Ray Bai

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Academic Employment

2025-	Assistant Professor of Statistics, George Mason University
2020-2025	Assistant Professor of Statistics, University of South Carolina
2018-2020	Postdoctoral Researcher in Biostatistics and Informatics, University of Pennsylvania *Supervisors*: Yong Chen and Mary Boland

Education

2014-2018	PhD in Statistics, University of Florida *Dissertation*: Bayesian High-Dimensional Models with Scale-Mixture Shrinkage Priors *Advisor*: Malay Ghosh
2014-2016	Master of Statistics, University of Florida *Project*: Irrigation Forecasting in Southwest Florida *Advisor*: Nikolay Bliznyuk
2010-2012	MS in Applied Mathematics, University of Massachusetts Amherst
2003-2007	BA in Economics and Government, Cornell University

Publications

(____ = *student whom I supervised*, * = *co-first author*)

Peer-Reviewed Papers

1. **Bai, R.** (2026). Bayesian group regularization in generalized linear models with a continuous spike-and-slab prior. *Annals of the Institute of Statistical Mathematics* (in press).
2. Deshpande, S. K., **Bai, R.**, Balocchi, C., Starling, J. E., and Weiss, J. (2026). VCBART: Bayesian trees for varying coefficients. *Bayesian Analysis* (in press).
3. Zgodic, A., **Bai, R.**, Zhang, J., Wang, Y., Rorden, C., and McLain, A. C. (2026). Quantifying predictive uncertainty of aphasia severity in stroke patients with sparse heteroscedastic Bayesian high-dimensional regression. *Computational Statistics*, **41**(1): 7.
4. Wang, S.-H., **Bai, R.**, and Huang, H.-H. (2025). Two-step mixed-type multivariate Bayesian sparse variable selection with shrinkage priors. *Electronic Journal of Statistics*, **19**(1): 397-457.

5. Zgodic, A., **Bai, R.**, Zhang, J., Olejua, P., and McLain, A. C. (2025). Sparse high-dimensional linear mixed modeling with a partitioned empirical Bayes ECM algorithm. *Statistics and Computing*, **35**(4): 109.

6. Zhao, Z., Li, Y., Luo, X., and **Bai, R.** (2025). A unified three-state model framework for analysis of treatment crossover in survival trials. *Statistics in Biopharmaceutical Research*, **17**(3): 390-403.

7. Wang, S., Shin, M., and **Bai, R.** (2024). Generative quantile regression with variability penalty. *Journal of Computational and Graphical Statistics*, **33**(4): 1202-1213.

8. Liu, Q., Huang, X., and **Bai, R.** (2024). Bayesian modal regression based on mixture distributions. *Computational Statistics & Data Analysis*, **199**: 108012.

9. Wang, S., Shin, M., and **Bai, R.** (2024). Fast bootstrapping nonparametric maximum likelihood for latent mixture models. *IEEE Signal Processing Letters*, **31**: 870-874.

10. **Bai, R.**, Boland, M. R., and Chen, Y. (2023). Scalable high-dimensional Bayesian varying coefficient models with unknown within-subject covariance. *Journal of Machine Learning Research*, **24**(259): 1-49.

11. **Bai, R.***, Moran, G. E.*, Antonelli, J. L.*, Chen, Y., and Boland, M. R. (2022). Spike-and-slab group lassos for grouped regression and sparse generalized additive models. *Journal of the American Statistical Association*, **117**(537): 184-197.

12. Meeker, J. R., Burris, H. H., **Bai, R.**, Levine, L. D., and Boland, M. R. (2022). Neighborhood deprivation increases the risk of post-induction cesarean delivery. *Journal of the American Medical Informatics Association*, **29**(2): 329-334.

13. **Bai, R.** and Ghosh, M. (2021). On the beta prime prior for scale parameters in high-dimensional Bayesian regression models. *Statistica Sinica*, **31**(2): 843-865.

14. Meeker, J. R., Canelón, S. P., **Bai, R.**, Levine, L. D., and Boland, M. R. (2021). Individual- and neighborhood-level risk factors for severe maternal morbidity. *Obstetrics & Gynecology*, **137**(5): 847-854.

15. Boland, M. R., Liu, J., Balocchi, C., Meeker, J., **Bai, R.**, Mellis, I., Mowery, D. L., and Herman, D. (2021). Association of neighborhood-level factors and COVID-19 infection patterns in Philadelphia using spatial regression. *AMIA Annual Symposium Proceedings*, **2021**: 545-554.

16. **Bai, R.** and Ghosh, M. (2019). Large-scale multiple hypothesis testing with the normal-beta prime prior. *Statistics*, **53**(6): 1210-1233.

17. **Bai, R.** and Ghosh, M. (2018). High-dimensional multivariate posterior consistency under global-local shrinkage priors. *Journal of Multivariate Analysis*, **167**: 157-170.

18. Duerr, I., Merrill, H. R., Wang, C., **Bai, R.**, Boyer, M., Dukes, M. D., and Bliznyuk, N. (2018). Forecasting urban water demand with statistical and machine learning methods using large space-time data: A comparative study. *Environmental Modelling and Software*, **102**: 29-38.

Book Chapters

19. **Bai, R.**, Ročková, V., and George, E. I. (2021). Spike-and-slab meets LASSO: A review of the spike-and-slab LASSO. In Tadesse, M. G. and Vannucci, M. (Eds.), *Handbook of Bayesian Variable Selection*, 81-108. Chapman & Hall/CRC Press.

Selected Preprints

(____ = *student whom I supervised*, * = *co-first author*)

1. **Bai, R.**, Lin, L., Boland, M. R., and Chen, Y. (2026+). A robust Bayesian Copas selection model for correcting and quantifying the impact of publication bias. *Under revision*.
2. **Bai, R.***, Liu, X.*, Lin, L., Liu, Y., Kimmel, S. E., Chu, H., and Chen, Y. (2026+). A Bayesian selection model for correcting outcome reporting bias with application to a meta-analysis on heart failure interventions. *Under revision*.
3. Olejua, P., Saha, E., Ghosal, R., **Bai, R.**, McLain, A. C. (2026+). Parameter expanded variational Bayes for well-calibrated high-dimensional linear regression with spike-and-slab priors. *Under revision*.
4. Liu, Q., Wang, S., **Bai, R.**, and Bandyopadhyay, D. (2026+). A monotone single-index modal regression powered by deep neural networks for non-Gaussian periodontal data. *Under revision*.
5. Wang, S., Chakraborty, S., Qin, Q., and **Bai, R.** (2026+). Neural-g: A deep learning framework for mixing density estimation. *Submitted*.
6. Tam, E., Liu, Q., Engelhardt, B. E., and **Bai, R.** (2026+). On the fundamental limits to learning heavy-tailed distributions in deep generative models. *Submitted*.
7. Fan, S. and **Bai, R.** (2026+). BiSSLB: Binary spike-and-slab lasso biclustering for binary datasets. *Preprint*.
8. Fan, S., Xiong, L., Wang, D., Cai, G., and **Bai, R.** (2026+). BVSIMC: Bayesian variable selection-guided inductive matrix completion for improved and interpretable drug discovery. *Preprint*.
9. Ritchie, M.*, Sitnik, E.*, Funderburg, E.*, and **Bai, R.** (2026+). Estimating causal effects of county-level exposures on chronic obstructive pulmonary disease emergency department visits. *Preprint*.

Advising

Past PhD Students

Zile Zhao, PhD in Statistics, 2025, University of South Carolina

Dissertation: Methods and Applications for Bayesian Semiparametric Survival Analysis
First job: Postdoctoral Fellow, Moffitt Cancer Center (Tampa, FL)

Shijie Wang, PhD in Statistics, 2024, University of South Carolina

Dissertation: New Deep Learning Approaches to Classical Statistical Problems
First job: Applied Scientist, Gauss Labs (Palo Alto, CA)
Winner of James D. Lynch Graduate Student Research Award

Current PhD Students

Sijian Fan, PhD in Statistics (expected 2026), University of South Carolina

Dissertation: Statistical Learning for Binary Data with Applications in Bioinformatics
Winner of Huynh-Feldt Award for using statistical rigor in the solving of a practical problem

Fanghua Chen, PhD candidate in Statistics (expected 2028), University of South Carolina, co-advising with Ting Fung Ma

Member of Doctoral Committee

George Mason University Department of Statistics

Shixue Zhang (PhD 2025)

University of South Carolina Department of Statistics

Jiasong Duan (PhD expected 2026), Yizhou Cai (PhD expected 2026), Qingyuan Hong (PhD 2025), Xin Zhi (PhD 2025), Jihyun Kim (PhD 2025), Yuchen Mao (PhD 2024), Zehao Yu (PhD 2024), Qingyang Liu (PhD 2023), Yang He (PhD 2023), Shan Zhong (PhD 2022), Zhen Yang (PhD 2022)

Other Departments at the University of South Carolina

Peter Olejua (PhD in Biostatistics, expected 2026), Anja Zgodic (PhD in Biostatistics, 2023), Chrisogonas Odhiambo (PhD in Computer Science, 2022)

Undergraduate Students

Honors Thesis Students

Leah Wood, BS in Statistics, 2025, University of South Carolina

Thesis: Spatiotemporal Modeling of Maternal Mortality in South Carolina, 2018–2023

Summer REU Students

Evan Funderburg, BS candidate in Computer Science and Data Science, University of South Carolina

Emily Sitnik, BS candidate in Mathematics and Statistics, University of South Carolina

Mark Ritchie, BS candidate in Mathematics, University of South Carolina

*Other Student Supervisions**

(* I mentored these students on research projects but was not their primary supervisor)

Xin Zhi (PhD in Statistics, 2025, University of South Carolina)

Qingyang Liu (PhD in Statistics, 2023, University of South Carolina)

Anja Zgodic (PhD in Biostatistics, 2023, University of South Carolina)

Winner of ENAR Distinguished Student Paper Award

Hung-Tien Huang (BS in Computer Science, 2023, University of South Carolina)

Liyan Xiong (PhD candidate in Biostatistics at University of South Carolina)

Dayuan Wang (PhD candidate in Biostatistics at University of Florida)

Funding

External Grants Funded

National Science Foundation, Division of Mathematical Sciences, Award 2015528 (2020-2024). Collaborative Research: Bayesian and Semi-Bayesian Methods for Detecting Relationships in High Dimensions. Role: **PI**. Amount: $99,562.

National Science Foundation, Division of Mathematical Sciences, Award 2038080 (2021-2026). RTG: Mathematical Foundation of Data Science at University of South Carolina. PI: Linyuan Lu, University of South Carolina. Role: **Senior Personnel**. Amount awarded to RB: $10,932.

Competitive Internal Grants

University of South Carolina Big Data Health Science Center Pilot Project grant (2023-2024). Leveraging Side Information for Improved Prediction and Inference in Computational Drug Repositioning. Role: **PI**. Amount: $20,000.

University of South Carolina McCausland Fellowship Research Award (2023-2024). New Methods for Bayesian Semiparametric Survival Analysis. Role: **PI**. Amount: $10,000.

University of South Carolina ASPIRE-I, Track 1 (2022-2023). Scalable Bayesian Survival Analysis with Informative Cluster Size. Role: **PI**. Amount: $13,583.

Honors and Awards

McCausland Faculty Fellow, University of South Carolina College of Arts and Sciences, 2023-2025

Graduate School Fellow, University of Florida, 2014-2018

Student Paper Competition Award, Section on Bayesian Statistical Science, Joint Statistical Meetings, 2018

Anderson Scholars Faculty Honoree, University of Florida, 2016

Teaching

George Mason University

Undergraduate Courses Taught

STAT 344: Probability and Statistics for Engineers and Scientists I, Fall 2025, Spring 2026

University of South Carolina

Undergraduate Courses Taught

STAT 515: Statistical Methods I, Fall 2024, Spring 2025

STAT 517: Advanced Statistical Models, Fall 2022, Fall 2024

Graduate Courses Taught

STAT 714: Linear Statistical Models, Fall 2020, Fall 2021, Fall 2022

STAT 718: Selected Topics in Statistics: High-Dimensional Data, Spring 2021, Spring 2023

STAT 721: Stochastic Processes, Spring 2022, Spring 2024

Independent Studies Supervised

STAT 798: Introduction to Causal Inference, Summer 2024

STAT 798: Advanced Algorithms in Bayesian Computing, Spring 2024

STAT 399: Advanced Topics in Stochastic Processes, Spring 2022

University of Florida

Courses Taught

STA 3024: Introduction to Statistics II, Spring 2016

Courses Served as Teaching Assistant

STAT 2023: Introduction to Statistics I, Fall 2015

Software Development

(* I am the primary author and maintainer of the following software products)

`SSGL` (R package): Spike-and-Slab Group Lasso for Group-Regularized Generalized Linear Models

`MBSP` (R package): Multivariate Bayesian Model with Shrinkage Priors

`NVCSSL` (R package): Nonparametric Varying Coefficient Spike-and-Slab Lasso

`MtMBSP` (R package): Mixed-type Multivariate Bayesian Regression with Shrinkage Priors

`NormalBetaPrime` (R package): Normal Beta Prime Prior

Presentations

Invited Seminar Talks

1. Department of Mathematics and Statistics, University of Maryland, Baltimore County, February 2026
2. Merck Oncology, Merck & Company, June 2025
3. Department of Statistics, George Mason University, April 2025
4. Department of Statistical Sciences, Wake Forest University, February 2025
5. Division of Biostatistics and Bioinformatics, Pennylvania State University, October 2024
6. Department of Mathematics and Statistics, McGill University, September 2024

7. Department of Statistics & Operations Research, University of North Carolina at Chapel Hill, March 2024
8. South Carolina SmartState Center for Healthcare Quality, University of South Carolina, March 2023
9. Department of Statistics, University of Georgia, February 2023
10. School of Mathematics & Statistics, University of Glasgow, December 2022
11. Department of Statistics, Virginia Tech, November 2022
12. School of Mathematical and Statistical Sciences, Clemson University, October 2022
13. Department of Mathematical Sciences, University of Cincinnati, April 2022
14. Department of Biostatistics, Virginia Commonwealth University, November 2021
15. Department of Statistics, University of South Carolina, October 2021
16. School of Statistics, University of Minnesota, October 2021
17. Department of Statistics, University of California, Davis, April 2021
18. School of Mathematical and Statistical Sciences, Arizona State University, January 2020
19. Department of Statistics, Florida State University, January 2020
20. Department of Mathematics & Statistics, San Diego State University, January 2020
21. Department of Statistics, University of California, Santa Cruz, January 2020
22. Department of Statistics, University of South Carolina, January 2020

Invited Conference Talks

1. 2026 ISBA World Meeting, Nagoya, Japan, June 2026
2. 2026 ICSA Applied Statistics Symposium, Arlington, VA, June 2026
3. 2025 Maryland Statistical Symposium, College Park, MD, December 2025
4. 2024 ICSA Applied Statistics Symposium, Nashville, TN, June 2024
5. 2024 ICSA-Canada Chapter Symposium, Niagara Falls, ON, Canada, June 2024
6. 2024 SRCOS Summer Research Conference, Clemson, SC, June 2024
7. 2023 Joint Statistical Meetings, Toronto, ON, Canada, August 2023
8. EcoSta 2023, Tokyo, Japan, August 2023
9. Invited poster session, 2022 Joint Statistical Meetings, Washington, DC, August 2022
10. EURO 2022 Conference, Espoo, Finland, July 2022 (canceled due to illness)
11. 2022 ICSA Applied Statistics Symposium, Gainesville, FL, June 2022
12. UP-STAT 2022 Hybrid Conference, Buffalo, NY, May 2022
13. CFE-CMStatistics 2021, London, UK, December 2021
14. Fifth EAC-ISBA Conference: A Satellite Meeting of the 2020 ISBA World Meeting in Celebrating James O Berger's 70th Birthday (virtual), November 2021
15. 2021 ICSA Applied Statistics Symposium (virtual), September 2021

Contributed Talks

BNP 14 World Meeting, Los Angeles, CA, June 2025

2024 ISBA World Meeting, Venice, Italy, July 2024

2021 Joint Statistical Meetings (virtual), August 2021

2021 ISBA World Meeting (virtual), June 2021

2019 Joint Statistical Meetings, Denver, CO, July 2019

2018 Joint Statistical Meetings, Vancouver, BC, Canada, July 2018

Contributed Conference Posters

Bayes Comp 2020, Gainesville, FL, January 2020

DBEI and CCEB Research Day, University of Pennsylvania, March 2019

O-Bayes 2017 Meeting, Austin, TX, December 2017

Departmental Service

George Mason University Department of Statistics

Department Seminar Co-Chair, 2025-2026

University of South Carolina Department of Statistics

Colloquium Chair, 2023-2024, 2024-2025

Member of Graduate Committee, 2021-2022, 2022-2023, 2023-2024

Member of Hiring Committee, 2021-2022

Member of Data Science Degree Planning Committee, 2022

Member of PhD Qualification Exam Committee, 2021

University Service

University of South Carolina

Member, ASPIRE Grant Review Committee, 2023

Panelist, LGBTQ+ Graduate Student Association's Queer in Higher Ed Panel, 2023

Member, SPARC Grant Review Committee, 2022

Lunch Ambassador for New Faculty Orientation, 2022

Member, Top Scholar Selection Committee, 2021-2022, 2022-2023

Professional Service

Editorial Activities

Journal reviewer for 65 papers: *Journal of the American Statistical Association* (8), *Journal of the Royal Statistical Society: Series B* (3), *The Annals of Applied Statistics* (3), *Journal of Machine Learning Research* (3), *Biometrics* (3), *Journal of Computational and Graphical Statistics* (4), *Biostatistics* (1), *IEEE Transactions on Information Theory* (1), *IEEE Transactions on Signal Processing* (1), *Statistica Sinica* (2), *Bernoulli* (1), *Bayesian Analysis* (4), *Electronic Journal of Statistics* (1), *Scandinavian Journal of Statistics* (3), *Statistics in Medicine* (5), *Computational Statistics & Data Analysis* (1), *Statistics and Computing* (1), *The American Statistician* (2), *Journal of the Royal Statistical Society: Series C* (1), *Statistical Methods in Medical Research* (4), *Journal of Statistical Planning and Inference* (2), *Sankhya B* (1), *Statistical Modelling* (1), *Journal of Nonparametric Statistics* (1), *Lifetime Data Analysis* (1), *Metrika* (1), *Journal of Biopharmaceutical Statistics* (1), *The R Journal* (1), *Research Synthesis Methods* (1), *Science China Mathematics* (1), *Annals of the Brazilian Academy of Sciences* (1), *BMJ Open* (1)

Judge for SBSS Student Paper Competition, 2020, 2024

Grant Reviewing

External grant reviewer for the National Science Foundation, 2020, 2021, 2022

Panelist for the National Science Foundation, 2022

Conference Activities

Session chair, "Junior advances in Bayesian treed regression," ISBA 2022 World Meeting

Session chair, Section on Bayesian Statistical Science, Joint Statistical Meetings, 2021, 2022

Member of Program Committee, "Your model is wrong: Robustness and misspecification in probabilistic modeling," NeurIPS 2021 Workshop

Professional Society Memberships

American Statistical Association

International Society for Bayesian Analysis

International Biometric Society

Professional Development

New Faculty Academy Certificate of Completion, University of South Carolina, 2022

Graduate Certificate in Business Administration, Northeastern University, 2009

Industry Experience

2012-2014 Systems Engineer, General Dynamics Mission Systems

2007-2010 Business Analyst, State Street Bank & Trust

Computer Skills

R, C/C++, Python, MATLAB, Octave, Julia, JAGS, Stan, Windows, Linux

Last updated: February 12, 2026