Sevin Mohammadi

Columbia University
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U.S. Permanent Resident
(Green Card Holder)

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EXPERTISE

Data Science | **Applied Machine Learning** | **Predictive Analytics** | **Bayesian Learning** | **Reinforcement Learning** | **Sequential Data Modeling**

EDUCATION

Ph.D. in Engineering, GPA 4.06/4.00
Columbia University, NY (Jan '20 to Dec '24)
Thesis: Probabilistic Machine Learning for Travel Time and Trajectory Modeling and Decision-making.

M.S. in Engineering, GPA 3.9/4.0
University of Tennessee Knoxville (UTK), TN (Aug '17 to Dec '19)
Project: "Study of Driving Volatility in Connected and Cooperative Vehicle Systems" funded by NSF.

WORK EXPERIENCE

- **Center for Smart Streetscapes**, *Researcher & Student Leadership Council* (Aug '23 to present)

  Research Area: Geospatial Data Science & Deep Learning
  - Engineered a Transformer-based surrogate model with a Sequence-to-Sequence architecture, inspired by LLMs, to match noisy GPS trajectories to digital road maps. Delivered an 85% accuracy, surpassing 77% accuracy of state-of-the-art rule-based models.

  Leadership: Institution Representative
  - Promoted Center for Smart Streetscapes by organizing events & communicating its mission to public.

- **Smart Cities Research Center**, *Researcher* (Jan '20 to Aug '23)

  Research Area: Optimizing Emergency Response with Data Analytics & Simulation
  - Developed and deployed a data-driven methodology with uncertainty quantification, substantially reducing ambulance response times by 1:13 to 2:13 across varying care needs within New York City's response system.
  - Developed predictive models for ambulance travel time using Bayesian Neural Networks and Hierarchical Bayesian learning, achieving superior accuracy and interpretability, outperforming NGBoost and Random Forest models.
  - Designed a dynamic heuristic-based ambulance dispatching policy, integrating simulation with reinforcement learning, and obtained superior performance over classic greedy policy.

- **Center for Transportation Research**, *Researcher* (Aug '18 to Dec '19)

  Research Area: Data-driven Analysis of Human Driving Behavior
  - Discovered empirical evidence of social interactions among drivers affecting microscopic driving behavior through the analysis of 151 million rows of time series data.
  - Identified correlations of environmental factors with such behavior using a random parameter binary logit model.

SKILLS

Programming: Python, SQL, R | **Data Science Libraries:** NumPy, Pandas, GeoPandas, Scikit-learn, TensorFlow, Pytorch, PyMC3 | **Others:** Git, Shell

COURSEWORK

Bayesian Machine Learning | Causal Inference for Data Science | Statistical Inference | Uncertainty & Risk | Data Analysis & Modeling | Signal Processing & Noise | Deep Learning | Reinforcement Learning | Infrastructure Systems Optimization | Transportation Analytics & Logistics | Big Data in Transportation

Journal Publications

[1] **S. Mohammadi**, A. Smyth, "Surrogate Modeling of Trajectory Map-matching in Urban Road Networks using Transformer Seq2seq Model," IEEE Intelligent Transportation Systems, *revision submitted*, 2024.

[2] **S. Mohammadi**, A. Olivier, A. Smyth, "Dynamic penalty-based dispatching decision-making for improved EMS response in urban environments: a heuristic approach," Sustainable Cities and Society, *under review*, 2024.

[3] **S. Mohammadi**, A. Olivier, A. Smyth, "Probabilistic Prediction of Trip Travel Time and its variability using Hierarchical Bayesian Learn- ing," Journal of Risk and Uncertainty in Engineering Systems, 2023.

[4] A. Olivier, **S. Mohammadi**, A. Smyth, "Bayesian Neural Networks with Physics-Aware Regularization For Travel Time Modeling from Imbalanced Data," Computer-Aided Civil Infrastructure Engineering, 2023.

[5] A. Olivier, M. Adams, **S. Mohammadi**, A. Smyth, "Data Analytics for Improved Closest Hospital Suggestion for EMS Operations in NYC," Sustainable Cities and Society, 2022.

[6] E. L. de Larrea, H. Lam, E. Sanabria, J. Sethuraman, **S. Mohammadi**, A. Olivier, A. Smyth et al., "Simulating NYC Hospital Load Balancing During COVID-19," IEEE: Winter Simulation Conference, 2021.

[7] E. Sanabria, H. Lam, E. L. de Larrea, J. Sethuraman, **S. Mohammadi**, A. Olivier, A. Smyth et al., "Short-term Adaptive Emergency Call Volume Prediction," IEEE: Winter Simulation Conference, 2021.

[8] **S. Mohammadi**, R. Arvin, et al., "The Role of Drivers' Social Interactions in their Driving Behavior: Empirical Evidence and Implication for Traffic Flow," Transportation Research Part F: Traffic Psychology & Behavior, 2021.

[9] A. Khattak, I. Mahdinia, **S. Mohammadi**, A. Mohammadnazar, B. Wali, "Big Data Generated by Connected and Automated Vehicles for Safety Monitoring, Assessment and Improvement," arXiv: Computers and Society, 2019.

Presentations

[1] "Dynamic Penalty-based Dispatching for Optimal EMS Response Times: A Heuristic Approach," INFORMS Annual Meeting, Washington, Seattle, 2024.

[2] "Enhancing Smart City Mobility on Urban Road Networks with Neural Network-Based Map-Matching of GPS Trajectory Data," Columbia University Data Science Day, New York City, 2023.

[3] "Optimizing Ambulances Hospital Transports in New York City," Columbia University Data Science Day, New York City, 2021.

[4] "Social Influence on Driver Decisions Using Modeling and Gossip Algorithms," Transportation Research Board Annual Meeting, Washington, DC, 2019.

Awards

- INFORMS Doing Good with Good O.R. Student Paper Competition Finalist, 2021
- Recipient of the New York Women in Transportation Leonard Braun Memorial Scholarship ($5000), 2022
- Selected for the Morgan Stanley Quantitative Finance Women's Ph.D. Mentorship Program, 2022
- Multiple NSF Conference Travel Awards

Mentorship

- Mentor of MY Streetscape 2023 Summer School for high school students:
  - Eunice Yanes, will be majoring in Engineering Physics at Fordham University
  - Christopher Grullon, currently a freshman at Columbia University Engineering

  Project title: Designing Safe Urban Traffic Intersections for Cyclists.
- Mentor of Columbia University 2023 Summer Undergraduate Research Experience Fellow:
  - Marylyn Carrillo, currently a senior student at the University of California, Los Angeles

  Project title: Manhattan in Motion: Visualizing Delivery Vehicle Crash Density for Safer Urban Mobility.

Outreach, Volunteering & Services

- Student Leadership Council for the Center for Smart Streetscapes, year 2023-24
- Girls' Science Day Volunteer at Columbia University, Spring 2023
- Vice President of Women's Transportation Seminar at UTK, Fall 2019
- Social Director of the Institute of Transportation Engineers at UTK, Spring 2019