Shushu Zhang

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EDUCATION

Ph.D. in Statistics, University of Michigan-Ann Arbor *Aug. 2021 - May 2026 (Expected)*
(Advisors: Xuming He, Kean Ming Tan, GPA: 4.0/4.0)

M.S. in Statistics, University of Wisconsin-Madison *Sept. 2019 - May 2021*
(Advisor: Vivak Patel, GPA: 4.0/4.0)

B.S. in Statistics, East China Normal University *Sept. 2016 - Jul. 2020*
(GPA: 3.87/4.0, Rank: 1/126)
Study Abroad at University of Wisconsin-Madison *Sept. 2019 - May 2020*
(GPA: 4.0/4.0)

RESEARCH EXPERIENCES

Expected Shortfall Regression using Random Forest
Dept. of Statistics, University of Michigan, Ann Arbor *May 2023 - Present*

- Expected shortfall (ES) is defined as the average over the tail below (or above) a certain quantile of a probability distribution. We proposed the ES (causal) random forest to estimate the nonlinear relationship between covariates and the ES of the response and the heterogeneous treatment effect. We established the consistency and asymptotic normality of the proposed estimators and applied them to health disparity research.
- Publication:
  - **Zhang, S.**, He, X., Tan, K., & Zhou, W. (2024). Expected Shortfall Regression for Heterogeneous Treatment Effect Estimation using Random Forest.

Linear Expected Shortfall Regression
Dept. of Statistics, University of Michigan, Ann Arbor *Jan. 2022 - Feb. 2023*

- Proposed lasso-penalized ES regression with high-dimensional covariates and established non-asymptotic error bounds and statistical inference for the proposed estimator, and applied to health disparity research for high cotinine populations.
- Proposed a novel optimization-based approach for the linear ES regression with minimal assumptions. We provided a prototype implementation of the proposed method and established the consistency and the asymptotic normality of the proposed estimator.
- Publications:
  - **Zhang, S.**, He, X., Tan, K., & Zhou, W. (2023). High-Dimensional Expected Shortfall Regression. *Major revision at Journal of the American Statistical Association (JASA).* arXiv.
  - Li, Y., **Zhang. S.**, He, X. (2024). Expected Shortfall Regression via Optimization. *Submitted.*

Stochastic Optimization
Dept. of Statistics, UW Madison *Aug. 2019 - Aug. 2021*

- Established global convergence of the stochastic gradient descent under less restrictive assumptions, expanding its applicability to more stochastic optimization problems.
- Adapted stochastic approximation methods, including Stochastic Gradient Descent (SGD) and Kalman-based Stochastic Gradient Descent (kSGD), to high-frequency observations in data assimilation that produce high-quality estimates and avoid computational problems.
- Publication:
  - **Zhang, S.**, Patel, V. (2021). Stochastic Approximation for High-frequency Observations in Data Assimilation. arXiv.
  - Patel, V., **Zhang, S.**, Tian, B. (2022). Global Convergence and Stability of Stochastic Gradient Descent. *Advances in Neural Information Processing Systems 35 (2022): 36014-36025.* Available at NeurIPS.

SELECTED PRESENTATIONS

- (**Poster with award**) "Expected Shortfall Regression via Optimization."
  Workshop for Translational Research on Data Heterogeneity at Washington University in St. Louis, Apr. 6-7, 2024.
- (**Poster with award**) "High-Dimensional Expected Shortfall Regression."
  Michael Woodroofe Memorial Conference, Sep. 9-10, 2023.
- (**Invited Poster**) "High-Dimensional Expected Shortfall Regression."
  Joint Statistical Meetings, Invited E-poster Presentation, Toronto, Aug. 5-10, 2023.
- (**Invited**) "High-Dimensional Expected Shortfall Regression."
  Joint Statistical Meetings, SLDS Student Paper Awards Session, Toronto, Aug. 5-10, 2023.
- (**Invited**) "High-Dimensional Expected Shortfall Regression."
  ICSA Applied Statistics Symposium, Ann Arbor, Michigan, Jun. 11-14, 2023.
- "Robust Estimation and Inference for Joint Quantile and Expected Shortfall *Regression in High-dimensional Settings."*
  International Conference on Robust Statistics (ICORS), University of Waterloo, Jul. 5-8, 2022.
- "Stochastic Approximation for High-frequency Observations in Data Assimilation."
  SIAM Conference on Computational Science and Engineering, Digital Conference, Mar. 1-5, 2021.

SELECTED AWARDS, FELLOWSHIPS, AND SCHOLARSHIPS

Statistical Learning and Data Science Student Paper Award, American Statistical Association (ASA). *2023*

Rackham International Students Fellowship, University of Michigan, Ann Arbor. *2022*

Outstanding First Year PhD Student, Department of Statistics, University of Michigan, Ann Arbor. *2022*

Lingzi Lu Memorial Award, American Statistical Association (ASA). *2021*

Academic Excellence Award, Department of Statistics, UW Madison. *2020*

Presidential Scholarship, East China Normal University. *2018*

Outstanding Student, East China Normal University. *2017-2019*

China National Scholarship (top 1% of cohort), Ministry of Education of the People's Republic of China. *2017*

TECHNICAL SKILLS

Python, C++, Julia, R (rSTAN, Rcpp), SQL, SAS, Vim, Emacs