Zhigen Zhao

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Fox School of Business
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EDUCATION

- Ph.D. in Mathematics, 2009, **Cornell University**, Ithaca, NY
  Ph.D. Dissertation: *Decision Approach and Shrinkage Confidence Intervals*

- B.S. in Mathematics, 2003, **Nankai University**, Tianjin, China

EMPLOYMENT

- Director of Graduate Programs, Fox School of Business and Administration, Temple University, 2019-2023.

- Associate Professor (with tenure), Department of Statistics, Operations and Data Science, Fox School of Business and Administration, Temple University, 2021-present,

- Associate Professor (with tenure), Department of Statistical Science, Fox School of Business and Administration, Temple University, 2016-2021,

- Associate Professor (Secondary Appointment), Center for Data Analytics and Biomedical Informatics, Temple University, 2016-2019,

- Charles E. Beury Research Fellow, Fox School of Business and Administration, Temple University, 2016-present,

- Visiting Scholar, Department of Statistics, Harvard University, 2019

- Visiting Scholar, Cornell University, May-August 2010,

- Assistant Professor, Department of Statistics, Fox School of Business and Administration, Temple University, 2009-2016,

HONORS & AWARDS

- Co-Editor of *Communications in Statistics, Theory and Methods.*   2026-

- Faculty Fellowship Program in Israel.   2024

- Elected Member, International Statistical Institute (ISI).   2023

- Dean's Research Honor Roll, Fox School of Business Management, Temple University.   2014

- IMS Laha Travel Award.   2009

GRANT

1. Principle Investigator. National Science Foundation. *Collaborative Research: Multiple Hypothesis Testing on the Regression Analysis.* 2023-2026. NSF-DMS-2311216. $197,009. (Post tenure)

2. Principle Investigator. National Science Foundation. *BIGDATA: Collaborative Research: F: Statistical Theory and Methods beyond the Dimensionality Barrier.* 2016-2020. NSF-IIS-1633283. $250,000. (Post tenure)

3. Co-Principle Investigator. Department of Transportation of State Pennsylvania. *Winter Roadway Maintenance Material Enhancers (Field) Evaluation.* 2016-2018. $298,000. (Post tenure)

4. Principle Investigator. National Science Foundation. *Bayesian Decision Theoretic Methods for Some High-Dimensional Multiple Inference Problems.* 2012-2015. NSF-DMS-1208735. $174,976. (Prior tenure)

RESEARCH CONTRIBUTIONS

Submitted Manuscript

1. Lei Yan, Zhigen Zhao, Henry Zhang. (2025) Model-free multiple testing for matrix-valued predictors with false discovery control. Submitted.

2. Zhang, K., Zhao, Z., and Zhou, W. (2024) BEAUTY Powered BEAST. Submitted.

3. Zhao, Z. and Xing, X. (2024) On the testing of multiple hypothesis in sliced inverse regression. Revise and resubmitted.

4. Liang, Z., Liu, J., Wang, X. and Zhao, Z. (2024) Bayesian Analysis of Multiple Index Additive Models. Revise and resubmitted.

5. Sanni, S. Yu, Y. and Zhao, Z. (2024) Ultra-high dimensional threshold selection for quantile mirror feature screening with FDR error rate control: A case study on high blood pressure analysis. Submitted.

6. Liu, L., Wang, X., Li, X. and Zhao, Z. (2025) The Impact of Leisure Travel on Loneliness among Older Adults in China and the United States. Submitted.

7. Zhang, W., Zhao, Z., Li, Y., Baiochio, M., and Zhang K. (2025) SorBET: A Fast and Powerful Algorithm to Test Dependence of Variables.

8. Zhang, W., Ni, H., Liu, Y., Zhang, K., and Zhao, Z. (2025) Regularizing BELIEF with Sequency Lasso.

Manuscript in preparation

1. Zu, T., Ji, P. and Zhao, Z. (2024) Two-stage Filter: an Optimal Multiple Testing Method in High-Dimensional Regression.

2. Yu, Y., Zu, T. and Zhao, Z. (2024) FDR control for high dimensional quantile variable selection.

3. Zhao, Z., Y. Tian, K. Zhang, and W. Zhou (2024). Test of exchangeability under binary expansion.

4. Ellingworth, A., Ghosh, D. , Zhao, Z. and Zhou, W. (2024) Reproducible or not: a data adaptive nonparametric procedure to define and assess reproducibility across high-throughput studies.

Publications

1. Liao, Y., Xiang, Y., Zhao, Z. and Ai, D. (2025) Bayesian Mixed Effect Higher-Order Hidden Markov Models with Applications to Predictive Healthcare Using Electronic Health Records. *IISE Transactions.* Volume 57, Issue 2.

2. Zhao, Z. (2025) Discussion on "Data Fission: Splitting a Single Data Point". *Journal of the American Statistical Association.* Volume 120, Issue 549, Page 178-179.

3. Zhao, Z. Wang, T., and Ji, B. (2024) Randomized Multiarm Bandits: An Improved Adaptive Data Collection Method. *Statistical Analysis and Data Mining.* Volume 17, Isse 2. E11681.

4. Xing, X., Zhao, Z. and Liu, J. (2023) Controlling False Discovery Rate using Gaussian Mierrors. *Journal of the American Statistical Association.*Volume 118, Issue 541. 222-241.

5. Kwon Y., Zhao, Z. (2023) On F-modelling based Empiricial Bayes Estimation of Variances. *Biometrika.* Volume 110, Issue 1, March 2023, Pages 69–81. Kwon is a PhD student of Zhao.

6. Sanat K. Sarkar, Zhao, Z. (2022) Local False Discovery Rate Based Methods for Multiple Testing of One-Way Classified Hypotheses. *Electronic Journal of Statistics.* Vol. 16, Issue 2, 6043-6085.

7. Zhao, Z. (2021) Where to find needles in a haystack? *TEST.* Vol. 31, Issue 1, 148-174.

8. Lin, Q., Zhao, Z., and Liu, J. (2021) Global testing under the sparse alternatives for single index models. *Festschrift in Honor of R. Dennis Cook.*

9. Lin, Q., Zhao, Z. , and Liu, J. (2019) Sparse Sliced Inverse Regression via Lasso, *Journal of the American Statistical Association.* Vol. 114, Issue 528, 1726-1739.

10. Zhang, J., Zhao, Z. , Zhang, K., and Wei, Z. (2019) A Feature Sampling Strategy for Analysis of High Dimensional Genomic Data. *IEEE/ACM Transactions on Computational Biology and Bioinformatics.* Vol. 16, No. 2, 434-441.

11. Lin, Q., Zhao, Z., and Liu, J. (2018) On consistency and sparsity for sliced inverse regression in high dimension. *Annals of Statistics.* Vol. 46, No. 2, 580-610.

12. Anis, M., Zhao, Z. , Khurana, J., Krynetskiy, E. and Soliman, A. (2017) Determining candidate single nucleotide polymorphisms in acquired laryngotracheal stenosis. *The Laryngoscope.* Vol. 128, Issue 3, 111-116.

13. Ni, H., Qin, J., Zhou, L., Zhao, Z., Wang, J., Hou, F. (2017). Network analysis in detection of early-stage mild cognitive impairment. *Physica A: Statistical Mechanics and its Applications.* Vol. 142, 113-119.

14. Chang, Y. W., Tsong, Y., and Zhao, Z. (2016) Sample size determination for a three-arm equivalence trial of Poisson and Negative binomial responses. *Journal of Biopharmaceutical Statistics.* Vol. 27, Issue 2, 239-256.

15. Zhang, J., Zhao, Z. , Zhang, K., and Wei, Z. (2016) A Feature Sampling Strategy for Analysis of High Dimensional Genomic Data. *APBC2017: The Fifteenth Asia Pacific Bioinformatics Conference.*

16. Liu, Y., Sarkar, S. K., and Zhao, Z. (2015) A new approach to multiple testing of grouped hypotheses. *Journal of Statistical Planning and Inference.* Vol. 179, 1-14. (One of the most downloaded articles from Journal of Statistical Planning and Inference in the last 90 days.)

17. He, L., Sarkar, S. K. and Zhao, Z. (2015) Capturing the severity of Type II errors in high-dimensional multiple testing. *Journal of Multivariate Analysis.* Vol. 142, 106-116.

18. Zhao, Z. and Sarkar, S. K. (2015) A Bayesian approach to construct multiple confidence intervals of selected parameters with sparse signals. *Statistica Sinica.* Volume 25, Number 2, 725-742.

19. Clements, N., Sarkar, S. K., Zhao, Z. and Kim, D. (2014) Applying multiple testing procedure to detect changes in east African vegetation. *Annals of Applied Statistics.* Volume 8, No.1, 286-308.

20. Anis, M., Zhao, Z., Khurana, J., Krynetskiy, E. and Soliman, A. (2014) Translational genomics of acquired laryngotracheal stenosis. *The Laryngoscope.* Vol. 124, Issue 5, 175-179.

21. Chang, Y. W., Tsong, Y., Dong, X. and Zhao, Z. (2013) Sample size determination for a three-arm equivalence trial of normally distributed responses. Journal of Biopharmaceutical Statistics. *Journal of Biopharmaceutical Statistics.* Vol. 24, Issue 6, 1190-1202.

22. Zhao, Z., Wang, W. and Wei, Z. (2013) An empirical Bayes testing procedure for detecting variants in analysis of next generation sequencing data. *Annals of Applied Statistics.* Volume 7, No.4, 2229-2248.

23. Hwang, J. T., Zhao, Z. (2013) Empirical Bayes confidence intervals for selected parameters in high dimensional data. *Journal of the American Statistical Association.* Volume 108, Issue 502, 607-618.

24. Zhao, Z. and Hwang, J. T. (2012) Empirical Bayes FCR controlling confidence interval. *Journal of the Royal Statistical Society, Series B*, Volume 74, Issue 5, 871-891.

25. Zhao, Z. (2010) Double shrinkage empirical Bayesian estimation for unknown and unequal variances, *Statistics and Its Interface.* Volume 3, 533-541.

26. Hwang, J. T., Qiu, J. and Zhao, Z. (2009) Empirical Bayes confidence intervals shrinking both means and variances. *Journal of the Royal Statistical Society, Series B*. Volume **71**, Issue 1, 265-285.

PATENT

1. Methods, systems, and computer readable media for non-parametric dependence detection using bitwise operations in a computing system. 2019.

SOFTWARE

1. R package: Binary Expansion Test (BET)

2. R package: generalized signal-to-noise ratio (gSNR)

3. R package: CLAT: Cdf and Local fdr Assisted multiple Testing method (CLAT)

4. R package: LassoSIR: Sparsed Sliced Inverse Regression via Lasso (LassoSIR)

5. R package: Multiple Testing Procedure for Grouped Hypotheses (GroupTest)

6. Bayesian LASSO with Zero Inflated Mixture Prior

7. EBVariant: An Empirical Bayes testing procedure for detecting variants in analysis of next generation sequencing data.

MENTORSHIP

I am serving as Ph.D. Dissertation Chair for

- Issac Lim. 2025 - present.

- Kyle Chen. 2023 - present.

- Jian Sun. 2019 - present.

- Yu Tian. 2017 - 2025. *Test of Exchangeability under Binary Expansion*

- Tong Wang. 2017 - 2022. *Resampling-based Bias Adjustment for Adaptively Collected Data*

- Zhengkang Liang. 2018 - 2022. *On the Bayesian Multiple Index Models*

- Yeil Kwon. 2013-2018. *Nonparametric empirical Bayes simultaneous estimation for multiple variances*. First position as a Tenure-Track Assistant Professor of Department of Mathematics, University of Central Arkansas.

- Yanping Liu. 2009-2016. *New Approaches to Multiple Testing of Grouped Hypotheses*. Co-chaired with Dr. Sanat K. Sarkar.

- Victoria(Yu-Wei) Chang. 2009-2014. *Sample Size Determination for a Three-arm Biosimilar Trial.*

I am serving as a member of Advisory Committees for

• Erya Ouyang • Peiyu Liang • Yufan Dong • Dan Luo • Hailey Park • Mengtian Li • Lanyu Lei • Michale D Power • Shinjini Nandini • Chao Han (Computer Science, Temple University) • Yanhui Xu • Zeda Li • Scott Bruce • Jie Zhang (Computer Science, NJIT) • Jelena Gligorijevic • Hang Kim • Kun Tang • Jing Xiao• Bu Hyoung Lee• Yiyong Fu• Yihuan Xu• Wei Wang (NJIT) • Nicolle Clements• Ibrahim Turkoz• Elizabeth Stone• Bhramori Banerjee• Li He• Tingting Zhan• Vishwanath Iyer

TEACHING

Graduate Course

- Stat8112, 8113, Statistical Methods in Business Research I, II
- Stat8003, Statistical Methods I
- BA9105, Econometrics I
- Stat8106, Generalized Linear Models I
- Stat8001, 8002, Probability Theory I, II

Undergraduate Course

- Stat3502, Regression and Predictive Analytics
- Stat3503/Stat8109, Intermediate Business Statistics
- Stat2103, Business Statistics
- Stat2512, Intermediate Statistics
- Stat2102, Selected Statistics Applications in Business

SERVICE CONTRIBUTION

Professional Service

- Co-editor, *Communications in Statistics, Theory and Methods.*   2026 -
- Associate editor, *The American Statistician.*   2024 - present
- Associate editor, *Journal of Biopharmaceutical Statistics.*   2024 - present
- Associate editor, *Statistical Analysis and Data Mining.*   2013 - present
- Editorial board reviewers, *Journal of Machine Learning Research.*   2020 - present
- Chair of the membership committee, International Chinese Statistical Association (ICSA). 2022 - 2024
- Chair of the Conference on Advances in Multiple Testing.   2023

Department Service

- Director of Graduate Programs.   2019 - 2023
- Faculty Search Committee.   2019 - 2020
- Department seminar Coordinator.   2016 - 2017
- Department seminar organizer.   2010 - 2011
- Department seminar organizer.   2009 - 2010

School Service

- Merit Committee.   2024

- P&T Promotion Committee of RIHM.   2021

- DPC committee.   2019 - 2023

- MPC committee.   2019 - 2020

- Young Research Forum Evaluation Committee.   2020

- Merit Committee.   2013

- AACSB Faculty Committee.   2014

PRESENTATIONS

Presentation at Conferences and Meetings

- Optimization-Based Framework for Nonparametric Empirical Bayes Inference. Statistics + AI Frontier Summit 2025.   2025

- Optimization-Based Framework for Nonparametric Empirical Bayes Inference. 8-th International Conference on Econometrics and Statistics   2025

- Testing of Independence and Exchangeability using Binary Expansion Testing. Keystone State Statistics Symposium.   2024

- On the testing of multiple hypothesis in sliced inverse regression. Eco-Stat   2024

- On the testing of multiple hypothesis in sliced inverse regression. ICSA-China   2024

- Bayesian Analysis of Multiple Index Additive Models. Joint Statistical Meetings.   2023

- On the testing of multiple hypothesis in sliced inverse regression. ICSA Symposium.   2023

- Model-free Multiple Testing using Mirror Statistics (MMM). CMStatistics.   2022

- BEAUTY powered BEAST. 12th International Conference on Multiple Comparison Procedures.   2022

- BEAUTY powered BEAST. ICSA China Conference.   2022

- BEAUTY powered BEAST. ICSA Symposium.   2022

- BEAUTY powered BEAST. 63rd ISI World Statistics Congress 2021 (ISI WSC 2021).   2021

- Bayesian selective inference, International Seminar on Selective Inference.   2020

- Controlling False Discovery Rate Using Gaussian Mirrors. CMStatistics.   2020

- Global testing under the sparse alternatives for single index models, CMStatistics Conference, Pisa, Italy,   2018

- Global testing under the sparse alternatives for single index models, The Second Annual Meeting of International Consortium of Chinese Mathematicians, Taipei, Taiwan, 2018

- Group Assisted Multiple Testing. ICSA Applied Statistics Symposium, New Jersey 2018

- Group Assisted Multiple Testing. Conference on Statistical Learning and Data Science. Chapel Hill, NC 2016

- Rate optimal multiple testing procedure in high-dimensional regression, IMS China International Conference on Statistics and Probability, Yunnan, China 2015

- Rate optimal multiple testing procedure in high-dimensional regression, ICSA China Statistics Conference, Shanghai, China 2015

- Rate optimal multiple testing procedure in high-dimensional regression, Joint Statistical Meetings, Boston, MA 2014

- Rate optimal multiple testing procedure in high-dimensional regression, International Workshop on Multiplicity, Shanghai, China 2014

- Optimal Multiple Testing Procedure Under Linear Regression Model, ENAR Conference, Orlando, FL 2013

- Optimal Multiple Testing Procedure Under Linear Regression Model, Joint Statistical Meetings, San Diego, CA 2012

- Capturing the Severity of Type II Errors in High-Dimensional Multiple Testing, ICSA Applied Statistics Symposiu, Boston, MA, 2012

- On the Credible Interval under the zero-inflated Mixture Prior in High Dimension Inference, Joint Statistical Meetings, Miami, FL, 2011

- On the Generalized Benjamini-Hochberg procedure, IMS-China International Conference on Statistics and Probability, Xi'an, Shanxi, 2011

- On the Generalized Benjamini-Hochberg procedure, ICSA Applied Statistics Symposium, New York City, NY, 2011

- Empirical Bayes Confidence Intervals for Selected Parameters for a Large Number of Normal Populations with Unequal but Estimable Means and Variances, the Eighth ICSA International Conference, Guangzhou, Guangdong, 2010

- Empirical Bayes Confidence Intervals for Selected Parameters for a Large Number of Normal Populations with Unequal but Estimable Means and Variances, Joint Statistical Meetings, Vancouver, Canada, 2010

- Empirical Bayes FCR Controlling Confidence Interval, Joint Statistical Meetings, Washington DC, 2009

- Empirical Bayes Confidence Intervals Shrinking Both Means and Variances, the 17-th annual International Chinese Statistical Association Applied Statistics Symposium, Piscataway, NJ, 2008

Departmental Colloquia

- Testing of Independence and Exchangeability using Binary Expansion Testing. Virginia Polytechnic Institute and State University   2024

- False Discovery Rate Control via Mirror Statistics. University of Georgia   2023

- False Discovery Rate Control via Mirror Statistics. Pennsylvania State University   2023

- On the testing of multiple hypothesis in sliced inverse regression . University of Pittsburgh. 2022

- Model-free Multiple Testing using Mirror Statistics (MMM). Colorado State University 2022

- BEAUTY powered BEAST. University of California at Riverside.   2022

- Controlling False Discovery Rate Using Gaussian Mirrors. North Carolina State University 2020

- Global testing under the sparse alternatives for single index models. George Mason University 2019

- Nonparametric Empirical Bayes Estimator For Simultaneous Variances, University of Connecticut, CT   2017

- A New Approach to Multiple Testing of Grouped Hypotheses, University of Illinois Urbana-Champaign, IL   2016

- A New Approach to Multiple Testing of Grouped Hypotheses, Purdue University, IN   2016

- A New Approach to Multiple Testing of Grouped Hypotheses, University of Delaware, DE 2015

- Testing Multiple Hypothesis in Big Data Analysis, Southwest Jiaotong University, Chengdou, China   2015

- Testing Multiple Hypothesis in Big Data Analysis, Beihang University, Beijing, China 2015

- Optimal Multiple Testing Methods, Auburn University, AL   2014

- Optimal Multiple Testing Procedure Under Linear Regression Model, Department of Statistics, University of Georgia, GA   2013

- Empirical Bayes Confidence Intervals for Selected Parameters in High dimension, National Institute of Environmental Health Sciences (NIEHS), Research Triangle Park, NC,   2011

- On the Credible Interval under the zero-inflated Mixture Prior in High Dimension Inference, Department of Mathematics, New Jersey Institute of Technology, Newark, NJ,   2011

- Empirical Bayes Confidence Intervals for Selected Parameters for a Large Number of Normal Populations with Unequal but Estimable Means and Variances, Department of Operations Research and Financial Engineering, Princeton University, Princeton, NJ,   2011

- Empirical Bayes Confidence Intervals for Selected Parameters with Unknown and Unequal Variances, Department of Statistics, University of Missouri, Columbia, MO,   2010

- Empirical Bayes Confidence Intervals for Selected Parameters with Unknown and Unequal Variances, Department of Statistics, Nankai University, Tianjin, China, 2010

- Empirical Bayes Confidence Intervals Shrinking Both Means and Variances, Department of Statistics, Temple University, Philadelphia, PA, 2009

- Empirical Bayes Confidence Intervals Shrinking Both Means and Variances, Department of Mathematics, Syracuse University, Syracuse, NY, 2008