Zhiyong CUI (崔志勇)

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RESEARCH INTEREST

- Urban Data Science
- Artificial Intelligence in Transportation
- Connected Autonomous Vehicles
- Intelligent Transportation Systems

EDUCATION

University of Washington, Seattle, USA 2015– 2020
Ph.D. in Civil Engineering (Intelligent Transportation Systems) (expected)
Dissertation: Artificial Intelligence based Transportation Data Modeling and Applications
Advisor: Prof. Yinhai Wang
Tools Developed: [TraffiX], [TPS], [DRIVE Net]

National Taiwan University, Taipei, Taiwan Feb. – July 2014
Visiting M.S. Student in Computer Science
Advisor: Prof. Hsin-Mu Tsai

Peking University, Beijing, China 2012 – 2015
M.S. in Software Engineering
Thesis: Autonomous Front-Vehicle Taillights Detection and Signal Recognition
Advisor: Prof. Ying Huang and Prof. Tong Mo

Beihang University, Beijing, China 2008 – 2012
B.S.E in Software Engineering

HONORS AND AWARDS

Student Paper Award, "Graph Markov Network for Traffic Forecasting with Missing Data" 2020
Transportation Statistics Interest Group (TSIG), American Statistical Association (ASA)
Student Travel Award, Joint Statistical Meeting 2020
Second Place in Student Poster Award, PacTrans | CSET Region 10 Transportation Conference 2019
Outstanding Award, Transportation Forecasting Competition (TRANSFOR19) 2019
Outstanding Award, 3rd DI-TECH Transportation Algorithm Competition 2018
Graduate Student Travel Award, PacTrans 2016-2020
AASHTO High Value Research Project Award 2016
Outstanding master's thesis nomination (Peking University Software Engineering Communication) 2015
Second Place Award, International Contest of Network of Things 2011
Excellent Student Cadre Award, Beihang University 2008 – 2011
Scholarship of Innovation Work, Beihang University 2008 – 2012
Emergency Treatment Volunteer Award, Beihang University 2009
Innovation Planning Award, Microsoft Technology Club of Beihang University 2009

REFEREED JOURNAL PUBLICATIONS

J1. **Cui Z**, Lin L, Pu Z, Wang Y*. (2020) Graph Markov Network for Traffic Forecasting with Missing Data. *Transportation Research Part C: Emerging Technologies* (**ASA TSIG Student Paper Award**)

J2. **Cui Z**, Ke R, Wang Y*. (2020) Stacked Bidirectional and Unidirectional LSTM Recurrent Neural Network for Forecasting Network-wide Traffic State with Missing Values. *Transportation Research Part C: Emerging Technologies*

J3. **Cui Z**, Ke R, Pu Z, Ma X, Wang Y*. (2020) Learning Traffic as a Graph: A Gated Graph Wavelet Recurrent Neural Network for Network-scale Traffic Prediction. *Transportation Research Part C: Emerging Technologies* (doi: 10.1016/j.trc.2020.102620)

J4. **Cui Z**, Henrickson K, Ke R, Wang Y*. (2019) Traffic Graph Convolutional Recurrent Neural Network: A Deep Learning Framework for Network-Scale Traffic Learning and Forecasting. *IEEE transaction on Intelligent Transportation Systems* (doi: 10.1109/TITS.2019.2950416)

J5. **Cui Z**, Long Y*. (2019) Perspectives on Stability and Mobility of Transit Passenger's Travel Behaviour through Smart Card Data. *IET Intelligent Transport Systems*. (doi: 10.1049/iet-its.2019.0212)

J6. **Cui Z**, Henrickson K, Biancardo S, Pu Z, Wang Y*. (2019) Establishing a Multi-Source Data Integration Framework for Transportation Data Analytics. *Journal of Transportation Engineering, Part A: Systems* (in press). (doi: 10.1061/JTEPBS.0000331)

J7. Ma X, Li Y, **Cui Z***, Wang Y. (2020) Forecasting Transportation Network Speed Using Deep Capsule Networks with Nested LSTM Models. *IEEE transaction on Intelligent Transportation Systems* (doi: 10.1109/TITS.2020.2984813)

J8. Pu Z, **Cui Z**, Wang S, Li Q, Wang Y*. (2020) Time-Aware Gated Recurrent Unit Networks for Road Surface Friction Prediction Using Historical Data. *IET Intelligent Transport Systems*. (doi: 10.1049/iet-its.2019.0428)

J9. Zhang J, Chen F*, **Cui Z**, Guo Y, Zhu Y. (2020) Deep learning Architecture for Short-term Passenger Flow Forecasting in Urban Rail Transit. *IEEE transaction on Intelligent Transportation Systems*

J10. Ke R, Li W, **Cui Z**, Wang Y*. (2020) Two-Stream Multi-Channel Convolutional Neural Network (TM-CNN) for Multi-Lane Traffic Speed Prediction Considering Traffic Volume Impact. *Transportation Research Record* (doi: 10.1177/0361198120911052)

J11. Ke R, Feng S, **Cui Z**, Wang Y*. (2020) An advanced framework for microscopic and lane-level macroscopic traffic parameters estimation from UAV video. *IET Intelligent Transport Systems* (doi: 10.1049/iet-its.2019.0463)

J12. Pu Z, Zhu M, Li W, **Cui Z**, Guo X, Wang Y. (2020) Monitoring Public Transit Ridership Flow by Passively Sensing Wi-Fi and Bluetooth Mobile Devices. *IEEE Internet of Things Journal*

J13. Wang Y*, **Cui Z**. (2019) The Development of Smart Transportation in Urgent Need of Transportation Data Science (in Chinese). *Urban Transport of China*, 17(3), 8-10. (doi: 10.13813/j.cn11-5141/u.2019.0301)

J14. Liang Y, **Cui Z**, Tian Y, Chen H, Wang Y*. (2018) A Deep Generative Adversarial Architecture for Network-Wide Spatial-Temporal Traffic State Estimation. *Transportation Research Record*, 2672(45), 87-105. (doi: 10.1177/0361198118798737)

J15. Ke R, Li Z, Kim S, Ash J, **Cui Z**, Wang Y*. (2017) Real-time bidirectional traffic flow parameter estimation from aerial videos. *IEEE Transactions on Intelligent Transportation Systems*, 18(4), 890-901. (doi: 10.1109/TITS.2016.2595526)

J16. Chen X, Li Z, Wang Y, **Cui Z**, Shi C, Wu H*. (2017). Evaluating the impacts of grades on vehicular speeds on interstate highways. *PloS one*, 12(9), e0184142. (doi: 10.1371/journal.pone.0184142)

PAPERS IN REVIEW

[1] **Cui Z**, Fu M, Zhu M, Ban X, Wang Y*. (2019) Transportation Artificial Intelligence Platform for Traffic Forecasting. *Transportation Research Record* (under first round review)

[2] **Cui Z**, Wang X, Wang Y*. (2020) Understanding Limits of Predictability in Free-floating Car Sharing Vehicles' Mobility. *Transportation* (under first round review)

[3] Zhu M, Zhu W, Lutin J, **Cui Z**, Yinhai Wang*. (2020) Developing a Statistically Valid and Practical Method to Compute State-Level Bus Occupancy Rates. *Transportation Research Part A: Policy and Practice* (under first round review)

REFEREED CONFERENCE PROCEEDINGS

C1. **Cui Z**, Lin L, Pu Z, Wang Y. (2020) Graph Markov Network for Traffic Forecasting with Missing Data. *Transportation Research Board 99th Annual Meeting*

C2. **Cui Z**, Fu M, Zhu M, Ban X, Wang Y. (2020) Transportation Artificial Intelligence Platform for Traffic Forecasting. *Transportation Research Board 99th Annual Meeting*

C3. Ke R, Li W, **Cui Z**, Wang Y. (2020) Two-Stream Multi-Channel Convolutional Neural Network (TM-CNN) for Multi-Lane Traffic Speed Prediction Considering Traffic Volume Impact. *Transportation Research Board 99th Annual Meeting*

C4. Pu Z, Guo X, **Cui Z**, Zhu M, Wang Y. (2020) Mining Public Transit Ridership Flow and Origin-Destination Information from Wi-Fi and Bluetooth Sensing Data. *Transportation Research Board 99th Annual Meeting*

C5. **Cui Z**, Henrickson K, Ke R, Dong X, Wang Y. (2019) High-Order Graph Convolutional Recurrent Neural Network: A Deep Learning Framework for Network-Scale Traffic Learning and Forecasting. *Transportation Research Board 98th Annual Meeting*

C6. **Cui Z**, Henrickson K, Pu Z, Guo G, Wang Y. (2019) A New Multi-Source Traffic Data Integration Framework for Traffic Analysis and Performance Measurement. *Transportation Research Board 98th Annual Meeting.*

C7. Ke R, Feng S, **Cui Z**, Wang Y. (2019) An Advanced Framework for Traffic Parameters Estimation from UAV Video. *Transportation Research Board 98th Annual Meeting* (No. 19-02564).

C8. Ke R, Li W, **Cui Z**, Wang Y. (2018) Multi-Lane Traffic Pattern Learning and Forecasting Using Convolutional Neural Network. *COTA International Symposium on Emerging Trends in Transportation (ISETT).*

C9. **Cui Z**, Ke R, Wang Y. (2017) Deep Bidirectional and Unidirectional LSTM Recurrent Neural Network for Network-wide Traffic Speed Prediction. *ACM SIGKDD International Workshop on Urban Computing* (UrbComp)

C10. Wang X, MacKenzie D, **Cui Z**. (2017) Complement or Competitor? Comparing car2go and Transit Travel Times, Prices, and Usage Patterns in Seattle. *Transportation Research Board 96th Annual Meeting* (No. 17-06234).

C11. Pu Z, Li Z, Zhu W, **Cui Z**, Wang Y. (2017) Evaluating Safety Effects of Variable Speed Limit System using Empirical Bayesian Before-After Analysis. *Transportation Research Board 96th Annual Meeting* (No. 17-05863).

C12. **Cui Z**, Zhang S, Henrickson K, Wang Y. (2016) New progress of DRIVE Net: An E-science transportation platform for data sharing, visualization, modelling, and analysis. *IEEE International Smart Cities Conference (ISC2),* (pp. 1-2).

C13. **Cui Z**, Long Y, Ke R, Wang, Y. (2015) Characterizing evolution of extreme public transit behavior using smart card data. *IEEE International Smart Cities Conference (ISC2),* (pp. 1-6).

C14. **Cui Z**, Long Y. (2015) Perspectives on Stability and Mobility of Passenger's Travel Behaviour through Smart Card Data. *ACM SIGKDD International Workshop on Urban Computing* (UrbComp).

C15. **Cui Z**, Yang S W, Tsai H M (2015) A vision-based hierarchical framework for autonomous front-vehicle taillights detection and signal recognition. *IEEE International Conference on Intelligent Transportation Systems* (ITSC), (pp. 931-937).

C16. Gao Y, Swaminathan K, **Cui Z**, Su, L. (2015) Predictive Traffic Assignment: A New Method and System for Optimal Balancing of Road Traffic. *IEEE 18th International Conference on Intelligent Transportation Systems* (ITSC), (pp. 400-407).

C17. **Cui Z**, Wang C, Tsai H M. (2014) Characterizing channel fading in vehicular visible light communications with video data. *IEEE Vehicular Networking Conference (VNC),* (pp. 226-229).

C18. **Cui Z**, Yang S W, Wang C, Tsai H M. (2014) On addressing driving inattentiveness: Robust rear light status classification using hierarchical matching pursuit. *IEEE 17th International Conference on Intelligent Transportation Systems* (ITSC), (pp. 2243-2244).

TECHNICAL REPORTS

R1. Wang Y, Ban X, **Cui Z**, Zhu M. (2019) An artificial intelligence platform for network-wide congestion detection and prediction using multi-source data. Connected Cities and Smart Mobility (C2SMART) Research Report (USDOT award number: 69A3551747124)

R2. Wang Y, **Cui Z**, Henrickson, K. (2018) Pilot Testing of SHRP2 Reliability Data and Analytical Products: Washington. SHRP2 Reliability Project L38 Report.

R3. Hallenbeck M, Ishimaru J, **Cui Z**, Wang Y, Wright D, Zhang W, Henrickson K. (2017) Implementing the Routine Computation and Use of Roadway Performance Measures Within WSDOT. SHRP2 PM Software Research Report. (Grant number: Agreement T1461, Task 16)

R4. Wang Y, Ke R, Zhang W, **Cui Z**, Henrickson K. (2016) Digital roadway interactive visualization and evaluation network applications to WSDOT operational data usage. Washington State Department of Transportation (WSDOT) Research Report (Report number: WA-RD 854.1).

ACADEMIC TALKS

T1. May. 2020, "Learning from Network-wide Traffic Sensor Data: Vehicle Travel and Traffic Performance Changes under the Influence of COVID-19", PacTrans Webinar, Seattle, USA.

T2. Jan. 2020, "Transportation Artificial Intelligence Platform", Transportation Research Board (TRB) ABJ70 Artificial Intelligence and Advanced Computing Standing Committee Meeting, Washington, DC, USA.

T3. Jan. 2020, "Artificial Intelligence in Transportation", COTA Young Professional Presentation, Transportation Research Board (TRB) Annual Meeting, Washington, DC, USA.

T4. Oct. 2019, "Learning Traffic as a Graph: Graph-based Neural Networks for Network-scale Traffic Prediction". *INFORMS* 2019, Seattle, USA.

T5. May 2019, "Artificial Intelligence based Transportation Analysis Platforms and Applications", *Institute of Transportation Engineers (ITE) Student Night*, Seattle, USA.

T6. Jan. 2019, "A Multi-Source Transportation Data Integration Framework based on High-resolution Geospatial Data for Transportation Analysis", *Transportation Research Board (TRB) AFB80 Standing Committee - Geospatial Control Subcommittee Meeting*, Washington, DC, USA.

T7. Jan. 2019, "A New Multi-Source Traffic Data Integration Framework for Traffic Analysis and Performance Measurement". *Transportation Research Board (TRB) 98th Annual Meeting*. Washington, DC, USA.

T8. Jan. 2019, "Traffic Graph Convolutional Recurrent Neural Network: A Deep Learning Framework for Network-scale Traffic Learning and Forecasting". *Transportation Research Board (TRB) 98th Annual Meeting*. Washington, DC, USA.

T9. Dec. 2018, "Big Data Applications in ITS – Key Arterial Performance Project", *ITS Washington Annual Meeting*, Seattle, USA.

T10. Aug. 2017, "Deep Bidirectional and Unidirectional LSTM Recurrent Neural Network for Network-wide Traffic Speed Prediction". *ACM SIGKDD International Workshop on Urban Computing* (UrbComp), Halifax, Canada.

T11. Aug. 2016, "Predictability of Vehicular Mobility in Free-floating Car Sharing System", *PacTrans-Tongji PhD Student Research Symposium in Transportation Science and Technologies*, Seattle, USA.

T12. Oct. 2015, "Characterizing evolution of extreme public transit behavior using smart card data". *IEEE International Smart Cities Conference (ISC2).* Guadalajara, Mexico.

T13. Aug. 2015, "Perspectives on Stability and Mobility of Passenger's Travel Behaviour through Smart Card Data". *ACM SIGKDD International Workshop on Urban Computing* (UrbComp), Sydney, Australia.

T14. Sep. 2015, "Predictive Traffic Assignment: A New Method and System for Optimal Balancing of Road Traffic". *IEEE 18th International Conference on Intelligent Transportation Systems* (ITSC).

T15. Sep. 2015, "A vision-based hierarchical framework for autonomous front-vehicle taillights detection and signal recognition". *IEEE International Conference on Intelligent Transportation Systems* (ITSC).

PROPOSAL WRITING

P1. NCHRP 03-138. Application of Big Data Approaches for Traffic Incident Management (TIM). Submitted in Feb. 2020 (Pending).

P2. USDOT UTC (PacTrans). TRAFFIX: A Platform for Evaluating and Sharing Traffic Forecasting Datasets and Models. Submitted in Nov. 2019 (Pending).

P3. USDOT Federal Highway Administration (FHWA). A Framework/Methodology to Support Data Fusion, Analysis, and Decision Making. Submitted in Aug. 2019 (Pending).

P4. Transportation Cooperative Research Program (TCRP). TCRP G-18: Improving Access and Management of Transit ITS Data. Submitted in Sep. 2019 (Pending).

P5. Washington State Department of Transportation (WSDOT). Real-Time Truck Parking Information Integration, Visualization and Prediction. (**Accepted**. Funds: $150,000. Funding Period: Sept. 2019-Mar.2021)

P6. National Cooperative Highway Research Program (NCHRP). NCHRP 07-26: Update of Highway Capacity Manual: Merge, Diverge, and Weaving Methodologies. (**Accepted**. Funds: $400,000, Funding Period: June, 2019-Dec., 2021)

P7. Center for Safety Equity in Transportation (CSET). Developing a Data-Driven Safety Assessment Framework for RITI Communities in Washington State. (**Accepted**. Funds: $120,000, Funding Period: July, 2018-Sept., 2019)

P8. USDOT UTC (C2SMART). An artificial intelligence platform for network-wide congestion detection and prediction using multi-source data. (**Accepted**. Funds: $82,500, Funding Period: June,2018-July, 2019)

P9. Seattle DOT (SDOT). Performance Measurement for a Selected Pilot Urban Corridor in Seattle. (**Accepted**. Funds: $39,198, Funding Period: April, 2017-June, 2017)

TOOLS

Platforms

TRAFFIX.AI: A Platform for Evaluating and Sharing Traffic Forecasting Datasets and Models. [website]

Traffic **P**erformance **S**core (**TPS**) in Greater Seattle area. [website]

Digital **R**oadway **I**nteractive **V**isualization and **E**valuation **Net**work (**DRIVE Net**): A Transportation Big Data Analytics Platform [website]

Code

Spatiotemporal Data Modeling Algorithms

TGC-LSTM: Traffic Graph Convolution Recurrent Neural Network [100+ stars]

GRU-D: Gated Recurrent Unit (GRU) dealing with missing values [50+ stars]

SBD-LSTM: Stacked Bidirectional and Unidirectional LSTM [15+ stars]

Datasets

Seattle Loop Detector Dataset [GitHub-version] [doi: 10.5281/zenodo.3258904]

TEACHING EXPERIENCE

Pre-Doctoral Instructor, University of Washington — Winter 2020

CEE 412/CET522 Transportation Data Management and Visualization

- 50 students including undergrads and grads; Course Evaluation Score: 4.1/5.0

Teaching Assistant, University of Washington — Winter 2019

CEE 412/CET512 Transportation Data Management

Guest Lecturer, University of Washington — Winter 2019

CEE 412/CET512 Transportation Data Management

Lecture Topic: Introduction of Transportation Data Management

Guest Lecturer, University of Washington — 2017 - 2019

Engineering Discovery Days

Lecture Topic: Transportation Big Data Analytics Platform

MEDIA COVERAGE

- Measuring Traffic Performance during COVID-19. UW CEE News — May. 2020
- 2018 Special TRB Meeting Newsletter. PacTrans. — Apr. 2018
- PacTrans Success Story: STAR Lab DRVIE Net. DRIVE Net 1, DRIVE Net 2 — Oct. 2018
- PacTrans Develops a Practical Data Analytics Tool for Network Performance Measures. UTC Spoltlight — Jul. 2016

MENTORSHIP

Undergraduate Student Research Mentor at University of Washington

Longfei Lin Beihang University	Summer 2019
Muzhi Han, Tsinghua University (now at University of California, Los Angeles)	Winter - Spring 2019
Tian Wang, Beijing University of Posts and Telecommunications (now at Northeastern Univ.)	Summer 2018
Yijun Sun, Tsinghua University (now at Tsinghua University)	Summer 2017
Zhaoyi Li, Tsinghua University	Summer 2017

Graduate Student Research Mentor at University of Washington

Shuyi Yin, Stanford University (now at University of Washington)	Summer 2019
Mingjian Fu, University of Washington (now at INRIX)	Summer 2017

PROFESSIONAL SERVICES

Committee Member

TRB Standing Committee on Intelligent Transportation Systems (AHB15)	2020
TRB Standing Committee on Geospatial Data Acquisition Technologies (AFB80)	2020
ASCE ICTD 2020 Scientific Committee	2020

Academic Society Membership

American Statistical Association (ASA) Transportation Statistical Interest Group Member	2020
Institute of Transportation Engineers (ITE) member	2018, 2019
ACM-SIGKDD member	2015, 2017
IEEE student member	2017, 2018, 2019
ASCE student member	2018, 2019
Chinese Overseas Transportation Association (COTA) member	2017, 2018, 2019

REFEREE FOR JOURNALS AND CONFERENCES

JOURNALS

Transportation Research Part C: Emerging Technologies
IEEE Transactions on Intelligent Transportation Systems
IEEE Transactions on Vehicular Technology
IEEE Transactions on Knowledge and Data Engineering
IEEE Vehicular Technology Magazine
Information Science
Physica A: Statistical Mechanics and its Applications
IET Intelligent Transport Systems
Transportation Research Record
Journal of Intelligent Transportation Systems
International Journal of Geographical Information Science
ASCE Journal of Transportation Engineering, Part A: Systems
PLoS ONE

CONFERENCES

ASCE International Conference on Transportation & Development (ICTD)	2020
Transportation Research Board (TRB) Annual Meeting	2017, 2018, 2019
IEEE Global Communications Conference: Wireless Communications	2019
COTA International Conference of Transportation Professionals	2018
IEEE International Smart Cities Conference	2016

IEEE International Intelligent Transportation Systems Conference 2015

INDUSTRIAL EXPERIENCES

Alibaba, Cainiao Network, Artificial Intelligence Group (Hangzhou, China) Oct. 2019 – Present
Remote Research Intern *Mentor: Lixia Wu*
- Project: Reinforcement Learning based Adaptive Dynamic Bipartite Graph Matching for Task Assignment Problems

Accenture, Smart City Technology Lab (Beijing, China) Oct. 2013 – Jan. 2014 & Aug. 2014 – Nov. 2014
Research Intern *Mentor: Dr. Yan Gao*
- Project 1: Mobility pattern mining based on cellular data and taxi trajectories
- Project 2: predictive traffic assignment (ITSC 2015)

Intel Labs (Taipei, Taiwan) Feb. 2014 – Jul. 2014
Research Intern *Mentor: Dr. Shao-Wen Yang & Prof. Tsin-Mu Tsai*
- Project 1: Vehicle taillights detection and signal recognition based on hierarchical framework (ITSC 2014, 2015);
- Project 2: Channel fading in vehicular visible light communications with video data (VNC 2015).

IBM, China Systems and Technology Laboratory (Beijing, China) Apr. 2013 – Oct. 2013
Intern *Mentor: Xin Liu*
- Project: Tool development for formatting z/OS migration files in the workflow system.

IBM-Peking University Creative Laboratory (Beijing, China) Sept. 2012 – Feb. 2013
Research Intern *Mentor: Dexin Wu*
- Project: Evaluating the live virtual machine migration performance, KVM on Linux

National Ocean Technology Center (Tianjin, China) Jul. 2012 – Aug. 2012
Intern
- Project: Configuring and Maintaining dynamic marine monitoring platform