Zhuoran Zhang

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Education

Carnegie Mellon University Pittsburgh, PA

Doctor of Philosophy (Ph.D.) in Civil Engineering May 2022 (Expected)

- GPA: 3.67/4.00
- Dr. Elio D'Appolonia Graduate Fellowship

Tsinghua University Beijing, China

Bachelor of Engineering in Construction Management (major) July 2017

- Thesis topic: *Quantifying scarcity of urban land in China based on multi-dimensional remote sensing data*
- GPA: 3.73/4.00 *Magna Cum Laude*

Bachelor of Science in Psychology (minor) July 2017

- Thesis topic: *The influence of social comparison on happiness: an individual tracking study based on experience sampling method*

Skills

Programming Languages: *Advanced* - Python, SQL, R, Stata; *Intermediate* - SAS, C++, JavaScript
Software & Packages: *Advanced* – MATLAB, ArcGIS, QGIS, Pandas, Scikit-learn, Tetrad, DoWhy; *Intermediate* -PyTorch, , GAMS
Languages: *Fluent* - English, *Native* - Chinese

Ph.D. Research Projects

Mitigating Work Zone Crashes by Causal Inference with High-resolution Data June 2018 - Present

- Developed map-matching and data-fusion algorithms to manage high-resolution TB-level multi-source data sets including work zones, accidents, traffic speed, and weather at minute and meter level (Publication [2])
- Proposed a causal discovery method based on the Fast Causal Inference model to efficiently identify dominant causes of thousands of work zone crashes (Publication [3])
- Proposed a novel causal inference model based on Regression Discontinuity Design to infer safety effects of work zone deployment configurations, eliminating confounding bias (Publication [1])
- Authored a technical report submitted to University Transportation Center Program in the U.S. Department of Transportation (Technical Report [1], $127,500 grant)

A Holistic Framework for Prioritizing Investments in Bridge Lifting Aug. 2017 - May 2019

- Led a team of three Ph.D. students and one Post-doc from two Departments, to develop a prioritization framework minimizing construction costs while maximizing social equity
- Implemented a Multi-class Dynamic Traffic Assignment model based on C++ to predict traffic volume changes after bridge lifting projects in a resolution of seconds and meters
- Introduced a prioritization method based on Efficiency Frontier to achieve highest social equity for a defined level of construction costs
- Authored a technical report submitted to Pennsylvania Infrastructure Technology Alliance (Technical Report [2], $140,821 grant)

Relevant Graduate Course Projects

Inferring Causal Effects of Weather Conditions on Work Zone Crash Risk Aug. - Dec. 2020

On course: Causality and Machine Learning

- Performed a Fast Causal Inference model and LiNGAM using Tetrad and R to evaluate the causal effects of weather conditions on work zone crash risk (Achieved a grade of 100/100)

A Real-world Audio Adversary against Wake-word Detection Systems Jan. - May 2019

On course: Probabilistic Graphical Model

- Collaborated with two Ph.D. students to perform a time-delayed bottleneck highway network with Discrete Fourier Transform using PyTorch to mimic the wake word detection on Amazon Alexa Voice Assistant
- Investigated the usage of a projected gradient descent model for adversarial audio attacks against the "Alexa" wake word detection on Amazon Alexa Voice Assistant

Predicting Building Energy Demand Using Building Automation System Information Aug. - Dec. 2017
On course: Data-driven Building Energy Management

- Implemented and compared five models (OLS, subset based on regression score, LASSO, Ridge, partial least square) to predict building energy demand using building time-series information.

A Web-based Bridge Management System Aug. -Dec. 2017
On Course: Advanced Python and Web Prototyping

- Scrapped web contents of a state bridge management system (legally permitted) with billions of entries and GB level text contexts, using Selenium
- Designed and administrated a multiple-user web server permitting users to query, edit, and visualize bridge data on online maps, with Django and MySQL

Professional Experience

Overstock.com, Inc. Salt Lake City, UT
Machine Learning Intern at Experimentation Science June 2021 - Present

Department of Civil and Environmental Engineering, Carnegie Mellon University Pittsburgh, PA
Graduate Research Assistant Aug. 2017 - Present
Teaching Assistant for 12-411 Project Management for Construction Fall 2017 - Fall 2020

Hang Lung Center for Real Estate, Tsinghua University Beijing, China
Undergraduate Research Assistant Nov. 2016 - Jan. 2017

UCLA Luskin School of Public Affairs Los Angeles, CA
Undergraduate Research Assistant July 2016 - Sep. 2016

Relevant Graduate Coursework

80816 Causality and Machine Learning, 10701 Machine Learning (Ph.D. level), 10718 Data Analysis & Machine Learning for Public Policy, 10725 Convex Optimization, 94834 & 94835 Applied Econometrics, 10718 Probabilistic Graphical Models, 12752 Data-driven Building Energy Management, 94867 Decision Analytics and Business Policy, 12780 Advanced Python and Web Prototyping for Infrastructure Systems

Publications

[1] Zhuoran. Zhang, Sean Qian, and Burcu Akinci. (2021). Inferring Causal Effects of Work Zone Deployment Configurations on Crashes. Working paper for *Transportation Research Part B: Methodological*
[2] Zhuoran Zhang, Burcu Akinci, and Sean Qian. (2021). A Novel Map-matching Algorithm for Relating Work Zones and Crashes. Submitted to *Construction Research Congress 2022*
[3] Zhuoran Zhang, Burcu Akinci, and Sean Qian. (2021). Identifying Temporal Instability in Factors Causing Work Zone Crash Occurrences Using Fast Causal Inference. Accepted in *ASCE International Conference on Computing in Civil Engineering 2021*
[4] Zhuoran Zhang, Maoshan Qiang, and Hanchen Jiang. (2017). Finding Academic Concerns on Real Estate of U.S. and China: A Topic Modeling Based Exploration. In *Proceedings of the 21st International Symposium on Advancement of Construction Management and Real Estate.* (pp. 807-817). Springer, Singapore.

Technical Reports

[1] Zhuoran Zhang, Sean Qian, and Burcu Akinci. (2018). Inferring causal effects of crashes in work zones: A case study in Pennsylvania. To *U.S. Department of Transportation, University Transportation Center Program*.
[2] Zhuoran Zhang, Samuel Jones, Crystal Fernandez-Pena, Jooho Kim, Sean Qian, Burcu Akinci, Daniel Armanios. (2019) A Holistic Framework for Prioritizing Investments in Bridge Lifting. To *Pennsylvania Infrastructure Technology Alliance (PITA)*.