Zhengwu Zhang (last updated: 11/05/2021)

Contact Information

356 Hanes Hall
Statistics and Operations Research
Chapel Hill, NC 27516

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Education

Florida State University, Tallahassee, FL USA

Ph.D. in Statistics, May 2015. Advisor: Prof. Anuj Srivastava
Thesis: Geometric Approaches for Analysis of Images, Densities and Trajectories on Manifolds

Sun Yat-Sen University, Guangzhou, China

M.S. in Pattern Recognition and Intelligent Systems, June, 2010

South China University of Technology, Guangzhou, China

B.E. in Electronic Engineering (Talented Student Program), June, 2008

Research Interests

Brain Connectomics, Imaging Genetics, Medical Image Analysis, Shape and Functional Data Analysis, Computational Neuroscience, Bayesian Statistics, Machine Learning

Academic Experience

University of North Carolina at Chapel Hill, Chapel Hill, NC

Assistant Professor (tenure-track) with appointment in 01/2021 - Present

- Department of Statistics and Operations Research (primary)
- Department of Psychology and Neuroscience (adjunct)
- Computational Medicine (member)

University of Rochester, Rochester, NY

Assistant Professor (tenure-track) with appointment in 10/2017 - 12/2020

- Department of Biostatistics and Computational Biology (primary)
- Department of Neuroscience (secondary)
- Goergen Institute for Data Science (affiliated)

Duke University, Durham, NC

Postdoctoral Fellow in Department of Statistical Science 07/2016 - 09/2017

- Geometry-based structural connectome analysis

Statistical and Applied Mathematical Sciences Institute (SAMSI), NC

Postdoctoral Fellow 08/2015 - 07/2016

- Affiliated with the program of Challenges in Computational Neuroscience (CCNS)

Florida State University (FSU), Tallahassee, FL

Graduate Research Assistant 05/2011 - 05/2015

Graduate Instructor 06/2014 - 08/2014
Fundamental Business Statistics (STA2023)

Graduate Teaching Assistant 08/2010 - 05/2012

Chinese Academy of Science, Shenzhen, China 12/2009 - 07/2010
Research Intern

Zhejiang University, Hangzhou, China 07/2009 - 12/2009
Visiting student

Sun Yat-Sen University, Guangzhou, China 07/2008 - 07/2009
Research Assistant

Honors and Awards

- R.A. Bradley Award, for *best Ph.D dissertation* in the Department of Statistics, Florida State University, September 2015
- CVPR 2015 Doctoral Consortium Travel Award, Boston, June 2015
- Travel Award for 10th Conference on Bayesian Nonparametrics, Raleigh, NC, June 2015
- Yongyuan and Anna Li Award, for *best graduate student presentation* in the Department of Statistics, Florida State University, May 2015
- Graduate Student Research and Creativity Award, *Only two awardees selected from STEM areas per year*, Florida State University, April 2015
- Boyd Harshbarger Student Travel Award, Summer Research Conference, Galveston, Texas, 2014
- Brumback Award *for best student presentation* at Florida Chapter ASA Meeting, 2012
- Best First Year Student in Theoretical Statistics, Florida State University, 2011
- Talented Student Program, South China University of Technology (Top 5%), 2005

Publications

Submitted Papers

6. **Z. Zhang**, Y. Wu, D. Xiong, A. Srivastava, H. Zhu. LESA: Longitudinal Elastic Shape Analysis of Brain Subcortical Structures. 2021+
5. B. Saparbayeva, **Z. Zhang**. Amplitude Mean of Functional Data on S^2. 2021+
4. Y. Zhao, C. Chang, J. Zhang, **Z. Zhang**. Genetic Underpinnings of Brain Structural Connectome for Young Adults. 2021+
3. W. Consagra, A. Venkataramana, **Z. Zhang**. Optimized Diffusion Imaging for Brain Structural Connectome Analysis. Revision in *IEEE Transactions on Medical Imaging* 2021+
2. A. Venkataramana, **Z. Zhang**, J. Zhong. How Q-space Sampling Affects Structural Connectome Analysis. 2021+
1. S. Acharyya, **Z. Zhang**, A. Bhattacharya, D. Pati. Bayesian Hierarchical Modeling on Covariance Valued Data. *arXiv:1811.00724*, 2021+

Peer-Reviewed Journals

2021

33. **Z. Zhang**, J Gewandter, P. Geha (2021). Brain Imaging Biomarkers for Chronic Pain. *Frontiers in Neurology*, in press
32. **Z. Zhang**, X. Wang, L. Kong, H. Zhu. (2021). High-Dimensional Spatial Quantile Function-on-Scalar Regression. *Journal of the American Statistical Association*, 1-16
31. M. Cole, K. Murray, E. St-Onge, B. Risk, J. Zhong, G. Schifitto, M. Descoteaux, **Z. Zhang**. (2021). Surface-Based Connectivity Integration: An Atlas-Free Approach to Jointly Study Functional and Structural Connectivity. *Human Brain Mapping*, 42: 3481– 3499
30. L. Wang, F. Lin, M. Cole, and **Z. Zhang**. (2021). Learning Clique Subgraphs in Structural Brain Network Classification with Application to Crystallized Cognition. *NeuroImage*, 225, 117493
29. L. Wang, **Z. Zhang**. (2021) Classification of longitudinal brain networks with an application to understanding superior aging. *STAT*, 10.1, e402
28. M. Liu, **Z. Zhang**, D. Dunson. (2021) Auto-encoding Graph-valued Data with Applications to Brain Connectomes, *Neuroimage*, 245, 118750
27. G. Papadogeorgou, **Z. Zhang**, D. Dunson. (2021) Soft Tensor Regression. *Journal of Machine Learning Research*, 22, 1-53
26. F. Lin, K. Heffner, R. Gevirtz, **Z. Zhang**, D. Tadin, A. Porsteinsson. (2021) Targeting autonomic flexibility to enhance cognitive training outcomes in older adults with mild cognitive impairment: study protocol for a randomized controlled trial. *Trials*, 22.1, 1-15

25. Q. Chen, T. Baran, A. Turnbull, **Z. Zhang**, G. Rebok, F. Lin. (2021) Increased Segregation of Structural Brain Networks Underpins Enhanced Broad Cognitive Abilities of Cognitive Training. *Human Brain Mapping*, 42, 3202– 3215
24. B. Risk, R. Murden, J. Wu, M. Nebel, A. Venkataraman, **Z Zhang**, D. Qiu. (2021) Which Multiband Factor Should You Choose for Your Resting-State fMRI Study? *NeuroImage*, 234, 117965
23. Y. Zhuang, **Z. Zhang**, M. Tivarus, X. Qiu, J. Zhong, G. Schifitto. (2021). Whole-brain computational modeling reveals disruption of microscale brain dynamics in HIV infected individuals. *Human Brain Mapping*, 42.1, 95-109

2020

22. X. Wang, G. Zhu, J. Rhen, J. Pang, **Z. Zhang**. (2020). Vessel Tech: A high-accuracy pipeline for comprehensive mouse retinal vasculature characterization. *Angiogenesis*, 1-5
21. X. Ding, D. Yu, **Z. Zhang**, D. Kong. (2020). Multivariate functional responses low rank regression with an application to brain imaging data. *The Canadian Journal of Statistics*, in press
20. Q. Chen, H. Yang, B. Rooks, M. Anthony, **Z. Zhang**, D. Tadin, K. L. Heffner, and F. V. Lin. (2020). Autonomic flexibility reflects learning and associated neuroplasticity in old age. *Human Brain Mapping*, 41.13, 3608-3619
19. Q. Chen, T. Baran, B. Rooks, M. K. O'Banion, M. Mapstone, **Z. Zhang**, F. Lin, and Alzheimer's Disease Neuroimaging Initiative. (2020). Cognitively supernormal older adults maintain a unique structural connectome that is resistant to Alzheimer's pathology. *NeuroImage: Clinical*, 28, 102413.
18. B. Rooks, M. Anthony, Q. Chen, Y. Lin, T. Baran, **Z Zhang**, P. A. Lichtenberg, F. Lin. (2020). A generic brain connectome map linked to different types of everyday decision-making in old age. *Brain Structure and Function*, 1-12
17. F. Lin, Y. Tao, Q. Chen, M. Anthony, **Z. Zhang**, D. Tadin, K.L. Heffner. (2020) Processing Speed and Attention Training Modifies Autonomic Flexibility: A Mechanistic Intervention Study. *Neuroimage*, 213, 116730

2019

16. A. Anderson, P. Ren, T. M. Baran, **Z. Zhang**, F. Lin. (2019). Insula and Putamen Centered Functional Connectivity Networks Reflect Healthy Agers' Subjective Experience of Cognitive Fatigue in Multiple Tasks. *Cortex*, 119, 428-440
15. T. Baran, **Z. Zhang**, A. Anderson, K. McDermott, F. Lin. (2019). Brain Structural Connectomes Indicate Shared Neural Circuitry Involved in Subjective Experience of Cognitive and Physical Fatigue in Oder Adults. *Brain Imaging and Behavior*, 1-12
14. M. Dai, **Z. Zhang**, A. Srivastava. (2019). Analyzing Dynamical Brain Functional Connectivity As Trajectories on Space of Covariance Matrices. *IEEE Transactions on Medical Imaging*, 39.3, 611-620
13. M. Dai, **Z. Zhang**, A. Srivastava. (2019). Discovering Common Change-Point Patterns in Functional Connectivity Across Population. *Medical Imaging Analysis*, 58, 101532
12. **Z. Zhang**, G. Allen, H. Zhu, D. Dunson. (2019). Tensor Network Factorizations: Relationships Between Brain Structural Connectomes and Traits. *NeuroImage*, 197, 330-343
11. L. Wang, **Z. Zhang**, D. Dunson. (2019). Symmetric Bilinear Regression for Signal Subgraph Estimation. *IEEE Transactions on Signal Processing*, 67.7, 1929-1940
10. L. Wang, **Z. Zhang**, D. Dunson. (2019). Common and Individual Structure of Brain Networks. *Annals of Applied Statistics*, 13.1, 85-112
9. **Z. Zhang**, E. Klassen, A. Srivastava. (2019). Robust Comparison of Kernel Densities on Spherical Domains. *Sankhya A*, 81.1,144-171.
8. **Z. Zhang**, M. Descoteaux, David Dunson. (2019). Nonparametric Bayes Models of Fiber Curves Connecting Brain Regions. *Journal of the American Statistical Association*, 114:528, 1505-1517.

2018

7. P. Ren, B. Chapman, **Z. Zhang**, G. Schifitto, F. Lin. (2018). Functional and Structural Connectivity of the Amygdala Underpins Locus of Control in Mild Cognitive Impairment. *NeuroImage: Clinical*, 20, 297-304.
6. **Z. Zhang**, J. Su, H. Le, E. Klassen, A. Srivastava. (2018). Rate-Invariant Analysis of Covariance

Trajectories. *Journal of Mathematical Imaging and Vision*, 60, 1306-1323.

5. **Z. Zhang**, M. Descoteaux, J. Zhang, D. Dunson, A. Srivastava, H. Zhu. (2018). Mapping Population-based Structural Connectome. *NeuroImage*, 172, 130-145.
4. **Z. Zhang**, E. Klassen, A. Srivastava. (2018). Phase-Amplitude Separation and Modeling of Spherical Trajectories. *Journal of Computational and Graphical Statistics*, 27.1, 85-97.

2017 and earlier

3. X. Dong, **Z. Zhang**, A. Srivastava. (2017). Bayesian Tractography Using Geometric Shape Priors. *Frontiers in Neuroscience*, 11, 483.
2. **Z. Zhang**, D. Pati, A. Srivastava. (2015). Bayesian Clustering of Shapes of Curves. *Journal of Statistical Planning and Inference*, 166, 171-186.
1. **Z. Zhang**, E. Klassen, A. Srivastava. (2013). Gaussian Blurring-Invariant Comparison of Signals and Images. *IEEE Transactions on Image Processing*, 22.8, 3145-3157.

Peer-Reviewed Conference Proceedings with Low Acceptance Rates

6. L. Yang, R. Shafipour, G. Mateos, **Z. Zhang**. Mapping brain structural connectivities to functional networks via graph encoder-decoder with interpretable latent embeddings. *GlobalSIP*, 2019
5. H. Ren, X. Wang, S. Wang, **Z. Zhang**. Predict Fluid Intelligence of Adolescent Using Ensemble Learning. *MICCAI Workshop*, 2019
4. M. Dai, **Z. Zhang**, A.Srivastava. Discovering Change-Point Patterns in Dynamic Functional Brain Connectivity of a Population. *Information Processing in Medical Imaging (IPMI)*, 2017
3. M. Dai, **Z. Zhang**, A. Srivastava. Testing Stationarity of Brain Functional Connectivity Using Change-Point Detection in fMRI Data. (Oral Presentation, one of four selected papers), *Diff-CVML, CVPR,* 2016
2. **Z. Zhang**, E. Klassen, A. Srivastava, P.K. Turaga, R. Chellappa. Blurring-Invariant Riemannian Metrics for Comparing Signals and Images, *International Conference on Computer Vision (ICCV)*, Barcelona, Spain, 2011
1. C. Xu, **Z. Zhang**, J. Liu, X. Tang. 3D Object Search Through Semantic Component. *ACM Multimedia*, 2010

Peer-Reviewed Abstracts

2 A. Venkataraman, B. Risk, D. Qiu, J. Zhong and **Z. Zhang**. Multi-band in Diffusion MRI: Can we go too fast? *International Society for Magnetic Resonance in Medicine (ISMRM)*, 2021

1 A. Venkataraman, B. Risk, D. Qiu, J. Zhong F. Lin, and **Z. Zhang**. Quantitative Evaluation of Multiband Diffusion MRI Data. *International Society for Magnetic Resonance in Medicine (ISMRM)*, 2021

Book Chapters

4. S. Joshi, J. Su, **Z. Zhang**, B. Amor. Elastic Shape Analysis of Functions, Curves and Trajectories. *Riemannian Computing in Computer Vision*, pp 211-231, 2016
3. A. Duncan, **Z. Zhang**, A. Srivastava. An Elastic Riemannian Framework for Shape Analysis of Curves and Tree-Like Structures. *Algorithmic Advances in Riemannian Geometry and Applications*, Oct. 2016
2. **Z. Zhang**, A. Srivastava, Q. Xie. Elastic Registration and Shape Analysis of Functional Objects. *Geometry Driven Statistics* , Chapter 11, Nov. 2015
1. **Z. Zhang**, D. Pati, A. Srivastava. Bayesian Shape Clustering. *Nonparametric Bayesian Inference in Biostatistics*, pp 57-75, 2015

Presentations

Invited Presentations / Lectures

36. (06/2021) *Surface-based Connectivity Integration*, Workshop on Geometric and Topological Methods in Biomedical Image Analysis, online
35. (05/2021) *Surface-based Connectivity Integration*, The Statistical Methods in Imaging Conference

2021, online

34. (01/2021) *Recent Progress on Brain Imaging Data Analysis*, Program of Computational Medicine, UNC Chapel Hill, NC
33. (12/2019) *Statistical Analysis of Brain Structural Connectomes*, Center for Biomedical Imaging Statistics (CBIS), Emory University, GA
32. (12/2019) *Statistical Analysis of Brain Structural Connectomes*, Department of Statistics, University of Georgia, GA
31. (11/2019) *Statistical Analysis of Brain Structural Connectomes*, Department of Biostatistics, University at Buffalo, NY
30. (09/2019) *Statistical Analysis of Brain Structural Connectomes*, Department of Statistics and Data Science, UT-Austin, TX
29. (06/2019) *Spatial Quantile Function-on-Scalar Regression*, Statistical Society of Canada 2019 Annual Meeting, Calgary, Alberta, Canada
28. (04/2019) *Geometry-Based Brain Structural Connectome Analysis*, Department of Brain and Cognitive Sciences, University of Rochester, Rochester, NY
27. (04/2019) *Rate-Invariant Analysis of Covariance Trajectories*, Special Invited Session in the IEEE International Symposium on Biomedical Imaging (ISBI) 2019, Venice, Italy.
26. (12/2018) *Geometry-based Brain Structural Connectome Analysis*, International Conference on Big Data and Information Analytics, Houston, TX
25. (07/2018) *Brain Structural Connectome and Traits*, ICSA China Conference with the Focus on Data Science, Qing Dao, China
24. (06/2018) *Bayesian Modeling of Fiber Tracts Connecting Brain Regions*, The 2nd International Conference on Econometrics and Statistics (EcoSta 2018), Hong Kong, China
23. (06/2018) *Brain Structural Connectome and Traits*, The 2018 ICSA Applied Statistics Symposium, New Brunswick, NJ
22. (06/2018) *Bayesian Modeling of Fiber Tracts Connecting Brain Regions*, Conference on Statistical Learning and Data Science, Columbia University, NY
21. (05/2018) *Optimization Problems in Brain Connectome Analysis*, Workshop in Statistical Theory and Methods Based on Distributed Computing, BIRS-CMO, Oaxaca, Mexican
20. (02/2018) *Relationships Between Brain Structural Connectome and Traits*, Featured Speaker for CIRC Symposium, University of Rochester, Rochester, NY
19. (10/2017) *Population-based Structural Connectome Analysis*, Workshop on Applications-Driven Geometric Functional Data Analysis, FSU, Tallahassee, FL
18. (08/2017) *Population-based Structural Connectome Analysis*, JSM 2017, Chicago, IL
17. (06/2017) *Population-based Structural Connectome Analysis*, SAND 8, CMU, Pittsburgh, PA
16. (08/2016) *Brain Structural Connectivity Analysis*, JSM 2016, Chicago, IL
15. (05/2016) *Robust Human Brain Structural Connectivity Analysis*, SAMSI 2016, Durham, NC
14. (03/2016) *Robust Brain Structural Connectivity Analysis*, ENAR 2016, Austin, TX
13. (03/2016) *Robust Brain Structural Connectivity Analysis*, NISS/SAMSI Affiliates Annual Meeting, Austin, TX
12. (02/2016) *Robust Brain Structural Connectivity Analysis Using HCP Data*, Mathematical and Statistical Challenges in Neuroimaging Data Analysis, Banff, Canada
11. (01/2016) *Metric-Based Registration and Analysis of Functional Data*, Arizona State University, Tempe, AZ
10. (10/2015) *Structural Brain Connectivity Analysis on HCP*, SAMSI, Durham, NC
9. (09/2015) *Metric-Based Shape and Functional Data Analysis*, UNC Chapel Hill, NC
8. (08/2015) *Metric-Based Functional Data Analysis*, Duke University, Durham, NC
7. (06/2015) *Bayesian Clustering of Shapes of Curves*, BNP 10, Raleigh, NC
6. (06/2015) *Video-Based Action Recognition Using Rate-Invariant Analysis of Covariance Trajectories*, CVPR (Poster), Boston
5. (06/2014) *A Novel Nonparametric Two-Sample Hypothesis Test Using Geometric Formulations*, Summer Research Conference, Galveston, TX
4. (02/2014) *Bandwidth-Invariant Comparison of Nonparametric Densities*, Florida ASA Chapter meeting, University of Florida, Gainesville, FL

3. (08/2013) *Flight Itinerary Extraction Framework*, Easilydo Inc. Mountain View, CA
2. (02/2013) *Blurring-Invariant Comparison of Signals and Images*, Florida ASA Chapter meeting, Pensacola, FL
1. (02/2012). *Blurring-Invariant Riemannian Metrics For Comparing Signals and Images.* Florida ASA Chapter meeting, Jacksonville, FL

Advising

Current Students and Postdocs

4. Shaleni Kovach Ph.D. student in Statistics
3. Andrew Ackerman, Ph.D. student in Statistics (UNC Chapel Hill)
2. Adrian Allen, Ph.D. student in Statistics (UNC Chapel Hill)
1. Martine Cole, Ph.D. student in Statistics (University of Rochester)

Former Students and Postdocs

4. Dr. Bayan Saparbayeva, postdoc (joint with Prof. Giovanni Schifitto)
4. Dr. Brian Rook (2020), postdoc (joint with Prof. Feng Vankee Lin)
3. Xuelin Wang (2020), master student in Biostatistics (University of Rochester)
2. Huijing Ren (2020), master student in Biostatistics (University of Rochester)
1. Sheng Wang (2019), master student in Biostatistics (University of Rochester)

Member, Ph.D. Candidacy Examination Committee

4. William Consagra, Statistics, 2021 (University of Rochester)
3. Haodong Wang, Statistics, 2021 (UNC at Chapel Hill)
2. Arun Venkataraman, Physics, 2020 (University of Rochester)
1. Jiatong Sui, Statistics, 2020 (University of Rochester)

Member Ph.D. Final Examination Committee

2. Arun Venkataraman, Physics, 2021 (University of Rochester)
1. Jiatong Sui, Statistics, 2021 (University of Rochester)

Grants

Ongoing

4. Develop an ANS-based Personalized Cognitive Training for Mild Cognitive Impairment, NIH R21/R33, Role: MPI (with Dr. Feng Lin and Dr. Cristiano Tapparello), 2021-2026
3. *Advancing methods for structural connectome acquisition and estimation in older adults*, NIH R21, Role: Contact PI (with MPI Dr. Benjamin Risk), 2020-2022
2. *Brain Structural and Functional Connections in HIV-Associated Neuroinflammation*, NIH/NIMH R01, Role: co-I (with PI Dr. Giovanni Schifitto), 2018-2023
1. *CRCNS: Geometry-based Brain Connectome Analysis*, NIH/NIMH R01, Role: MPI (with PI Dr. David Dunson), per year, 2018-2022

Complete

4. *Supernormal Structural Connectomes: Lessons for Alzheimer's Disease*, Roberta K. Courtman Revocable Trust & Rochester Center for Alzheimer's Disease, Role: PI (with PI Dr. Timothy Baran), $\$50,000$, 2018-2019
3. *The NDA Computational Credits Pilot Program*, NIMH, Role: PI, $\sim \$5,000$ per year, 2018-2019
2. *Understanding Effects of Substance Use on Brain Structural Connectome and Cognition Development during Adolescence*, Health Sciences Center for Computational Innovation, Role: PI, $\sim \$25,000$, 2019-2020
1. *Personalized Medical Image Analysis Based on Partial Differential Equations*, UR-CTSI Pilot Grant, Role: co-PI (with PI Dr. Xing Qiu), $\$35,000$, 2018-2019

Computer Skills Python, MATLAB, R, C/C++, SAS, SQL, MySQL, VTK library, OpenCV library

Professional Services

Proposal Reviewer

- Reviewer for NSF-DMS
- Reviewer for Chilean National Commission for Scientific and Technological Research
- Reviewer for Clinical and Translational Science Awards (CTSA) pilot grant

Journal Reviewer

- Journal of the American Statistical Association, Journal of the Royal Statistical Society: Series B, Annals of Applied Statistics, Nature Neuroscience, Bioinformatics, Statistica Sinica, Journal of Computational and Graphical Statistics, SIAM Journal on Mathematics of Data Science, Electronic Journal of Statistics, Computer Vision and Image Understanding, Journal of Mathematical Imaging and Vision, Journal of Statistical Computation and Simulation, Biosystems Engineering, Computers & Graphics, Human Brain Mapping

Conference Reviewer

- WACV, ICPR, Cosyne, CVPR and so on.

Workshop & Session Organizer

- Organizer of Invited Session "New Advances in Nonparametric Statistics for Big Data", ICSA-Canada Symposium 2019
- Organizer of Imaging Analysis Workshop at University of Rochester, Sept. 2018
- Session Chair at BIRS Workshop - *Mathematical and Statistical Challenges in Neuroimaging Data Analysis*
- Session Chair at SAMSI Workshop - *CCNS Transition Workshop*
- Organizer of Invited Session "Geometric Approaches in Functional Data Analysis", ICSA 2016

Ad Hoc Committee

- Neuroscience Executive Advisory Committee (UNC Chapel Hill)
- Data Science Master Student Selection Committee (University of Rochester)
- 2017, 2018 and 2019 ASA Statistics in Imaging Section student paper award committee
- 2020 SMI paper competition committee

Professional Memberships

Memberships

- The American Statistical Association
- The Institute of Electrical and Electronics Engineers
- International Society for Bayesian Analysis
- International Chinese Statistical Association

Others

- President of Badminton Club at FSU, May 2013 - May 2014