

# CURRICULUM VITAE

**Rayleigh X. Lei**

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## SUMMARY

I am currently a postdoctoral fellow seeking a tenure track position in a statistics or biostatistics department. My research is focused on using the geometry underlying the model or data to create Bayesian latent variable models and develop more efficient computational tools.

## CURRENT POSITION

**Postdoctoral Fellow**; Advisor: Research Associate Professor Yajuan Si  
Institute for Social Research, University of Michigan

8/2024-present  
*Ann Arbor, MI*

- Improve credible interval coverage for small area estimates

## EDUCATION

Ph.D. Statistics

University of Michigan

**Thesis:** Modeling Simplex-valued Data and Latent Structures

**Advisor:** Professor (Xuan)Long Nguyen

2016-2022  
*Ann Arbor, MI*

B.A. Mathematics (with Honors)

Columbia University

**Honors thesis:** Generalizing results from Eric Rowland's "A Natural Prime-Generating Recurrence"

2009-2013  
*New York, NY*

## HONORS AND AWARDS

American Statistical Association Travel Grant

2024

International Society of Bayesian Analysis World Meeting Travel Grant

2024

eScience Postdoctoral Research Fund Recipient

2024

BayesComp Travel Grant

2023

eScience Postdoctoral Research Fund Recipient

2023

University of Washington Data Science Postdoctoral Fellow

2022-2024

Outstanding Teaching Award, *Honorable Mention*, Department of Statistics

2022

University of Michigan

University of Michigan Graduate Teacher Certificate

2021

Junior Travel Support, the 12<sup>th</sup> International Conference on Bayesian Nonparametrics

2019

National Science Foundation Graduate Research Fellowship

2018-2023

Outstanding Teaching Award, Department of Statistics, University of Michigan

2018

## RESEARCH EXPERIENCES

- Postdoctoral Fellow**; Advisor: Professor Abel Rodriguez 9/2022-8/2024  
Department of Statistics, University of Washington *Seattle, WA*
- Develop Bayesian ideal point models to analyze embeddings of congressional and Supreme Court justices' votes
- Graduate Research Assistant**; Advisor: Professor (Xuan)Long Nguyen 9/2016-8/2022  
Department of Statistics, University of Michigan *Ann Arbor, MI*
- Developed random movement and direction models for changes in simplicial data
  - Examined theoretical properties of and developed algorithms to fit general mixtures of probability simplices and tree-based probability simplices
  - Applied optimal transport techniques to cluster traffic patterns and analyze these clusters
- Graduate Research Assistant**; Advisor: Professor Jun Zhang 6/2017-7/2017  
Department of Mathematics, University of Michigan *Ann Arbor, MI*
- Explored connection between information geometry and Hamiltonian and Riemannian Manifold Hamiltonian Monte Carlo
- Researcher**; Advisor: Professor Andrew Gelman 6/2015-5/2016  
Department of Statistics, Columbia University *New York, NY*
- Implemented Bayesian regression models to analyze voter behavior and national pride
  - Created unary vectorization testing framework and vectorized unary functions in Stan with template metaprogramming
  - Compared inference results from the No U-Turn Sampler (NUTS) to Automatic Differentiation Variational Inference (ADVI)
- Undergraduate Researcher**; Advisor: Professor Chris Wiggins 9/2010-5/2011  
Department of Mathematics, Columbia University *New York, NY*
- Created a Python program to process databases and gather data
- Research Intern**; Advisor: Professor Lukas Mueller 1/2011-5/2013 (3 terms)  
Boyce Thompson Institute *Ithaca, NY*
- Developed web-based tools to facilitate visualization of experimental results using Moose, Catalyst, Mason, and PostgreSQL

## PUBLICATIONS

1. **Rayleigh Lei** and Abel Rodriguez. 2024. Modeling Ordinal Survey Data with Unfolding Models. *Under preparation*.
2. **Rayleigh Lei** and Abel Rodriguez. 2024. A Novel Class of Unfolding Models for Binary Preference Data. *Political Analysis*. <https://doi.org/10.1017/pan.2024.11>.
3. **Rayleigh Lei** and Abel Rodriguez. August 2024. Dynamic Factor Models for Binary Data in Circular Spaces: An Application to the U.S. Supreme Court. *Journal of the Royal*

*Statistical Society Series C: Applied Statistics*, Volume 73, Issue 4, Pages 1042 - 1064.  
<https://doi.org/10.1093/jrsssc/qlae025>.

4. **Rayleigh Lei** and Abel Rodriguez. 2024. Logistic Unfolding Models for Binary Preference Data. *Revised and resubmitted to Statistics and Computing*.  
<https://arxiv.org/abs/2407.06395>.
5. Sunrit Chakraborty\*, **Rayleigh Lei**\*, and (Xuan)Long Nguyen. 2024. Learning Topic Hierarchies by Tree-Directed Latent Variable Models. *Under review in Bernoulli*.  
<https://arxiv.org/abs/2408.14327>.  
\* co-first author
6. **Rayleigh Lei** and (Xuan)Long Nguyen. 2024. Modeling Random Direction of Changes in Simplex-valued Data. *Under review in Communications in Statistics - Theory and Methods*. <https://arxiv.org/abs/2310.19985>.
7. Sunrit Chakraborty, Aritra Guha, **Rayleigh Lei**, (Xuan)Long Nguyen. 2023. Scalable nonparametric Bayesian learning for dynamic velocity fields. *Proceedings of the Thirty-Ninth Conference on Uncertainty in Artificial Intelligence*, PMLR 216:282-292.  
<https://proceedings.mlr.press/v216/chakraborty23a.html>.
8. Aritra Guha, **Rayleigh Lei**, Jiacheng Zhu, (Xuan)Long Nguyen, and Ding Zhao. 2022. Robust unsupervised learning of temporal dynamic vehicle-to-vehicle interactions, *Transportation Research Part C: Emerging Technologies*, Volume 142, 103768,  
<https://doi.org/10.1016/j.trc.2022.103768>.
9. **Rayleigh Lei**, Andrew Gelman, and Yair Ghitza. 2017. The 2008 Election: A Preregistered Replication Analysis. *Statistics and Public Policy*, 4 (1), 1-8.  
<https://doi.org/10.1080/2330443X.2016.1277966>.

## PRESENTATIONS

1. **Rayleigh Lei**, Abel Rodriguez. 2024. Dynamic Factor Models for Binary Data in Circular Spaces: An Application to the U.S. Supreme Court. Oral presentation for Invited Session at Joint Statistical Meeting at Portland, Oregon on August 3rd to 8th, 2024.
2. **Rayleigh Lei**, Abel Rodriguez. 2024. Dynamic Factor Models for Binary Data in Circular Spaces: An Application to the U.S. Supreme Court. Oral presentation for Invited Session at International Society of Bayesian Analysis World Meeting at Venice, Italy on July 1st to 7th, 2024.
3. **Rayleigh Lei**, Abel Rodriguez. 2023. A Novel Class of Unfolding Models for Binary Preference Data. Short oral presentation at BAYSM 2023 on November 13th to 17th, 2023.
4. **Rayleigh Lei**, Sunrit Chakraborty, (Xuan)Long Nguyen. 2023. Geometrically Fitting Tree-directed Topic Models. Poster presentation at BayesComp 2023 on March 15th to 17th, 2023.
5. **Rayleigh Lei** and (Xuan)Long Nguyen. 2021. Modeling Random Directions in 2D Simplex Data. Speed oral presentation at Joint Statistical Meetings on August 6-11, 2021.

6. **Rayleigh Lei** and (Xuan)Long Nguyen. 2021. Modeling Random Directions in 2D Simplex Data. Oral presentation at International Society of Bayesian Analysis World Meeting 2021 on June 28-July 02, 2021.
7. **Rayleigh Lei** and (Xuan)Long Nguyen. 2019. Modeling Simplex Data Transformations (v2). Poster presentation at the Statistics in the Data Science Era: A Symposium to Celebrate 50 Years of Statistics at the University of Michigan, Ann Arbor, MI, September 20-21, 2019.
8. **Rayleigh Lei** and (Xuan)Long Nguyen. 2019. Modeling Simplex Data Transformations (v1). Poster presentation at the 12th International Conference on Bayesian Nonparametrics, Oxford, UK, June 24-28, 2019.
9. Aritra Guha, **Rayleigh Lei**, Jiahui Ji, Jawad Mroueh, and (Xuan)Long Nguyen. 2018. Clustering and Evaluation of Driving Primitives. Poster presentation at the 2018 University of Michigan Toyota Research Institute Annual Review, Ann Arbor, MI, November 13, 2018.

## TEACHING EXPERIENCES

### Guest Lecturer, University of Michigan:

- STATS 551: Topics in Bayesian Modeling and Computation 3/10/2021

### Graduate Student Instructor, University of Michigan:

- STATS 511: Statistical Inference Spring 2022
- STATS 501: Applied Statistics Fall 2021
- STATS 499: Honors Seminar Fall 2018, 2019
- STATS 503: Statistical Learning II: Multivariate Analysis Spring 2018
- STATS 408: Statistical Principles for Problem Solving: A Systems Approach Fall 2017
- STATS 412: Introduction to Probability and Statistics Spring 2017
- STATS 250: Introduction to Statistics and Data Analysis Fall 2016

## MENTORING EXPERIENCES

*Skylar Shi*, Masters in Statistics 2024  
University of Washington

- Developed R package implementing probit unfolding models

*Xinyu He*, Junior in Data Science 2020  
University of Michigan

- Explored the basics of optimal transportation

*Di Wang*, Senior in Mathematics, Data Science, and Honors Statistics 2019  
University of Michigan

- Utilized mixture model to model how the proportion for a certain income category in Los Angeles County changed yearly from 1990 to 2010

*Yingsi Jian*, Senior in Mathematics, Data Science, and Honors Statistics 2018-2019  
University of Michigan

- Applied topic modeling to analyze chords and voice leading strands in Bach

- chorales and explore topic modeling with a distance metric on “words”
- Supervised her Senior Honors Thesis (earned the highest honors in statistics)

## **PROFESSIONAL ACTIVITY**

### 2024 Joint Statistical Meeting

- Organized Invited Program session, “Advances and Applications in Modeling Dynamic Data” 8/2024

### University of Washington

- First round reviewer of University of Washington statistics PhD student applications 2022-2023

### University of Michigan

- Statistics Graduate Student Justice, Equity, Diversity, and Inclusion committee member 2020-2022
- Co-organizer for Statistics Directed Reading Group 2020-2021
- Statistics PhD Student Council member 2019-2022
- Co-Organizer for 2019 Michigan Student Symposium for Interdisciplinary Statistics Sciences (representing the Department of Statistics) 2018-2019
- Union representative for Department of Statistics’ Graduate Student Instructors 2016-2018