Seongjin Choi

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EDUCATION

- **Korea Advanced Institute of Science and Technology**　　Daejeon, South Korea
  Doctor of Philosophy in Civil and Environmental Engineering　　*Mar. 2017 – Aug. 2021*
  Dissertation: Deep-Learning based Urban Vehicle Trajectory Analytics　　*Supervisor: Hwasoo Yeo*

- **Korea Advanced Institute of Science and Technology**　　Daejeon, South Korea
  Master of Science in Civil and Environmental Engineering　　*Sep. 2015 – Feb. 2017*
  Thesis: Development of Simulation-based Lane Change Control for Autonomous Vehicles　　*Supervisor: Hwasoo Yeo*

- **Korea Advanced Institute of Science and Technology**　　Daejeon, South Korea
  Bachelor of Science in Civil and Environmental Engineering　　*Feb. 2011 – Aug.2015*

CAREER

- **(Upcoming) Assistant Professor**
  University of Minnesota, Twin Cities
  Department of Civil, Environmental, and Geo- Engineering　　University of Minnesota
  　　Jan. 2024 –

- **Postdoctoral Researcher at Smart Transportation Lab**
  Fully funded from McGill University
  Supervised by Prof. Lijun Sun　　McGill University

  ○ **Project**: *Bridging Data-Driven and Behavioral Models for Transportation (IVADO)*
  Responsibility: *Spatiotemporal Forecasting, Spatiotemporal Residual Correction, Multi-agent reinforcement learning for cooperative adaptive cruise control (CACC), Deep Generative Models*　　*Jan. 2022 – Dec. 2023*
  Collaboarators: *Prof. Nicolas Saunier (Polytechnique Montreal), Professor Martin Trepanier (Polytechnique Montreal), Professor Fracesco Ciari (Polytechnique Montreal)*

- **Postdoctoral Researcher at AIxMobility Lab**
  Fully funded from KAIST
  Supervised by Prof. Hwasoo Yeo　　KAIST

  ○ **Project**: *Development of Multi-level Traffic Simulation for C-ITS and CAV*
  Responsibility: *Designing overall system architecture and data structure, Developing core functions including lane-changing-model and car-following-model, Deploying cloud-based simulator using Microsoft Azure, Developing scenario generator based on real-time data collected in Sejong city*
  Collaboarators: *Dr. Sehyun Tak (Korea Transport Institute), Dr. Donghoun Lee (Korea Transport Institute)*　　*Sep. 2021 - Nov. 2021*

  ○ **Project**: *Development of Cloud-based Demand-Responsive Routing System*
  Responsibility: *Designing cloud system architecture on Microsoft Azure, Optimizing computation for real-time applications*

- **Visiting scholar at the University of Queensland**
  Funded from BK21+ (Brain Korea 21 Plus)
  Supervised by Prof. Jiwon Kim　　University of Queensland

  ○ **Project**: *Deep learning applications in urban vehicle trajectory analytics*
  Responsibility: *Research conceptualization, Problem design, model development, result analysis, writing and editing*　　*May. 2017 – Aug. 2017*
  Achievements: *2 journal papers, 2 conference presentations*　　*Sep. 2018 – Nov. 2018*

Research Interests

- Urban Mobility Data Analytics

- Spatiotemporal Data Modeling

- Deep Learning & Artificial Intelligence

- Connected Automated Vehicles & Cooperative-ITS

- Sustainable and Integrated Future Transportation System

Selected Publications

[S1] **Choi, Seongjin**, and Jinwoo Lee. "Optimal planning of parking infrastructure and fleet size for Shared Autonomous Vehicles." *Transportation Research Part E: Logistics and Transportation Review*, 176, (2023): 103213. [**JCR Q1; IF=10.6**]

[S2] **Choi, Seongjin***, Donghoun Lee*, Sari Kim and Sehyun Tak. "Framework for Connected and Automated Bus Rapid Transit with Sectionalized Speed Guidance based on Deep Reinforcement Learning: Field Test in Sejong City." *Transportation Research Part C: Emerging Technologies*, 148, (2023): 104049. [**JCR Q1; IF=8.3**]

[S3] **Choi, Seongjin**, Nicolas Saunier, Martin Trepanier, and Lijun Sun. "Spatiotemporal Residual Regularization with Kronecker Product Structure for Traffic Forecasting." *Thirty-sixth Conference on Neural Information Processing Systems (NeurIPS 2022), Workshop on Gaussian Processes, Spatiotemporal Modeling, and Decision-making Systems* (December 2022).

[S4] Jin, Zhixiong, Jiwon Kim, Hwasoo Yeo, and **Seongjin Choi**[†]. "Transformer-based map-matching model with limited labeled data using transfer-learning approach." *Transportation Research Part C: Emerging Technologies*, 140, (2022) 103668.[**†Corresponding author**][**JCR Q1; IF=8.3**]

[S5] **Choi, Seongjin**, Jiwon Kim, and Hwasoo Yeo. "TrajGAIL: Generating Urban Vehicle Trajectories using Generative Adversarial Imitation Learning." *Transportation Research Part C: Emerging Technologies*, 128, (2021): 103091. [**JCR Q1; IF=8.3**]

[S6] **Choi, Seongjin**, Hwasoo Yeo, and Jiwon Kim. "Network-wide Vehicle Trajectory Prediction in Urban Traffic Networks Using Deep Learning" *Transportation Research Record* 2672.45 (2018): 173-184. [**JCR Q3; IF=1.7**]

Professional Services

- **Editorial Member**
  Journal of Korean Society of Transport   *2023-present*

- **Guest Editor**
  Journal of Advanced Transportation (Special Issue)
  Advanced Data Intelligence Theory and Practice in Transportation 2023   *2023-present*

- **Reviewer**
  Transportation Research Part C: Emerging Technologies
  IEEE Transactions on Intelligent Transportation Systems
  IEEE Open Journal of Intelligent Transportation Systems
  Scientific Data
  Transportation Research Records
  Energy
  Physica A: Statistical Mechanics and its Applications
  Sensors
  IEEE International Conference on Intelligent Transportation Systems
  IEEE Intelligent Vehicles Symposium
  Transportation Research Board Annual Meeting

Teaching Experience

- **Guest Lecturer**   McGill University
  Spatiotemporal Data Mining (CIVE650) - Fall 2022
  Graduate course - Introduction to Deep Learning

- **Guest Lecturer**   McGill University
  Traffic Engineering and Simulation (CIVE440) - Fall 2022
  Undergraduate course - Car following models and microscopic simulation

- **Guest Lecturer**   KAIST
  Transportation System Analysis and Operations (CE547) - Fall 2020
  Graduate course - Urban Trajectory Analytics

- **Counseling Assistant**   KAIST
  Department of Civil and Environmental Engineering - Spring 2018
  Undergraduate/Graduate student counseling

- **Teaching Assistant**   KAIST
  Introduction to Transportation System Engineering (CE350) - Spring 2016
  Intelligent U-Space Transportation Systems (CE563) - Fall 2017
  Transportation System Analysis and Operations (CE547) - Spring 2018

Full List of Publications

— International Journal

[J1] **Choi, Seongjin**, and Jinwoo Lee. "Optimal planning of parking infrastructure and fleet size for Shared Autonomous Vehicles." *Transportation Research Part E: Logistics and Transportation Review*, 176, (2023): 103213. [**JCR Q1; IF=10.6**]
- https://doi.org/10.1016/j.tre.2023.103213

[J2] **Choi, Seongjin***, Donghoun Lee*, Sari Kim and Sehyun Tak. "Framework for Connected and Automated Bus Rapid Transit with Sectionalized Speed Guidance based on Deep Reinforcement Learning: Field Test in Sejong City." *Transportation Research Part C: Emerging Technologies*, 148, (2023): 104049. [**JCR Q1; IF=8.3**]
- https://doi.org/10.1016/j.trc.2023.104049

[J3] Jin, Zhixiong, Jiwon Kim, Hwasoo Yeo, and **Seongjin Choi**[†]. "Transformer-based Map-Matching Model with Limited Labeled Data using Transfer-Learning Approach." *Transportation Research Part C: Emerging Technologies*, 140, (2022) 103668.[[†]**Corresponding author**][**JCR Q1; IF=8.3**]
- https://doi.org/10.1016/j.trc.2022.103668

[J4] Tak, Sehyun and **Seongjin Choi**[†]. "Safety Monitoring System of CAVs Considering the Trade-off Between Sampling Interval and Data Reliability." *Sensors*, 22(10), 3611 (2022). [[†]**Corresponding author**][**JCR Q2; IF=3.9**]
- https://doi.org/10.3390/s22103611

[J5] **Choi, Seongjin**, Jiwon Kim, and Hwasoo Yeo. "TrajGAIL: Generating Urban Vehicle Trajectories using Generative Adversarial Imitation Learning." *Transportation Research Part C: Emerging Technologies*, 128, (2021): 103091. [**JCR Q1; IF=8.3**]
- Source code available at [Github/benchoi93/TrajGAIL] — 43 stars and 9 forks
- https://doi.org/10.1016/j.trc.2021.103091

[J6] **Choi, Seongjin**, Hwasoo Yeo, and Jiwon Kim. "Network-wide Vehicle Trajectory Prediction in Urban Traffic Networks Using Deep Learning" *Transportation Research Record* 2672.45 (2018): 173-184. [**JCR Q3; IF=1.7**]
- https://doi.org/10.1177/0361198118794735

[J7] **Choi, Seongjin**, Jiwon Kim, and Hwasoo Yeo. "Attention-based recurrent neural network for urban vehicle trajectory prediction." *Procedia Computer Science* 151 (2019): 327-334.
- https://doi.org/10.1016/j.procs.2019.04.046

[J8] **Choi, Seongjin**, Jonghae Suh, and Hwasoo Yeo. "Microscopic Analysis of Climbing Lane Performance at Freeway Uphill Section." *Transportation Research Procedia* 21 (2017): 98-109.
- https://doi.org/10.1016/j.trpro.2017.03.081

[J9] Lee, Donghoun, Sehyun Tak, **Seongjin Choi**, and Hwasoo Yeo. "Development of risk predictive collision avoidance system and its impact on traffic and vehicular safety." *Transportation Research Record* 2673.7 (2019): 454-465. **[JCR Q3; IF=2.019]**
- https://doi.org/10.1177/0361198119836972

[J10] Kim, Yeeun, **Seongjin Choi**, and Hwasoo Yeo. "Extended Urban Cell Transmission Model Using Agent-based Modeling." *Procedia Computer Science* 170 (2020): 354-361.
- https://doi.org/10.1016/j.procs.2020.03.058

[J11] Kim, Yeeun, **Seongjin Choi**, Jihyuk Park, and Hwasoo Yeo. "Agent-based Mesoscopic Urban Traffic Simulation based on Multi-lane Cell Transmission Model." *Procedia Computer Science* 151 (2019): 240-247.
- https://doi.org/10.1016/j.procs.2019.04.035

— PEER-REVIEWED INTERNATIONAL CONFERENCE

[C1] **Choi Seongjin**, and Jinwoo Lee. "Analytical Parking Planning Model with Shared Autonomous Vehicles" *The 102nd Transportation Research Board Annual Meeting* (January 2023).

[C2] Lin Tengfeng, **Seongjin Choi**, Zhixiong Jin, and Hwasoo Yeo. "Evaluation of Pedestrian's Potential Risk at Non-signalized Intersection Based on Predicted Post-Encroachment Time using Deep Learning Methods" *The 102nd Transportation Research Board Annual Meeting* (January 2023).

[C3] **Choi, Seongjin**, Nicolas Saunier, Martin Trepanier, and Lijun Sun. "Spatiotemporal Residual Regularization with Kronecker Product Structure for Traffic Forecasting." Thirty-sixth Conference on Neural Information Processing Systems (NeurIPS 2022), Workshop on Gaussian Processes, Spatiotemporal Modeling, and Decision-making Systems (December 2022).

[C4] Lin Tengfeng, Zhixiong Jin, **Seongjin Choi**, and Hwasoo Yeo. A Framework for Pedestrian Sub-classification and Arrival Time Prediction at Signalized Intersection Using Preprocessed Lidar Data. *The 101st Transportation Research Board Annual Meeting* (January 2022).

[C5] Jin Zhixiong, **Choi, Seongjin**, and Hwasoo Yeo. Transformer-based Map Matching with Model Limited Ground-Truth Data using Transfer-Learning Approach. *TRB 2022 Annual Meeting* (January 2022).

[C6] **Choi, Seongjin**, Jiwon Kim, Min Ju Park, and Hwasoo Yeo. TrajGAIL: Generating Urban Trajectories using Generative Adversarial Imitation Learning. *The 100th Transportation Research Board Annual Meeting* (January 2021).

[C7] **Choi, Seongjin**, Hwasoo Yeo, and Jiwon Kim. Incorporating Network Traffic State for Urban Vehicle Trajectory Prediction. *The 99th Transportation Research Board Annual Meeting* (January 2020).

[C8] **Choi, Seongjin**, Jiwon Kim, Hwapyeong Yu, and Hwasoo Yeo. "Real-time Prediction of Arterial Vehicle Trajectories: An Application to Predictive Route Guidance for an Emergency Vehicle." *2019 IEEE Intelligent Transportation Systems Conference (ITSC)*. IEEE, (Oct 2019).

[C9] Kim, Yeeun, **Seongjin Choi**, Jihyuk Park, and Hwasoo Yeo. Agent-based Mesoscopic Urban Traffic Simulation based on Multi-lane Cell Transmission Model. *The 10th International Conference on Ambient Systems, Networks and Technologies*. Acadia University, (May 2019).

[C10] **Choi, Seongjin**, Jiwon Kim, and Hwasoo Yeo. Attention-based Recurrent Neural Network for Urban Vehicle Trajectory Prediction. *The 10th International Conference on Ambient Systems, Networks and Technologies*. Acadia University, (May 2019).

[C11] Lee, Donghoun, Sehyun Tak, **Seongjin Choi**, and Hwasoo Yeo. Development of risk predictive collision avoidance system and its impact on traffic and vehicular safety. *The 98th Transportation Research Board Annual Meeting* (January 2019).

[C12] Kim, Yeeun, **Seongjin Choi**, and Hwasoo Yeo. Incorporation of Driver Distraction in Car-following model based on Driver's Eye Glance Behavior. *2018 21st International Conference on Intelligent Transportation Systems (ITSC)*. IEEE, (October 2018).

[C13] **Choi, Seongjin**, Hwasoo Yeo, and Jiwon Kim. Network-wide Vehicle Trajectory Prediction in Urban Traffic Networks Using Deep Learning. *The 97th Transportation Research Board Annual Meeting* (January 2018).

[C14] **Choi, Seongjin**, Sehyun Tak, Jihu Kim, and Hwasoo Yeo. Traffic Event Classification using Convolutional Neural Network. *The 30th KKHTCNN Symposium on Civil Engineering* (November 2017).

[C15] Tak, Sehyun, Hwasoo Yeo, Yeeun Kim and **Seongjin Choi**. A Study on the Dynamics of Driver Vision Transitions and its Impacts on Vehicle Safety. *10th SHRP 2 Safety Data-Symposium: From Analysis to Results* (October 2017)

[C16] Tak, Sehyun, Donghoun Lee, **Seongjin Choi**, and Hwasoo Yeo. Collision Avoidance System with Uni-directional Communication for Mitigating the Adverse Effects on Following Vehicles. *Urban Transport 2017* (September 2017)

[C17] **Choi, Seongjin**, and Hwasoo Yeo. Framework for simulation-based lane change control for autonomous vehicles. Intelligent Vehicles Symposium (IV), 2017 IEEE (June 2017).

[C18] Tak, Sehyun, **Seongjin Choi**, Donghoun Lee, and Hwasoo Yeo. A Comparison Analysis of Track-Based Train Operation System and Communication-Based Train Operation System for Train Safety. *The 96th Transportation Research Board Annual Meeting* (January 2017).

[C19] Tak, Sehyun, **Seongjin Choi**, and Hwasoo Yeo. The Effect of Communication and GPS Uncertainty on Safety Performance of Communication-based Train Control. *The 1st Asian Conference on Railway Infrastructure and Transportation*, 359 (October 2016).

[C20] **Choi, Seongjin**, Jonghae Suh, and Hwasoo Yeo. Microscopic Analysis of Climbing Lane Performance at Freeway Uphill Section. *2016 International Symposium of Transport Simulation* (June 2016)

— Korean Domestic Journal

[K1] **Choi, Seongjin**, Jiwon Kim, Hwapyeong Yu, Dongho Ka, and Hwasoo Yeo. "Deep-learning based urban vehicle trajectory prediction." *Journal of Korean Society of Transportation* 37.5 (2019): 422-429.

[K2] Kim, Yeeun, **Seongjin Choi**, and Hwasoo Yeo. "A study on development of a car-following model for accident simulation caused by driver distraction." *Journal of Korean Society of Transportation* 37.1 (2019): 39-50.

[K3] Suh, Jonghae, **Seongjin Choi**, and Hwasoo Yeo. "A Study on Climbing Lane in Freeway Uphill Segment by Developing a Microscopic Traffic Simulation Model" *Journal of Korean Society of Transportation* 36.4 (2018): 263-273

Invited Talks

- **Deep Generative Models Tutorial** — KAIST
  Virtual — 2023.11.02
- **Deep Generative Models for Mobility Trajectory Data** — Western University
  London, Canada — 2023.08.02
- **Learning the Distribution of Traffic and Mobility Data** — KAIST
  Daejeon, South Korea — 2023.05.31
- **Learning the Distribution of Traffic and Mobility Data** — Seoul National University
  Seoul, South Korea — 2023.05.23
- **Deep Generative Models for Transportation and Mobility Data** — 2022 Future-Shaping ACE Congress
  Virtual — 2022.11.21
- **Trending Research Topics in AI and Potential Applications in Transportation Domain: (Part 2) Representation Learning** — Korea Transport Institute
  Virtual — 2022.11.01
- **Trending Research Topics in AI and Potential Applications in Transportation Domain: (Part 1) Deep Generative Models** — Korea Transport Institute
  Virtual — 2022.09.27
- **Modeling Behaviors of Road Users by Imitation Learning** — Korean Society of Road Engineers
  Seoul, South Korea — 2021.11.19

Awards & Scholarships

- **TRANSFOR22 Data Competition - 3rd place** — Award
  TRB AED50 Artificial Intelligence and Advanced Computing Applications — 2022
- **BK21 PLUS (Brain Korea 21 PLUS) Long-term Overseas Training Program (University of Queensland)** — Scholarship
  Korea Advanced Institute of Science Technology — 2017
- **National Scholarship (Fully-Funded Doctoral Course)** — Scholarship
  Korea Advanced Institute of Science Technology — 2017-2021
- **Railroad Specialized Graduate School Scholarship** — Scholarship
  Ministry of Land, Infrastructure, and Transport in Republic of Korea — 2015-2017
- **National Scholarship (Fully-Funded Master Course)** — Scholarship
  Korea Advanced Institute of Science Technology — 2015-2017
- **National Scholarship (Fully-Funded Bachelor Course)** — Scholarship
  Korea Advanced Institute of Science Technology — 2011-2015

Patents (Domestic in Korea)

- **10-22795860000: Server and Method for Managing Shared Autonomous Vehicles**
  A management method for shared autonomous vehicles. This method proposes a demand-predictive management system for shared autonomous vehicles. It covers from the prediction algorithm and server framework to handle real-time data to predict the demand hot-spots to the route planning algorithm based on Artificial Intelligence.

- **10-2018-0141857: Traffic Simulator for Evaluation of ITS systems**
  A hybrid traffic simulator that can simulate the urban traffic networks in both mesoscopic and microscopic scales. This simulator uses distributed computing to simulate multiple scenarios in small amount of time, and aims to be applied to many applications such as route optimization of shared autonomous vehicles and signal control based on reinforcement learning.

Research Projects (As a Project Manager)

- **Development of Cloud-based Traffic Prediction Simulation Software for Solving Urban Traffic Problems**
  Project Manager — *developed cloud-based traffic simulation system for short-term and long-term traffic prediction.* — 2017 - 2018

- **Development of Behavior model for Cooperative Autonomous Vehicle Simulation and Demand-Responsive Routing Algorithm**
  Project Manager — *developed a hybrid traffic simulator combining microscopic and mesoscopic scales, participated in developing hierarchical demand-responsive routing algorithm for autonomous public transit system, and worked as team leader to communicate with other institutions.* *2019 - 2021*

Research Projects (As a Researcher)

- **Study on the Climbing Lane Type and Establishment of Dynamic Operation**
  Researcher — developed microscopic simulation considering behaviors of HOV *2015*

- **Development of Shared Autonomous Vehicle based Traffic System for Smart City**
  Researcher — developed mesoscopic simulation and autonomous vehicle management system *2016 - 2017*

- **Development of Machine-Learning & Simulation based Prediction Methodology**
  Researcher — developed CNN-based traffic incident detection and simulation-based traffic prediction method *2017 - 2018*

- **Development of DQN Reinforcement Learning based Intelligent Signalized Intersection Interlocking control technology**
  Researcher — Basic analysis and participated in implementing DQN reinforcement learning *2018*

- **Development of Large Scale Traffic Signal Control System based on AI for Metropolitan Area**
  Researcher — Basic analysis and participated in developing signal control coordination system *2018*

Programming Skills

- **Programming Languages**: Python, R, C++, Julia

- **Deep learning**: Pytorch, Tensorflow

- **Other skills**: Microsoft Azure, Docker, QGIS