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RESEARCH INTEREST

Urban Computing and Spatiotemporal Data Modeling
Artificial Intelligence-based Traffic Forecasting, Spatiotemporal Data Modeling, and Urban Mobility Pattern Mining
Transportation Data Science
Transportation Data Management, Data Fusion, Data Imputation, and Geospatial Map Conflation
Connected Vehicles and Autonomous Driving
Artificial Intelligence-based Traffic Light and Vehicle Control under Connected Vehicle Environment
Intelligent Transportation Systems
Data-drive Transportation Analytics Platforms, Advanced Urban Sensing Technologies, and Smart Infrastructures

EDUCATION

University of Washington 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, DRIVE Net

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

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

HONORS AND AWARDS

Second Prize, Research Poster Competition, PacTrans Region 10 Student Transportation Conference	2019
Outstanding Award, Transportation Forecasting Competition (TRANSFOR19)	2019
Recognition Award, 3rd DI-TECH Transportation Algorithm Competition	2018
AASHTO High Value Research Project Award	2016
Outstanding master's thesis nomination (Peking University Software Engineering Communication)	2016
Second Prize, 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

PREPRINTS

[1] **Cui Z**, Lin L, Pu Z, Wang Y*. (2019) Graph Markov Network for Traffic Forecasting with Missing Data. *Transportation Research Part C: Emerging Technologies* (under review)

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

[3] **Cui Z**, Ke R, Pu Z, Ma X, Wang Y*. (2019) Learning Traffic as a Graph: A Gated Graph Wavelet Recurrent Neural Network for Network-scale Traffic Prediction *Transportation Research Part C: Emerging Technologies* (under review)

[4] **Cui Z**, Ke R, Wang Y*. (2019) Stacked Bidirectional and Unidirectional LSTM Recurrent Neural Network for Forecasting Network-wide Traffic State with Missing Values. *Transportation Research Part C: Emerging Technologies* (under review)

[5] Ma X, Li Y, **Cui Z***, Wang Y*. (2018) Forecasting Transportation Network Speed Using Deep Capsule Networks with Nested LSTM Models. *IEEE transaction on Intelligent Transportation Systems* (under review)

[6] Lin L, **Cui Z**, Wang Y. (2020) MLG-Net: Multi-Layer Graph Network for Traffic Forecasting. *24th European Conference on Artificial Intelligence (ECAI)* (under review)

[7] Pu Z, **Cui Z**, Zhu M, Wang Y*. (2019) Mining Public Transit Ridership Flow and Origin-Destination Information from Wi-Fi and Bluetooth Sensing Data. *Transportation Research Part C: Emerging Technologies* (under review)

[8] Ke R, Li W, **Cui Z**, Wang Y*. (2019) Two-Stream Multi-Channel Convolutional Neural Network (TM-CNN) for Multi-Lane Traffic Speed Prediction Considering Traffic Volume Impact. *Transportation Research Record* (under review)

[9] Ke R, Feng S, **Cui Z**, Wang Y*. (2019) An advanced framework for microscopic and lane-level macroscopic traffic parameters estimation from UAV video. *IET Intelligent Transport Systems* (under review)

REFEREED JOURNAL PUBLICATIONS

[10] **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* (in press)

[11] **Cui Z**, Long Y*. (2019) Perspectives on Stability and Mobility of Transit Passenger's Travel Behaviour through Smart Card Data. *IET Intelligent Transport Systems* (in press). (doi: 10.1049/ietits.2019.0212)

[12] **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)

[13] 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)

[14] 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)

[15] 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)

INVITED ARTICLES

[16] 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)

REFEREED CONFERENCE PROCEEDINGS

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

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

[19] **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*

[20] **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.*

[21] **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)

[22] **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).

[23] **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).

[24] **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).

[25] **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).

[26] **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).

[27] **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).

[28] 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*

[29] 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*

[30] 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).

[31] 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).*

[32] 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).

[33] 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).

[34] 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).

TECHNICAL REPORTS

[1] 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)

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

[3] 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)

[4] 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).

CONFERENCE PRESENTATIONS

1. "Learning Traffic as a Graph: Graph-based Neural networks for Network-scale Traffic Prediction". *INFORMS* 2019, Seattle, USA. October, 2019.
2. "A New Multi-Source Traffic Data Integration Framework for Traffic Analysis and Performance Measurement". *Transportation Research Board (TRB) 98th Annual Meeting*. Washington, DC, USA. January 14, 2019.
3. "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. January 16, 2019.
4. "Deep Bidirectional and Unidirectional LSTM Recurrent Neural Network for Network-wide Traffic Speed Prediction". *ACM SIGKDD International Workshop on Urban Computing* (UrbComp), Halifax, Canada. August, 2017.
5. "Characterizing evolution of extreme public transit behavior using smart card data". *IEEE International Smart Cities Conference (ISC2).* Guadalajara, Mexico. October, 2015.
6. "Perspectives on Stability and Mobility of Passenger's Travel Behaviour through Smart Card Data". *ACM SIGKDD International Workshop on Urban Computing* (UrbComp), Sydney, Australia. 2015.

7. "Predictive Traffic Assignment: A New Method and System for Optimal Balancing of Road Traffic". *IEEE 18th International Conference on Intelligent Transportation Systems* (ITSC). Spain, 2015.
8. "A vision-based hierarchical framework for autonomous front-vehicle taillights detection and signal recognition". *IEEE International Conference on Intelligent Transportation Systems* (ITSC). Spain, 2015.

ACADEMIC TALKS

1. May 2019, Artificial Intelligence based Transportation Analysis Platforms and Applications, *Institute of Transportation Engineers (ITE) Student Night*, Seattle, USA.
2. January 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.
3. December 2018, Big Data Applications in ITS – Key Arterial Performance Project. *ITS Washington Annual Meeting*, Seattle, USA.
4. August 2016, Predictability of Vehicular Mobility in Free-floating Car Sharing System, PacTrans-Tojing PhD Student Research Symposium in Transportation Science and Technologies, Seattle, USA.

PROPOSAL WRITING

1. USDOT UTC (PacTrans). TRAFFIX: A Platform for Evaluating and Sharing Traffic Forecasting Datasets and Models. Submitted in Nov. 2019 (Pending).
2. USDOT Federal Highway Administration (FHWA). A Framework/Methodology to Support Data Fusion, Analysis, and Decision Making. Submitted in Aug. 2019 (Pending).
3. Transportation Cooperative Research Program (TCRP). TCRP G-18: Improving Access and Management of Transit ITS Data. Submitted in Sep. 2019 (Pending).
4. 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)
5. National Cooperative Highway Research Program (NCHRP). NCHRP 07-26: Update of Highway Capacity Manual: Merge, Diverge, and Weaving Methodologies. (**Accepted**. Funded, $400,000, Funding Period: June, 2019-Dec., 2021)
6. Center for Safety Equity in Transportation (CSET). Developing a Data-Driven Safety Assessment Framework for RITI Communities in Washington State. (**Accepted**. Funds: $, Funding Period: July, 2018-Sept., 2019)
7. 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)
8. Seattle DOT (SDOT). Performance Measurement for a Selected Pilot Urban Corridor in Seattle. (**Accepted**. Funded, $39,198, Funding Period: April, 2017-June, 2017)

TOOLS

Platforms

TRAFFIX: A Platform for Evaluating and Sharing Traffic Forecasting Datasets and Models. [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 Modoling Algorithms

TGC-LSTM: Traffic Graph Convolution Recurrent Neural Network [95+ 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 (undergrad and grad course)

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 — Spring 2017 - 2019
Engineering Discovery Days
Lecture Topic: Transportation Big Data Analytics Platform

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 — 2019 – Present
Transportation Research Board (TRB) Standing Committee on Intelligent Transportation Systems (AHB15)

Committee Member — 2019 – Present
Transportation Research Board (TRB) Standing Committee on Geospatial Data Acquisition Technologies (AFB80)

Membership

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

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

Conferences

Transportation Research Board Annual Meeting (TRB)	2017, 2018, 2019
IEEE Global Communications Conference: Wireless Communications	2019
IEEE International Intelligent Transportation Systems Conference	2015
IEEE International Smart Cities Conference	2016
COTA International Conference of Transportation Professionals	2018

INDUSTRIAL EXPERIENCES

Alibaba, Cainiao Network, Artificial Intelligence Group (Hangzhou, China) — Oct. 2019 – Present
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: Mobility pattern mining based on cellular data and taxi trajectories and 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 using a robust 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, IBM-Peking University Creative Laboratory (Beijing, China) Sept. 2012 – Feb. 2013
Research Intern *Mentor: Dexin Wu*
- Project: Evaluation of live virtual machine migration performance, KVM on Linux.