Andy (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) *Magna Cum Laude* — July 2017

Bachelor of Science in Psychology (minor) — July 2017

Skills

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

Related Selected 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
- Proposed a novel causal inference model based on Regression Discontinuity Design to infer safety effects of work zone configurations, eliminating confounding bias
- Proposed to incorporate lagged-dependent variable in the causal forest model to infer the heterogeneous treatment effect of work zone presence on crash risk with unmeasured confounders
- Developed a causal model with Rubin's generalized methods (g methods) to infer the treatment effect of work zone presence on crash risk under different posted speed limits

Professional Experience

Overstock.com, Inc. — Salt Lake City, UT

Machine Learning Data Science Intern -- Experimentation Science — June - Aug. 2021

- Decided the sample size needed for an online A/B test on inferring the causal effect of delivery message accuracy on conversion rate.
- Created a panel data set covering hundreds of variables for thousands of subcategories of products over three years, collaborating with associates from four different departments.
- Proposed to leverage past experiments as instruments to mitigate the reverse causation problem when inferring the average treatment effect of site sale discount on gross merchandise sales
- Implemented the causal forest model to infer the heterogeneous treatment effect of site sale discount on gross merchandise sales across various types of products

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

Other Ph.D. Research Projects

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

Related Selected 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

Related Selected 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 the causal effect of work zones on crashes: methodology and a case study. *Analytic Methods in Accident Research*. doi:10.1016/j.amar.2021.100203.
[2] Zhuoran. Zhang, Sean Qian, and Burcu Akinci. (2021). Inferring causal effects of work zone configurations on crash risk. *The Transportation Research Board (TRB) 101st Annual Meeting*
[3] Zhuoran Zhang, Burcu Akinci, and Sean Qian. (2021). A novel map-matching algorithm for relating work zones and crashes. *Construction Research Congress 2022*
[4] Zhuoran Zhang, Burcu Akinci, and Sean Qian. (2021). Identifying temporal instability in factors causing work zone crash occurrences using fast causal inference. *ASCE International Conference on Computing in Civil Engineering 2021*
[5] 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*. doi: 10.1007/978-981-10-6190-5_73

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)*.