaviors with surrogate safety measures **(Sponsor: Ministry of Land, Infrastructure and Transport, South Korea)**
- Collaborated and coordinated with faculty members, businessmen, and researchers at the Korea Transport Institute, Korea Transportation Safety Authority, and InnoSim

Publications

In Review

2. **Ka, E.**, Xue, J., Leclercq, L, and Ukkusuri. S. V. (TBD).PIML-GBM: A Physics-Informed Machine Learning for Estimating Traffic State with a Generalized Bathtub Model in Large-scale Urban Networks. *Transportation Science*. .
1. Xue, J., **Ka, E.**, and Ukkusuri. S. V. (TBD). Network Macroscopic Fundamental Diagram-Informed Graph Learning for Traffic State Imputation. *ISTTT25: 25th International Symposium on Transportation and Traffic Theory*, Ann Arbor, Michigan, United States. .

Refereed Journal Publications

3. **Ka, E.**, Sharma, S., and Ukkusuri, S. V. (2022). Leveraging Location-Based Data for Assessing Network-Level Traffic Impact of Lane Management: A Case Study of Alex Fraser Bridge. *Journal of Transportation Engineering, Part A: Systems*, 148(12), 04022105. **[2022 Editor's Choice Collections]**. `https://doi.org/10.1061/JTEPBS.0000760`
2. **Ka, E.**, Kim, D. G., Hong, J., and Lee, C. (2020). Implementing surrogate safety measures in driving simulator and evaluating the safety effects of simulator-based training on risky driving behaviors. *Journal of advanced transportation*, 2020. . `https://doi.org/10.1155/2020/7525721`
1. Lee, D., Hwang, S., **Ka, E.**, and Lee, C. (2018). Evaluation of the rain effects on gap acceptance behavior at roundabouts by a logit model. *Journal of Advanced Transportation*, 2018. . `https://doi.org/10.1155/2018/2726732`

Refereed Conference Proceedings

9. **Ka, E.**, Ka, D., Jung, Y., and Lee, C. (2020). A Cluster-Based Route Design of Multi-Capacity Vehicle in Large-Scale Demand Responsive Transport Service for the Disabled. *99th Annual Meeting of the Transportation Research Board*, Washington DC, United States. .
8. **Ka, E.**, Hong, D., Na, Y., and Lee, C. (2018). Analysis of Status in DRT Service for the Disabled in Seoul and Comparison Domestic and Foreign Cases. *International Conference for Road Engineers*, Jeju, South Korea. .
7. Hong, D., **Ka, E.**, Ha, S., and Lee, C. (2018). Selection of Appropriate Hyperparameter for Waiting Time Prediction Model for Demand Responsive Transport for the Disabled in Seoul Using Long Short-Term Memory (LSTM) Network. *78th Korean Society of Transportation Conference*, Wonju, South Korea. **[Outstanding Paper Award]**.
6. **Ka, E.**, Ha, S., Hong, J., and Lee, C. (2017). Application of Deep Learning for Demand Forecasting of Call Taxi for the Handicapped in Seoul. *77th Korean Society of Transportation Conference*, Seoul, South Korea. .
5. **Ka, E.**, Kim, S., Hong, J., and Lee, C. (2017). A Preliminary Study of Comparison with Lane Changing Model Parameters in Merging Area between Normal and Raining Conditions. *12th International Conference of Eastern Asia's Society for Transportation Studies (EASTS)*, Ho Chi Minh, Vietnam. .
4. **Ka, E.**, Woo, D., and Lee, C. (2016). The Importance of Demand Prediction for Vehicle Relocation Strategy Development in One-way Car-sharing System. *3rd International Conference on Computational Science and Engineering*, Ho Chi Minh, Vietnam. .
3. **Ka, E.**, Kim, S., Woo, D., and Lee, C. (2016). An Estimation of Critical Gap for Gap Acceptance Model Applied to Lane Change of Surrounding Vehicles in Driving Simulator. *2016 Fall Korea Institute of ITS Conference*, Jeju, South Korea. .
2. **Ka, E.**, Lee, S., Lee, J., and Lee, C. (2016). Comparison of Survival Model of Traffic Flow Deterioration due to Traffic Accident according to VDS Aggregation Level. *75th Korean Society of Transportation Conference*, Busan, South Korea. .

1. Lee, S., Lee, H., Lee, J., **Ka, E.**, and Lee, C. (2016). Analysis of Traffic Flow Impacts of Highway Traffic Accidents Using Survival Analysis. *74th Korean Society of Transportation Conference*, Jeju, South Korea. **[Outstanding Paper Award]**.

Awards, Fellowships, & Grants

Outstanding Paper Award *Mar. 10, 2018*
78th Conference of Korean Society of Transportation, Korean Society of Transportation

Lecture & Research Scholarship *$ 4,500* *Sep. 2016 - Feb. 2017*
Department of Civil and Environmental Engineering, Seoul National University

Brain Korea 21 Plus Scholarship *$ 2,400* *Mar. 2016 - Aug. 2016*
National Research Foundation of Korea

Need-based Scholarship *$ 500* *Mar. 01, 2016*
Department of Civil and Environmental Engineering, Seoul National University

Outstanding Paper Award *Feb. 19, 2016*
74th Conference of Korean Society of Transportation, Korean Society of Transportation

Alumni Association Scholarship *$ 3,000* *Oct. 25, 2015*
Alumni Association of Department of Civil Engineering, Seoul National University

Bronze Award *$ 400* *June 17, 2013*
6th Science and Technology Writing Excellent Research Paper Presentation Competition, College of Engineering, Seoul National University

Teaching & Mentoring Experience

Teaching Assistant *Jan. 2021 - Present*
Lyles School of Civil Engineering, Purdue Univeristy
- CE 597 - Netowrk Models for Connected Autonomous Vehicles (Spring 2022, Fall 2021)
- CE 597 - Smart Logistics (Fall 2021, Graduate)
- CE 597 - Data Science for Smart Cities - CE597 (Spring 2021, Graduate), [link]

Lecturer *Nov. 2019*
Department of Civil and Environmental Engineering, Seoul National University
- Introduction to Civil and Environmental Engineering (Transportation Engineering)

Mentor *Aug. 2017, Feb. 2018*
College of Engineering, Seoul National University
- Youth Engineering Frontier Camp

Teaching Assistant *Sep. 2016 - Dec. 2017*
Department of Civil and Environmental Engineering, Seoul National University
- Sustainable Transportation Systems (Fall 2017, Undergraduate)
- Advanced Transportation Operation (Spring 2017, Graduate)
- Leadership for Civil Engineers (Spring 2017, Undergraduate)
- Introduction to Transportation Engineering (Fall 2016, Undergraduate)

Professional Activities

Referee Service

- Journal Referee:
  Journal of Transportation Engineering, Part A: Systems
- Conference Referee:
  Transportation Research Board; ISTTT25 (Co-reviewer)

Extracurricular Activities

Leader *Mar. 2016 - Feb. 2017 & Mar. 2009 - Feb. 2011*

Campus Ministry in Seoul, South Korea, Youth With A Mission (YWAM)

Leader of a Voluntary Team *Jan. 2012*

Project for Improvement of Drinking Water in Tanzania, Serving Friends International (Non-governmental organization)

Sergeant *Feb. 2014 - Nov. 2015*

MND Service Support Corps, Republic of Korea Army (ROKA)

Skills

Programming

Python (w/ TensorFlow, PyTorch, Keras, PySpark, and GeoPandas): Machine learning and deep learning models based on TensorFlow, Pytorch, and Keras; Massive data (e.g., mobile phone location data) preprocessing for trip data extraction based on PySpark and GeoPandas

R: Time-series analysis; Data preprocessing; Data clustering; Data visualization; Discrete choice modeling; and Statistical analysis

Java (w/ CPLEX): Agent-based simulation (demand responsive transport services); Event-based simulation (one-way car-sharing services); Optimization models using the API of CPLEX

Software

MATLAB, CPLEX, SPSS, NLOGIT, TransCAD, VISSIM, LaTex, Windows, Linux (Ubuntu), and Mac OS