

# LEI LIN

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## RESEARCH INTERESTS

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My research interests focus on data science, machine learning and deep learning models, as well as their applications in healthcare, intelligent transportation systems, and smart city.

## WORK EXPERIENCE

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- **Senior Research Scientist, University of Rochester**, September 2018 - Now.
- **Research Associate, Purdue University**, October 2017 - September 2018.
- **Research Scientist, Xerox/PARC**, February 2015 - September 2017.

## EDUCATION

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University at Buffalo, the State University of New York Ph. D. in Transportation Systems Engineering	Buffalo, NY <i>February 2015</i>
University at Buffalo, the State University of New York M. S. in Computer Science	Buffalo, NY <i>September 2014</i>
Beijing Jiaotong University M. S. in Systems Engineering	Beijing, China <i>June 2010</i>
Beijing Jiaotong University B. S. in Traffic and Transportation Engineering	Beijing, China <i>June 2008</i>

## DISSERTATION

Title: "Data Science Application in Intelligent Transportation Systems: An Integrative Approach for Border Delay Prediction and Traffic Accident Analysis"  
Advisor: Prof. Adel W. Sadek and Dr. Qian Wang

## FUNDED RESEARCH PROJECTS

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- **Heart Health Intelligence Biometric Identification.** Funded by HHI. March 2020 - May 2020. Principal Investigator (\$10,000).
- **Driving Behavior Analysis to Improve Fuel Efficiency for Commercial Trucks.** Funded by Vnomics. September 2019 - December 2019. Co-Principal Investigator with John Handley, Joseph Voelkel (\$65,000).
- **Advanced Modeling of Power System Dynamics using Machine Learning.** Funded by New York State Energy Research and Development Authority (NYSERDA). September 2019 - September 2020. Co-Principal Investigator with Beilei Xu, Wencheng Wu (\$300,000).

## RESEARCH PROJECTS PARTICIPATED

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- **Explainable Artificial Intelligence in Healthcare.** University of Rochester. September 2018 - September 2019  
- *Develop a novel Temporal Convolutional Neural Network with Hierarchical Attention Mechanism for Myotonia time series classification*

- **Compressive Sensing Approach for Connected Vehicle Data Capture and Recovery.** Purdue University. October 2017 - September 2018
  - Develop a novel Compressive Sensing based approach that can largely compress the connected vehicle data in real time and recover the raw signal accurately
  - Build a traffic simulation model that shows the proposed connected vehicle data collection approach can increase travel time estimation accuracy
- **Deep Learning-based Human-Driven Vehicle Trajectory Prediction.** Purdue University. October 2017 - September 2018
  - Propose a LSTM model with spatial-temporal attention mechanisms for vehicle trajectory prediction
  - The model shows state-of-the-art prediction accuracy and can capture the impact of historical trajectories and neighboring vehicles
- **Work Zone Travel Time Estimation and Prediction in a Connected Vehicle Ready System.** Palo Alto Research Center. September 2016 - September 2017
  - Develop work zone traffic simulation models using PARAMICS and SUMO
  - Determine optimal number and locations of roadside units (RSU)
  - Estimate and predict work zone travel time with Support Vector Regression model
- **Collaborative Optimization and Planning for Transportation Energy Reduction (COPTER).** Palo Alto Research Center. January 2016 - December 2016
  - Develop a subway simulation model in Los Angeles, which includes six lines and 86 stations
  - Generate second-by-second trajectory data for about 300,000 trips per weekday
- **Impact Evaluation of Inclement Weather on Transportation Systems using Novel Social Media Data.** University at Buffalo. October 2013 - February 2015
  - Demonstrate Twitter Weather Events Observation algorithm has high sensitivity and low false alarm rate
  - Incorporate Twitter weather variables in linear regression models
  - Improves the prediction accuracy of freeway traffic speed prediction
  - The Study was Reported by the Washington Post, the Weather Channel and 30 other Media Outlets
- **Exploring Novel Applications of Archived Transportation Data: Predicting Freeway Crash Risk, Border Crossing Delay and Inclement Weather Impacts.** University at Buffalo. April 2012 - October 2013
  - Develop a hybrid M5P tree and Hazard-based Duration Model for traffic accident duration prediction
  - Propose a variable selection algorithm based on FP tree for real-time traffic accident risk prediction
  - Employ community detection algorithm and association rule algorithm for traffic accident hotspot analysis
- **A Prototype Decision Support System for Optimally Routing Border Crossing Traffic Based on Predicted Border Crossing Times.** University at Buffalo. August 2010 - January 2012
  - Apply state-of-the-art machine learning models for short-term border crossing traffic prediction
  - Build a queueing model that can generate accurate waiting times given the predicted traffic volumes
  - Develop a smartphone app that can provide historical, current and future waiting times at the border
  - Develop a smartphone app "Toronto Buffalo Border Waiting" which is downloaded more than 650 times

## PUBLICATIONS

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### JOURNAL PAPERS

1. Shuyun Ren, Tsan-Ming Choi, Ka-Man Lee, and **Lei Lin**. "Intelligent Service Capacity Allocation for Cross-Border-E-Commerce Related Third-Party-Forwarding Logistics Operations: A Deep Learning Approach". *Transportation Research Part E: Logistics and Transportation Review* 134 (2020): 101834.
2. **Lei Lin**, Weizi Li, and Srinivas Peeta. "Efficient Data Collection and Accurate Travel Time Estimation in a Connected Vehicle Environment via Compressive Sensing". *Journal of Big Data Analytics in Transportation* 1 (2019): 95-107.
3. Shuyun Ren, Fengji Luo, **Lei Lin**, Shu-Chien Hsu, and Xuran Li. "A Novel Dynamic Pricing Scheme for a Large-scale Electric Vehicle Sharing Network Considering Vehicle Relocation and Vehicle-Grid-Integration". *International Journal of Production Economics* 218 (2019): 339-351.
4. Lishan Liu, Ning Jia, **Lei Lin**, and Zhengbing He. "A cohesion-based heuristic feature selection for short-term traffic forecasting." *IEEE Access* 7 (2019): 2169-3536.
5. **Lei Lin**, Zhengbing He, and Srinivas Peeta. "Predicting Station-level Hourly Demand in a Large-scale Bike-sharing Network: A Graph Convolutional Neural Network Approach." *Transportation Research Part C: Emerging Techniques* 97 (2018): 258-276.

6. **Lei Lin**, John Handley, Yiming Gu, Lei Zhu, Xuejin Wen, and Adel W. Sadek. “Quantifying Uncertainty in Short-term Traffic Prediction and its Application to Optimal Staffing Plan Development.” *Transportation Research Part C: Emerging Technologies* 92 (2018): 323-348.
7. Lei Zhu, Jeffrey Gonder, and **Lei Lin**. “Prediction of Individual Social-Demographic Role Based on Travel Behavior Variability Using Long-Term GPS Data.” *Journal of Advanced Transportation*, 2017.
8. **Lei Lin**, Qian Wang, and Adel W. Sadek. “A combined M5P tree and hazard-based duration model for predicting urban freeway traffic accident durations.” *Accident Analysis & Prevention* 91 (2016): 114-126.
9. **Lei Lin**, Qian Wang, and Adel W. Sadek. “A novel variable selection method based on frequent pattern tree for real-time traffic accident risk prediction.” *Transportation Research Part C: Emerging Technologies* 55 (2015): 444-459.
10. **Lei Lin**, Ming Ni, Qing He, Jing Gao, and Adel W. Sadek. “Modeling the impacts of inclement weather on freeway traffic speed: exploratory study with social media data.” *Transportation Research Record: Journal of the Transportation Research Board* 2482 (2015): 82-89.
11. **Lei Lin**, Qian Wang, and Adel Sadek. “Data mining and complex network algorithms for traffic accident analysis.” *Transportation Research Record: Journal of the Transportation Research Board* 2460 (2014): 128-136.
12. **Lei Lin**, Qian Wang, and Adel W. Sadek. “Border crossing delay prediction using transient multi-server queueing models.” *Transportation Research Part A: Policy and Practice* 64 (2014): 65-91.
13. **Lei Lin**, Qian Wang, Shan Huang, and Adel W. Sadek. “On-line prediction of border crossing traffic using an enhanced Spinning Network method.” *Transportation Research Part C: Emerging Technologies* 43 (2014): 158-173.
14. **Lei Lin**, Qian Wang, and Adel W. Sadek. “Short-term forecasting of traffic volume: evaluating models based on multiple data sets and data diagnosis measures.” *Transportation Research Record* 2392 (2013): 40-47.

## CONFERENCE PAPERS

15. Trevor Richardson, Wencheng Wu, **Lei Lin**, Beilei Xu, and Edgar Bernal. “MCFlow: Monte Carlo Flow Models for Data Imputation.” *2020 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, June 16-18, 2020, Seattle, Washington, USA.
16. Tianjie Cheng, Beilei Xu, Wencheng Wu, **Lei Lin**, Trevor Richardson, and Edgar Bernal. “An Unsupervised Machine Learning Framework for Parkinson’s Disease Progression Analysis and Subtyping.” *IEEE EMB Special Topic Conference on Healthcare Innovations and Point-of-Care Technologies*, November 20-November 22, 2019, Bethesda, MD, USA.
17. **Lei Lin**, Beilei Xu, Wencheng Wu, Trevor Richardson, and Edgar Bernal. “Deep Metric Learning with Triplet Networks: Application to Hand-grip Myotonia Quantification.” *IEEE EMB Special Topic Conference on Healthcare Innovations and Point-of-Care Technologies*, November 20-November 22, 2019, Bethesda, MD, USA.
18. **Lei Lin**. “Vehicle Trajectory Prediction Using LSTMs with Spatial-Temporal Attention Mechanisms.” *The 5th Annual Symposium on Transportation Informatics*. August 8, 2019, University at Buffalo, USA.
19. **Lei Lin**, Beilei Xu, Wencheng Wu, Trevor Richardson, and Edgar Bernal. “Medical Time Series Classification with Hierarchical Attention-based Temporal Convolutional Networks: A Case Study of Myotonic Dystrophy Diagnosis.” *The IEEE Conference on Computer Vision and Pattern Recognition (CVPR) Workshops-Explainable AI*, June 16-June 20, 2019, Long Beach, CA, USA.
20. Tao Li, and **Lei Lin**. “AnonymousNet: Natural face de-identification with measurable privacy.” *The IEEE Conference on Computer Vision and Pattern Recognition (CVPR) Workshops-Challenges and Opportunities for Privacy and Security*, June 16-June 20, 2019, Long Beach, CA, USA.
21. Trevor W. Richardson, Beilei Xu, Wencheng Wu, **Lei Lin**, Charles Venuto, Monica Javidnia, and Edgar A. Bernal. “Exploring Parkinson’s Disease Progression using Deep Generative Models Built on DaTscan Brain Imagery.” *CEIS University Technology Showcase*, April 4, 2019, DoubleTree Hotel, Rochester, NY, USA.
22. **Lei Lin**, Beilei Xu, Wencheng Wu, Trevor Richardson, Edgar A. Bernal, Bill Martens, Charles Thornton, Chad Heatwole. “Deep Metric Learning with Triplet Networks: Application to Myotonic Dystrophy Diagnosis.” *CEIS University Technology Showcase*, April 4, 2019, DoubleTree Hotel, Rochester, NY, USA.
23. Tao Li, **Lei Lin**, and Siyuan Gong. “AutoMPC: Efficient Multi-Party Computation for Secure and Privacy-Preserving Cooperative Control of Connected Autonomous Vehicles.” *The AAAI’s Workshop on Artificial Intelligence Safety*, January 27-February 1, 2019, Honolulu, Hawaii, USA.

24. Tao Li, Kantapon Kaewtip, Jianxiong Feng, **Lei Lin**. "IVAS: Facilitating safe and comfortable driving with intelligent vehicle audio systems." *2018 IEEE International Conference on Big Data (Big Data)*, December 10-December 13, 2019, Seattle, WA, USA.
25. Tao Li, Minsoo Choi, Yuntao Guo, **Lei Lin**. "Opinion mining at scale: A case study of the first self-driving car fatality." *2018 IEEE International Conference on Big Data (Big Data)*, December 10-December 13, 2019, Seattle, WA, USA.
26. **Lei Lin**, Srinivas Peeta, and Jian Wang. "Efficient Collection of Connected Vehicle Data based on Compressive Sensing." *The 21st IEEE International Conference on Intelligent Transportation Systems*, November 4-7, 2018, Hawaii, USA.
27. **Lei Lin**, Siyuan Gong, Tao Li, and Srinivas Peeta. "Deep Learning-based Human-Driven Vehicle Trajectory Prediction and its Application for Platoon Control of Connected and Autonomous Vehicles". *The Automated Vehicle Symposium*, July 9-12, 2018, San Francisco, USA.
28. Lin Liu, Chunyuan Li, Yongfu Li, Srinivas Peeta, and **Lei Lin**. "Car-following Behavior of Connected Vehicles in a Mixed Traffic Flow: Modeling and Stability Analysis." *The 8th Annual IEEE Int. Conf. on CYBER Technology in Automation, Control, and Intelligent Systems*. July 19-23, 2018, Tianjin, China.
29. **Lei Lin**, and Srinivas Peeta. "Real-Time Compression of Connected Vehicle Data based on Compressive Sensing." *The 2018 Global Symposium for Connected and Automated Vehicles and Infrastructure*, March 7-8, 2018, Ann Arbor, Michigan, USA.
30. Liu Lin, Srinivas Peeta, Siyuan Gong, **Lei Lin**, and Jian Wang. "Car Following Behavior of Connected Vehicles in a Mixed Traffic Flow: Modeling and Stability Analysis". *The 2018 Global Symposium for Connected and Automated Vehicles and Infrastructure*, March 7-8, 2018, Ann Arbor, Michigan, USA.
31. Zhenhua Zhang, **Lei Lin**, Lei Zhu, and Anuj Sharma. "Bi-National Delay Pattern Analysis For Commercial and Passenger Vehicles at Niagara Frontier Border". *The 97th Annual Transportation Research Board Meeting*, January 7-11, 2018, Washington, D.C., USA.
32. **Lei Lin**, John Handley and Adel W. Sadek. "Interval Prediction of Short-term Traffic Volume based on Extreme Learning Machine and Particle Swarm Optimization". *The 96th Annual Transportation Research Board Meeting*, January 8-12, 2017, Washington, D.C., USA.
33. **Lei Lin**, John Handley and Adel W. Sadek. "Interval Prediction of Short-term Traffic Volume based on Extreme Learning Machine and Particle Swarm Optimization". *The Second Annual TranInfo Symposium*. August 4-5., 2016, George Mason University, USA.
34. **Lei Lin**, and Gregory Kott. "Performance Evaluation and Prediction for Long Haul Railway Freight Transportation based on Sparse Spatial-Temporal Data". *The Second Annual TranInfo Symposium*. August 4-5., 2016, George Mason University, USA.
35. **Lei Lin**, and Gregory Kott. "Performance Evaluation and Prediction for Long Haul Railway Freight Transportation based on Sparse Spatial-Temporal Data". *The Proceedings of the 2015 XIG R&T Conference*, Sep 21-25, 2015, Webster, NY, USA.
36. **Lei Lin**, Ming Ni, Qing He, Jing Gao, and Adel W. Sadek. "Modeling the Impacts of Inclement Weather on Freeway Traffic Speed: An Exploratory Study Utilizing Social Media Data". *The 94th Annual Transportation Research Board Meeting*, January 11-15, 2015, Washington, D.C., USA.
37. **Lei Lin**, Qian Wang, and Adel W. Sadek, Gregory Kott. "An Android Smartphone Application for Collecting, Sharing, and Predicting Border Crossing Wait Time". *The 94th Annual Transportation Research Board Meeting*, January 11-15, 2015, Washington, D.C., USA.
38. **Lei Lin**, Qian Wang, and Adel W. Sadek. "Data Mining and Complex Network Algorithms for Traffic Accident Analysis". *The 93rd Annual Transportation Research Board Meeting*, January 12-16, 2014, Washington, D.C., USA.
39. **Lei Lin**, Qian Wang, and Adel W. Sadek. "Duration Prediction of Urban Freeway Traffic Accidents based on the M5P Tree and Hazard-based Duration Model". *The 1st International Conference on Engineering and Applied Sciences Optimization*. June 4-6, 2014, Kos Island, Greece.
40. **Lei Lin**, Qian Wang, and Adel W. Sadek. "A Novel Variable Selection Method based on Frequent Pattern Tree for Real-time Traffic Accident Risk Prediction". *The 1st International Conference on Engineering and Applied Sciences Optimization*. June 4-6, 2014, Kos Island, Greece.
41. **Lei Lin**, Kai Yuan, and Shuyun Ren. "Analysis of urban freeway traffic flow characteristics based on frequent pattern tree". *The 2014 IEEE 17th International Conference on Intelligent Transportation Systems (ITSC)*, October 8-11, 2014, Qingdao, China.

42. **Lei Lin**, Qian Wang, Adel W. Sadek, and Yan Li. "An Android Smartphone Application for Collecting, Sharing and Predicting the Niagara Frontier Border Crossings Waiting Time". *The 2014 ITS-NY 21st Annual Meeting*, June 12-13, 2014, Saratoga Springs, NY, USA.
43. **Lei Lin**, Qian Wang, and Adel W. Sadek. "Evaluating Short-term Traffic Volume Forecasting Models Based on Multiple Datasets and Data Diagnosis Measures". *The 92nd Annual Transportation Research Board Meeting*, January 13-17, 2013, Washington, D.C., USA.
44. **Lei Lin**, Yan Li, and Adel W. Sadek. "A k Nearest Neighbor based Local Linear Wavelet Neural Network Model for On-line Short-term Traffic Volume Prediction". *The 13th COTA International Conference of Transportation Professionals*, August 13-16, 2013, Shenzhen, China.
45. **Lei Lin**, Adel W. Sadek, and Qian Wang. "Multiple-Model Combined Forecasting Method for Online Prediction of Border Crossing Traffic at Peace Bridge". *The Proceedings of the 91st Annual Transportation Research Board Meeting*, January 22-26, 2012, Washington, D.C., USA.

## PAPERS UNDER REVIEW

46. **Lei Lin**, Weizi Li, and Lei Zhu. "Network-wide Multi-step Traffic Volume Prediction using Graph Convolutional Neural Network with Data-driven Graph Filter". Submitted to IEEE Transactions on Intelligent Transportation Systems, 2020.
47. **Lei Lin**, Weizi Li, Huikun Bi, and Lingqiao Qin. "Vehicle Trajectory Prediction Using LSTMs with Spatial-Temporal Attention Mechanisms". Submitted to IEEE Intelligent Transportation Systems Magazine, 2019.
48. Dongwei Xu, Yongdong Wang, Peng Peng, **Lei Lin**, and Liu Yi. "The evaluation of urban road network based on complex network". Submitted to IEEE Intelligent Transportation Systems Magazine, 2019.
49. Lei Zhu, Brennan Borlaug, **Lei Lin**, Jacob Holden, and Jeffrey Gonder. "Identifying Light-Duty Vehicle Travel from Large-Scale Multi-Modal Wearable GPS Data with Novelty Detection Approach". Submitted to Journal of Intelligent Transportation Systems: Technology, Planning, and Operations, 2019.

## TALKS

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1. "Explainable Deep Learning Models for Medical Time Series Classification", Corning Corporation, Apr, 2019.
2. "Careers in Data Science: Meet the Data Science Consortium Research Scientists", University of Rochester, Feb, 2019.
3. "Predicting Station-level Hourly Demand in a Large-scale Bike-sharing Network: A Graph Convolutional Neural Network Approach", University at Buffalo, Oct, 2018.
4. "An Integrative Approach to Account for Data Heterogeneity in Traffic Accident Analysis", BMW Technology Corp. Chicago, Mar, 2015.
5. "A Two-step Modeling Approach for Predicting Border-Crossing Delay at the Peace Bridge", Fourth TRANSLOG2012 Conference. McMaster University, Burlington, Ontario, Canada, 2012.

## TEACHING EXPERIENCE

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- **Guest Lecture.** DSC 475: Time Series Analysis & Forecasting in Data Science, Fall 2019, University of Rochester.
- **Teaching Assistant.** CIE 491: Construction Estimating, Spring 2014, University at Buffalo.
- **Teaching Assistant.** CIE 424: CAD of Civil Infrastructure, Spring 2011, University at Buffalo.

## PROFESSIONAL ACTIVITIES

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- IEEE Member - 2019-2020.
- IS & T The Society for Imaging Science & Technology - 2018-2019.
- Chinese Overseas Transportation Association - 2017-2018.

## SERVICE

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### EDITOR

- PLOS ONE
- Journal of Big Data Analytics in Transportation

### REVIEWER (JOURNALS)

- Chaos: An Interdisciplinary Journal of Nonlinear Science
- IEEE Access
- IEEE/CAA Journal of Automatica Sinica
- IEEE Transactions on Intelligent Transportation Systems
- IEEE Transactions on Computational Social Systems
- IET Electronics Letters
- IEEE Intelligent Transportation Systems Magazine
- IET Intelligent Transportation Systems
- IET Science Measurement & Technology
- International Journal of Communication Systems
- International Journal of Modern Physics B
- Journal of the Operational Research Society
- Journal of Advanced Transportation
- Journal of Selected Topics in Signal Processing
- Journal of Intelligent Transportation Systems
- Journal of Traffic and Transportation Engineering
- Journal of Transport Geography
- Journal of Transportation Safety & Security
- Mathematical Problems in Engineering
- PLOS ONE
- Safety Science
- Scientia Iranica
- Transactions on Knowledge and Data Engineering
- Transportation Research Part B: Methodological
- Transportation Research Part C: Emerging Technologies
- Transportation Research Part E: Logistics and Transportation Review
- Transportmetrica A: Transport Science

### REVIEWER (CONFERENCES)

- ITS America, 2016
- Transportation Research Board Annual Meeting, 2019, 2018, 2017, 2016
- International IEEE Annual Conference on Intelligent Transportation Systems, 2018, 2015, 2014, 2012
- COTA International Conference of Transportation Professionals, 2020, 2018, 2017, 2016, 2015, 2014
- International Conference of Chinese Transportation Professionals, 2011

### REVIEWER (FUNDING PROPOSALS)

- Transportation Informatics (TransInfo) Tier I University Transportation Center, 2017

## ACADEMIC HONORS

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- Best Student ITS Paper, ITS-NY, 2014.
- Graduate Dean's Scholars Award, University at Buffalo, the State University of New York, 2011.