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Zhiyong CUI - 崔志勇

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RESEARCH INTEREST

- Urban Computing and Spatiotemporal Data Modeling
  - AI-based Traffic Forecasting, Traffic Network 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
  - AI-based Traffic Control, Optimization under Connected Vehicle Environment, and Computer Vision-based Autonomous Driving
- Intelligent Transportation Systems
  - Data-drive Transportation Analytics Platforms, Advanced Urban Sensing Technologies, and Smart Infrastructures

EDUCATION

- Ph.D. in Civil Engineering (Intelligent Transportation Systems) 2015– 2020 (expected)
  - Department of Civil and Environmental Engineering
  - University of Washington, Seattle, WA
  - Advisor: Prof. Yinhai Wang

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

- M.S. in Software Engineering 2012 – 2015
  - School of Software & Microelectronics
  - Peking University, Beijing, China
  - Advisor: Prof. Ying Huang and Prof. Tong Mo

- B.S.E in Software Engineering 2008 – 2012
  - College of Software Engineering
  - Beihang University, Beijing, China
  - Advisor: Prof. Haiquan Wang

HONORS AND AWARDS

- 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*, Volume 3, 2016) 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

REFEREED JOURNAL PUBLICATIONS

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**, 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* (under review)
5. **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)
6. **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/iet-its.2019.0212**)
7. **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* (accepted). (doi: **10.1061/JTEPBS.0000331**)
8. 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)
9. 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)
10. 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. *IET Intelligent Transportation Systems* (under review)
11. 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)
12. 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**)
13. 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**)
14. 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

1. 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

1. **Cui Z**, Lin L, Pu Z, Wang Y. (2020) Graph Markov Network for Traffic Forecasting with Missing Data. *Transportation Research Board 99th Annual Meeting* (under review)
2. **Cui Z**, Fu M, Zhu M, Ban X, Wang Y. (2020) Transportation Artificial Intelligence Platform for Traffic Forecasting. *Transportation Research Board 99th Annual Meeting* (under review)
3. Pu Z, **Cui Z**, Vaa T, Wang S, Wang Y. (2020) Road Surface Friction Prediction Based on Gated Recurrent Unit Networks Using Historical Data with Missing Values. *Transportation Research Board 99th Annual Meeting* (under review)
4. 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* (under review)
5. 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* (under review)
6. Yin S, Wang J, Wang Z, **Cui Z**, Wang Y. (2020) Attention-Enabled Network-Level Traffic Speed Prediction. *Transportation Research Board 99th Annual Meeting* (under review)
7. **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*
8. **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.*
9. 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).
10. 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).*
11. **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)
12. 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).
13. 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).
14. **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).
15. **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).

16. **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).
17. **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).
18. 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).
19. **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).
20. **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 REPORT

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

"Learning Traffic as a Graph: Graph based Neural networks for Network-scale Traffic Prediction". *INFORMS* 2019, Seattle, USA. October, 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. January 14, 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. January 16, 2019.

"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.

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

"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.

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

INVITED TALKS

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

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.

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

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.

PROFESSIONAL SERVICES

- **Committee Member**:
  - Transportation Research Board (TRB) Standing Committee on Intelligent Transportation Systems – AHB15
  - Transportation Research Board (TRB) Standing Committee on Geospatial Data Acquisition Technologies – AFB80
- **Membership**
  - Institute of Transportation Engineers (ITE) member
  - ACM-SIGKDD member
  - IEEE student member
  - Chinese Overseas Transportation Association (COTA) member

REFEREE FOR JOURNALS AND CONFERENCES

- IEEE Transactions on Intelligent Transportation Systems
- IEEE Transactions on Knowledge and Data Engineering
- Transportation Research Part C: Emerging Technologies
- Journal of Intelligent Transportation Systems
- ASCE Journal of Transportation Engineering
- Transportation Research Record
- International Journal of Geographical Information Science
- IEEE Sensors Journal
- PLoS ONE
- Physica A: Statistical Mechanics and its Applications
- Transportation Research Board Annual Meeting (2018, 2019)
- IEEE Global Communications Conference: Wireless Communications (2019)
- IEEE International Intelligent Transportation Systems Conference (2015)
- IEEE International Smart Cities Conference (2016)

DEVELOPED TOOLS, PLATFORMS, & CODE

- Transportation data analytics platform: Digital Roadway Interactive Visualization and Evaluation Network (DRIVE Net) (**http://www.uwdrive.net/**)
- Published Data & Code on GitHub (**https://github.com/zhiyongc**)

SKILLS

- Computer Language: Skilled in Python and Java. Familiar with R, JavaScript, MATLAB, C++
- Deep Learning Packages: Skilled in PyTorch and Keras. Familiar with TensorFlow
- Other Technologies: SQL, PostgreSQL, PostGIS, D3.js, Vissim, SUMO

PROFESSIONAL EXPERIENCE

- **Research Assistant** at UW collaborating with Pierce Transit **July. 2019 – Present**
  - Working on Pierce Transit automated collision avoidance system project
    Developing Transit Event Logging System (TELS) that can detect and log near-miss events in real-time based on Nvidia Jetson TX2

- **Research Assistant** at UW collaborating with C2SMART **July. 2018 – June. 2019**
  - Working on C2SMART Transportation Artificial Intelligent Platform Project
    Developing an online platform for designing and sharing transportation data and AI-based traffic prediction models.

- **Research Assistant** at UW collaborating with WSDOT **Apr. 2017 – July. 2018**
  - Working on SHPR2 Reliability Data and Tool Project
    Research on geospatial map conflation for multiple data sources.
    Developing online functions on DRIVE Net to measure travel time reliability.

- **Research Assistant** at UW collaborating with Seattle DOT **July. 2017 – Sept. 2017**
  - Working on Seattle Arterial Performance Measurement Project
    Research on Integrating multiple traffic data, containing inductive loop detector data, license plate reader data, Wi-Fi & Bluetooth data, Verizon cellular data, etc.

- **Research Assistant** at UW collaborating with WSDOT **Apr. 2016 – Apr. 2017**
  - Working on TRACFLOW Migration Project
    Migrating functions from a transportation data analytical platform to DRIVE Net

- **Research Assistant** at UW collaborating with WSDOT **Sept. 2015 – Apr. 2016**
  - Working on DRIVE Net Phase II Project
    Designing and developing novel transportation big data analytics functions

- **Intern** at Accenture Technology Lab, Beijing, China **Aug. 2014 – Nov. 2014**
  - Working with intelligent transportation team. Mentor: Yan Gao
    Research on investigating similarity of the city blocks based on taxis' activities.

- **Intern** at Mobile and Vehicular Network Laboratory, NTU, Taipei **Feb. 2014 – Jul. 2014**
  - Working with visible light communication team. Mentor: Tsin-Mu Tsai
    Research on characterizing channel fading in vehicular visible light communications with video data (VNC 2015).

- **Intern** at Intel Lab, Taipei, Taiwan **Feb. 2014 – Jul. 2014**
  - Working with intelligent transportation team. Mentor: Shao-Wen Yang
    Research on detecting signals of vehicle taillights using a robust hierarchical framework (ITSC 2014, ITSC 2015).

- **Intern** at Accenture Technology Lab, Beijing, China **Oct. 2013 – Jan. 2014**
  - Working with intelligent transportation team. Mentor: Yan Gao

Research on exploring a predictive traffic assignment model (ITSC 2015). Investigating traffic pattern based on cellular phone data.

- **Intern** at IBM, Beijing, China **Apr. 2013 – Oct. 2013**
  - Working with z/OS build group, CSTL. Mentor: Xin Liu
    Developed a format transferring tool for z/OS migration files in the workflow system.

- **Intern** at IBM Creative Laboratory, Beijing, China **Sept. 2012 – Feb. 2013**
  - Working with intelligent transportation team. Mentor: Dexin Wu
    Evaluating the live virtual machine migration performance, KVM on Linux.

- **Intern** at National Ocean Technical Center, Tianjin, China **Jul. 2012 – Aug. 2012**
  - Working with marine monitoring team.
    Configuring network and adding node to the dynamic marine monitoring network.