

# Xianyuan Zhan

CURRICULUM VITAE

Urban Computing Business Unit & JD Intelligent City Research, JD Digits

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## Research Interests

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Deep Reinforcement Learning, Complex System Optimization, Urban Computing, Big data Analytics in Transportation, Intelligent Transportation Systems, Complex Networks

## Education

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### Doctor of Philosophy

Jan. 2013 - Aug. 2017

PURDUE UNIVERSITY

Transportation Systems, Civil Engineering. Advisor: Dr. Satish V. Ukkusuri

### Master of Science

Jan. 2014 - Dec. 2016

PURDUE UNIVERSITY

Computer Science

### Master of Science in Engineering

Aug. 2011 - Dec. 2012

PURDUE UNIVERSITY

Transportation Systems, Civil Engineering

### Bachelor of Engineering

Aug. 2007 - Jul. 2011

TSINGHUA UNIVERSITY

Beijing, China

Civil Engineering

## Professional Experience

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### Data Scientist, Senior Researcher

Jan. 2018 - Present

JD DIGITS

Beijing, China

JD Urban Computing Business Unit, JD Intelligent City Research

### Research Associate

Aug. 2017 - Jan. 2018

MICROSOFT RESEARCH ASIA

Beijing, China

Urban Computing Group

### Research Assistant

Aug. 2011 - Aug. 2017

PURDUE UNIVERSITY

West Lafayette, US

Lyles School of Civil Engineering

### Teaching Assistant

SPRING 2013, FALL 2015

PURDUE UNIVERSITY

West Lafayette, US

Lyles School of Civil Engineering

### Visiting Research Fellow

May. - Aug. 2015

MICROSOFT RESEARCH ASIA

Beijing, China

Mentor: Dr. Yu Zheng

### Research Assistant

Jun. 2009 - Jan. 2011

TSINGHUA UNIVERSITY

Beijing, China

3S (GNSS/RS/GIS) Research Center

## Assistant Engineer

BEIJING CONSTRUCTION ENGINEERING GROUP, CO., LTD.

Intern

Jun. - Sep. 2010

Beijing, China

## Honors & Awards

2020	2019 Synced Machine Intelligence Awards: 30 Best AI Use Cases of the Year	SYNCED
2018	Artificial Intelligence Innovation Award	CAIS 2018
2018	Committee Member of Technical Committee on Artificial Intelligence & Pattern Recognition of China Computer Federation (CCF-AI)	CCF
2016	James S. McDonnell Foundation (JSMF) Postdoctoral Fellowship Award in Studying Complex Systems	James S. McDonnell Foundation
2014	Pai Tao Yeh Fellowship	Purdue University
2013	Pai Tao Yeh Fellowship	Purdue University
2010	2nd Prize of Fifth National Competition of Transport Science and Technology	China
2010	Gammon Scholarship	Tsinghua University
2009	Zheng Ge Ru Scholarship	Tsinghua University
2008	Gammon Scholarship	Tsinghua University

## Publications

### JOURNAL PUBLICATIONS

1. **Zhan, X.**, Li, R., and Ukkusuri, S. V., 2020. Traffic State Estimation for Arterial Networks Using License-plate Recognition Data. *Transportation Research Part C: Emerging Technologies*, 117, 102660.
2. Yang, C., Zhang, Y., **Zhan, X.**, Ukkusuri, S. V. and Chen, Y., 2020. Fusing Mobile Phone and Travel Survey Data to Model Urban Activity Dynamics. Accepted in *Journal of Advanced Transportation*.
3. **Zhan, X.**, and Ukkusuri, S. V., 2019. Spatial Dependency of Urban Sprawl and the Underlying Road Network Structure. *Journal of Urban Planning and Development*, 145(4), 04019014.
4. Zischg, J., Klinkhamer, C., **Zhan, X.**, Rao, S. C., and Sitzenfrei, R., 2019. A Century of Topological Co-Evolution of Complex Infrastructure Networks in an Alpine City. *Complexity*, 2019, 2096749.
5. Gehlot, H., **Zhan, X.**, Qian, X., Thompson, C., Kulkarni, M. and Ukkusuri, S. V., 2018. A-Rescue 2.0: A High Fidelity, Parallel, Agent-based Evacuation Simulator. *Journal of Computing in Civil Engineering*, 33(2), 04018059.
6. **Zhan, X.**, Ukkusuri, S. V., and Rao, S. C., 2017. Dynamics of Functional Failures and Recovery in Complex Road Networks. *Physical Review E*, 96(5), 052301.
7. **Zhan, X.**, and Ukkusuri, S. V., 2017. Multiclass, Simultaneous Route and Departure Time Choice Dynamic Traffic Assignment with an Embedded Spatial Queuing Model. *Transportmetrica B: Transport Dynamics*, doi: 10.1080/21680566.2017.1354738.
8. Mo, B., Li, R., **Zhan, X.**, 2017. Speed Profile Estimation Using License Plate Recognition Data. *Transportation Research Part C: Emerging Technology*, 82, 358–378.
9. Kreuger, E., Klinkhamer, C., Urich C., **Zhan, X.**, and Rao, S. C., 2017. Generic Patterns in the Evolution of Urban Water Networks: Evidence from a Large Asian City. *Physical Review E*, 95(3), 032312.
10. Li, R. Ye, Z., Li. B. and **Zhan, X.**, 2017. Simulation of Hard Shoulder Running Combined with Queue Warning During Traffic Accident with CTM model. *IET Intelligent Transport Systems*, 11(9), 553-560.
11. **Zhan, X.**, Zheng, Y., Yi, X., and Ukkusuri, S. V., 2016. Citywide Traffic Volume Estimation Using Trajectory Data. *IEEE Transactions on Knowledge and Data Engineering (TKDE)*, 29(2), 272-285.
12. **Zhan, X.**, Qian, X., Ukkusuri, S. V., 2016. A Graph Based Approach to Measure the Efficiency of Urban Taxi Service System. *IEEE Transactions on Intelligent Transportation Systems*, 17(9), 2479-2489.
13. **Zhan, X.**, Ukkusuri, S., V., Yang, C., 2016. A Bayesian Mixture Model for Short-term Average Link Travel Time Estimation Using Large-scale Limited Information Trip-based Data. *Automation in Construction*, 72(3), 237-246.
14. Mesa-Arango, R., **Zhan, X.**, Ukkusuri, S. V., Mitra, A., 2016. Direct Transportation Economic Impacts of Highway

- Networks Disruptions Using Public Data from United States. *Journal of Transportation Safety & Security*, 8(1), 36-55.
15. Hasan, S., Ukkusuri, S., **Zhan, X.**, 2016. Understanding Social Influence in Activity-Location Choice and Life-Style Patterns Using Geo-location Data from Social Media. *Frontiers in ICT*, 3:10, doi: 10.3389/fict.2016.00010.
  16. Aziz, H. M., Ukkusuri, S., **Zhan, X.**, 2016. Determining the Impact of Personal Mobility Carbon Allowance Schemes in Transportation Networks. *Network and Spatial Economics*, 17(2), 505-545.
  17. Ukkusuri, S., Hasan, S., Doan, K., Luong, B., **Zhan, X.**, Murray-Tuite, P., Yin, W., 2016. A-RESCUE: An Agent-based Regional Evacuation Simulator Coupled with User Enriched Behavior. *Network and Spatial Economics*, 17(1), 197-223.
  18. **Zhan, X.**, Aziz, H. M., Ukkusuri, S. V., 2015. An Efficient Parallel Sampling Technique for Multivariate Poisson-Lognormal Model: Analysis with Two Crash Count Datasets. *Analytic Methods in Accident Research*, 8, 45-60.
  19. **Zhan, X.**, Li, R., Ukkusuri, S. V., 2015. Lane-based Real Time Queue Length Estimation Using License Plate Recognition Data. *Transportation Research Part C: Emerging Technology*, 57, 85-102.
  20. **Zhan, X.**, Ukkusuri, S., V., Zhu, F., 2014. Inferring Urban Land Use Using Large-Scale Social Media Check-in Data. *Network and Spatial Economics*, 14, 647-667.
  21. **Zhan, X.**, Hasan, S., Ukkusuri, S. V., Kamga, C., 2013. Urban Link Travel Time Estimation Using Large-scale Taxi Data with Partial Information. *Transportation Research Part C: Emerging Technologies*, 33, 37-49.
  22. Ukkusuri, S., **Zhan, X.**, Sadri A., Ye, Q., 2013. Exploring Crisis Informatics Using Social Media Data: A Study on 2013 Oklahoma Tornado. *Transportation Research Record*, 2459, 110-118.

#### PEER REVIEWED BOOK CHAPTER

1. Qian, X., **Zhan, X.**, Ukkusuri, S. V. Characterizing Urban Dynamics Using Large Scale Taxicab Data. Engineering and Applied Sciences Optimization: Vol. 38, 17-32, Springer International Publishing, 2015.
2. Ukkusuri, S. V., Hasan, S., and **Zhan, X.** Checking the Urban Pulse: Social Media Data Analytics for Transportation Applications. Best Practices for Transportation Agency Use of Social Media Data. Taylor and Francis/CRC Press, 2013.

#### CONFERENCE PROCEEDINGS

1. Qin, H., **Zhan, X.**, Ke, S., Yang, X., Xu, H., and Zheng, Y. Robust Spatio-Temporal Purchase Prediction via Deep Meta Learning. In *Thirty-Fifth AAAI Conference on Artificial Intelligence (AAAI2021)*.
2. Yang, C., Zhang, Y., **Zhan, X.**, Ukkusuri, S. V., and Qiu, W. Activity Chain Inference Using Travel Survey and Mobile Phone data. In *Proceedings of Transportation Research Board Meeting*, Washington D.C., January 2017.
3. Zischg, J., Klinkhamer, C., **Zhan, X.**, Krueger, E., Ukkusuri, S., Rao, P. S. C., Rauch, W. and Sitzenfrie, R. Evolution of Complex Network Topologies in Urban Water Infrastructure. In *World Environmental and Water Resources Congress 2017*, Sacramento, May 2017.
4. **Zhan, X.**, Ukkusuri, S. V. A Probabilistic Urban Link Travel Time Estimation Model Using Large-scale Taxi Trip Data. In *Proceedings of 94th Transportation Research Board Meeting*, Washington D.C., January 2015.
5. **Zhan, X.**, Qian, X., Ukkusuri, S. V. Measuring the Efficiency of Urban Taxi Service System. In *Proceedings of the 3rd ACM SIGKDD International Workshop on Urban Computing*, New York, August 2014.
6. Qian, X., **Zhan, X.**, Ukkusuri, S. Characterizing Urban Dynamics Using Large Scale Taxicab Data. In *Proceedings of 93rd Transportation Research Board Meeting*, Washington D.C., January 2014.
7. **Zhan, X.**, Ukkusuri, S. V.. Multi-User Class, Simultaneous Route and Departure Time Choice Dynamic Traffic Assignment with an Embedded Spatial Queuing Model. *5th International Symposium on Dynamic Traffic Assignment*. Salerno, Italy, June, 2014.
8. Hasan, S., **Zhan, X.**, and Ukkusuri, S. V. Understanding Urban Human Activity and Mobility Patterns Using Large-scale Location-based Data from Online Social Media. *Proceedings of the 2nd ACM SIGKDD International Workshop on Urban Computing*, 2013.

#### ARXIV PREPRINTS

1. Klinkhamer, C., Kreuger, E., **Zhan, X.**, Blumesaat, F., Ukkusuri, S. V., and Rao, S. C. Functionally Fractal Urban Networks: Geospatial Co-location and Homogeneity of Infrastructure. *arXiv preprint arXiv:1712.03883*.

## THESES

1. Novel Approaches to Model Congestion Evolution and Dependencies in Complex Road Networks. Ph.D. Dissertation, Purdue University, 2017.
2. Understanding the Aggregate Level Urban Activity Patterns Using Large-Scale Geo-Location Data. MS Thesis, Purdue University, 2012.
3. A Cellular Automaton Based Microscopic Traffic Flow Simulation Model for Abnormal Traffic Flow. Undergraduate Thesis, Tsinghua University, 2011.

## PAPERS UNDER REVIEW

1. Qin, H., **Zhan, X.**, Zheng, Y. CSCAD: Correlation Structure-based Collective Anomaly Detection in Complex System. Submitted to *IEEE Transactions on Knowledge and Data Engineering (TKDE)*.

## WORKING MANUSCRIPT

1. Xu, H., **Zhan, X.**, Li, C., and Zheng, Y. CEQ: Constraint Evaluation Q-Learning for Offline Reinforcement Learning under Constraints.

## Talks & Presentations

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1. Application of Deep Reinforcement Learning in Control Optimization of Thermal Power Plants. *IEEE Services - Industry Symposium*. October 2020.
2. Urban Computing: Building Intelligent Cities with Big Data and AI. Invited talk at Tsinghua University. November 2019, Beijing, China.
3. Data-driven Methods in Urban Applications: New Problems, New Directions and New Approaches. Invited talk at Tsinghua University. December 2018, Beijing, China.
4. Spatio-Temporal Deep Learning in Intelligent Cities. *Smart Cities and Urban Computing Forum, China National Computer Congress (CNCC 2018)*. October 2018, Hangzhou.
5. Data-driven Optimization Models for Logistics in Urban Applications. *3rd Workshop on Applications of the Mathematical Modeling in Enterprises*. July 2018, University of Chinese Academy of Sciences, Beijing.
6. Data-driven Methods in Urban Transportation Applications. Invited talk at Tsinghua University. September 2017, Beijing, China.
7. A Vertex Split-Recovery Model for Congestion Evolution Process on Road Networks. *INFORMS 2016*. November 2016, Nashville.
8. Traffic State Estimation for Arterial Networks Using License-plate Recognition Data. *INFORMS 2016*. November 2016, Nashville.
9. A Node Split-Recovery Model for Congestion Evolution Process on Road Networks. *Resilience Week 2016*. August 2016, Chicago.
10. A Node Splitting-Recovery Model for Congestion Evolution Process on Road Networks. *4th International Symposium on Water, Feedbacks, and Complexity*. March 2016, Purdue University.
11. A Bayesian Mixture Model for Short-term Average Link Travel Time Estimation Using Large-scale Limited Information Trip-based Data. *INFORMS 2015*, November 2015, Philadelphia.
12. A Graph-based Approach to Measure the Efficiency of Urban Taxi Service System. *INFORMS 2015*, November 2015, Philadelphia.
13. Measuring the Efficiency of Urban Taxi Service System. *KDD 2014 International Workshop on Urban Computing*, August 2014, New York.
14. Urban Link Travel Time Estimation Using Large-scale Taxi Data with Partial Information. *MPE 2013+ Workshop on Sustainable Human Environments*. April 2014, Rutgers University.
15. Multiclass Dynamic User Equilibrium with a Path Based Cell Transmission Model for General Traffic Networks. *INFORMS 2013*, October 2013, Minneapolis.
16. Real Time Link Travel Time Estimation Using License-plate Recognition Data. *INFORMS 2013*, October 2013, Minneapolis.

## Collaborative Research Activities

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### **Traffic Signal Optimization: A Data-driven and Deep Reinforcement Learning Approach**

2017 - 2018

COLLABORATED WITH DIDI CHUXING

1 patent granted.

### **Citywide Traffic Volume Estimation Using Large-scale Trajectory Data**

2015 - 2016

COLLABORATED WITH MICROSOFT RESEARCH ASIA (MSRA)

1 paper published in IEEE Transactions on Knowledge and Data Engineering (TKDE).

### **Real Time Queue Length Estimation Using License-plate Recognition Data**

2014 - 2015

COLLABORATED WITH TSINGHUA UNIVERSITY, CHINA

1 paper published in Transportation Research Part C.

### **The Use of Large-scale Dataset for Understanding Network State**

2013

COLLABORATED WITH THE CITY UNIVERSITY OF NEW YORK (CUNY)

1 paper published in Transportation Research Part C.

## Research Projects

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### **Artificial Intelligence-based Optimization System for Thermal Power Generating Units.**

2018

FUNDED BY CNH ENERGY AND JD INTELLIGENT CITY RESEARCH

Research project manager for developing a deep reinforcement learning model and system to optimize power generation efficiency for thermal power generating units in power plants. This research has already finished software productization and been deployed in three power plants in China.

### **Collective Anomaly Detection for Large-Scale Complex Sensory Systems.**

2018

FUNDED BY CNH ENERGY AND JD INTELLIGENT CITY RESEARCH

Research project manager for developing a collective anomaly detection algorithm for very high dimensional sensory data in complex systems.

### **Bridging Information, Uncertainty and Decision-Making in Hurricanes Using an Interdisciplinary Perspective**

2015 - 2017

FUNDED BY NATIONAL SCIENCE FOUNDATION (NSF)

Project leader for developing parallelized large-scale agent-based traffic simulator for hurricane evacuation in urban road networks.

### **Incorporating Household Decision Making with Dynamic Transportation Modeling in Hurricane Evacuation**

2012 - 2015

FUNDED BY NATIONAL SCIENCE FOUNDATION (NSF)

Participated in coding a Java-based large-scale agent-based traffic simulator for hurricane evacuation (A-RESCUE). A research paper is published in Network and Spatial Economics.

### **The Use of Large Scale Datasets for Understand Traffic Network State**

2012 - 2013

SPONSOR: UNIVERSITY TRANSPORTATION RESEARCH CENTER - REGION 2

Developed a real-time link travel time estimation model using large-scale taxi trip data from New York City. Published in Transportation Research Part C.

## Professional Activities

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### REVIEWER OF JOURNALS

- PLOS ONE

- ACM Transactions on Intelligent Systems and Technology
- IEEE Transactions on Knowledge and Data Engineering (TKDE)
- IEEE Transactions on Big Data (TBD)
- IEEE Transactions on Knowledge Discovery from Data (TKDD)
- IEEE Transactions on Intelligent Transportation Systems (ITS)
- IEEE Access
- Expert Systems With Applications
- Transportation Research Part B: Methodological
- Transportation Research Part C: Emerging Technologies
- Transportation Research Part D: Transport and Environment
- Transportmetrica B: Transport Dynamics
- European Journal of Operational Research
- Network and Spatial Economics
- Transportation
- Journal of Advanced Transportation
- Environment and Planning B: Urban Analytics and City Science
- IET Intelligent Transport Systems
- Journal of Physics: Complexity

#### REVIEWER OF CONFERENCES

- AAAI Conference on Artificial Intelligence
- IEEE Conference on Decision and Control
- Transportation Research Board Annual Meeting
- China Conference on Data Mining (CCDM)

#### CHAIR OF CONFERENCE SESSIONS

- **Session Chair:** Innovative Data Sources in Transportation. *INFORMS 2015*, November, Philadelphia.
- **Session Chair:** Advances in Transportation Network Modeling. *INFORMS 2015*, November, Philadelphia.

## Teaching Experience

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#### Courses as Teaching Assistant

LYLES SCHOOL OF CIVIL ENGINEERING, PURDUE UNIVERSITY

- **CE 597** (Fall 2015): The Science and Business of Logistics Systems
- **CE 398** (Spring 2013): Introduction to Civil Engineering System Design

#### Co-Instructor of a Summer Course

*Jun 2016*

SCHOOL OF TRANSPORTATION ENGINEERING, TONGJI UNIVERSITY, CHINA

- **Summer Course:** Big Data Transportation Analytics

#### Instructor at Workshop

*Jun. - Jul. 2015*

KOREA UNIVERSITY, SEOUL, SOUTH KOREA

Synthesis Workshop on “Dynamics of Structure and Functions of Complex Networks”

#### Supervised Exchange Undergraduate Students at Purdue

*2015*

LYLES SCHOOL OF CIVIL ENGINEERING, PURDUE UNIVERSITY

- Jingxing Wang (Jan. - Feb. 2015), from Tsinghua University, China
- Xiaodong Qian (Jun. - Sep. 2015), from Tsinghua University, China
- Victorial Mutran (Jul. - Aug. 2015), from Universidade do Estado do Pará, Brazil

## Supervised Interns

2017

### MICROSOFT RESEARCH ASIA

- Huilin Qin (2017-2018), PhD student at Xidian University, China

## Supervised Interns

2018 - Present

### JD INTELLIGENT CITY RESEARCH

- Yixian Li (2018), Master student at Northeastern University, China
- Huilin Qin (2018-2020), PhD student at Xidian University, China
- Haoran Xu (2018-2020), Master student at Xidian University, China
- Chunyang Li (2018-2020), Master student at Xidian University, China

## Membership & Affiliations

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### Committee Member

2018 - Present

Technical Committee on Artificial Intelligence & Pattern Recognition of China Computer Federation (CCF-AI)

### Member

2018 - Present

China Computer Federation (CCF)

### Member

2011 - 2017

Purdue Institute of Transportation Engineers (ITE)

### Member

2013 - 2017

INFORMS Chapter at Purdue University

### Co-chair

2012 - 2014

Tsinghua University Alumni Association of Purdue University