Didong Li

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Personal website

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Research Interests

Geometric data analysis, information geometry, nonparametric Bayes, spatial statistics.

Employment

2022 – **Assistant Professor**, Department of Biostatistics, Gillings School of Global Public Health, University of North Carolina at Chapel Hill.

2021 – 2022 **Visiting Postdoctoral Scholar**, Gladstone Institutes.

2020 – 2022 **Postdoctoral Research Associate**, Department of Computer Science, Princeton University. Supervisor: Barbara Engelhardt.

2020 – 2022 **Assistant Project Scientist**, Department of Biostatistics, University of California, Los Angeles. Supervisor: Sudipto Banerjee.

Education

2020 **Ph.D. Mathematics**, Duke University, USA.
Advisors: David B. Dunson and Sayan Mukherjee

2020 **M.Sc. Statistics**, Duke University, USA.

2015 **M.Sc. Mathematics**, Beijing Institute of Technology, China.

2012 **B.Sc. Mathematics**, Beijing Institute of Technology, China.

Publications

Publications

1. Badea*, A., **Li***, D., Niculescu, A., Anderson, R., Stout, J., Williams, C., … Dunson, D. (2022). Absolute winding number differentiates spatial navigation strategies with genetic risk for alzheimer's disease. *Frontier Neuroscience*.

2. Cui, S., Yoo, E. C., **Li**, **D.**, Laudanski, K., & Engelhardt, B. E. (2022). Hierarchical Gaussian processes and mixtures of experts in predicting COVID patient trajectories. *Pacific Symposium on Biocomputing (PSB)*.

3. Jones, A., Townes, F. W., **Li**, **D.**, & Engelhardt, B. E. (2022b). Contrastive latent variable modeling with application to case-control sequencing experiments. *The Annals of Applied Statistics*.

4. **Li**, **D.**, Mukhopadhyay, M., & Dunson, D. (2022). Efficient manifold approximation with spherelets. *Journal of the Royal Statistical Society: Series B. Inaugural IMS Lawrence D. Brown Ph.D. Student Award*.

5. Cao, Y., **Li**, **D.**, Sun, H., Assadi, A. H., & Zhang, S. (2021). Efficient Weingarten map and curvature estimation on manifolds. *Machine Learning*, 1–26.

6. **Li**, **D.** & Dunson, D. B. (2020). Classification via local manifold approximation. *Biometrika*, *107*(4), 1013–1020.

7. Li, M., Sun, H., & **Li**, **D.** (2020a). A geometric approach to average problems on multinomial and negative multinomial models. *Entropy*, *22*(3), 306.
8. Li, M., Sun, H., & **Li**, **D.** (2020b). Riemannian submersion based Riemanninan center of mass of positive definite matrices. *Mathematical Methods in the Applied Science*, *43*(7), 4927.
9. Mukhopadhyay*, M., **Li***, D., & Dunson, D. B. (2020). Estimating densities with non-linear support by using Fisher–Gaussian kernels. *Journal of the Royal Statistical Society: Series B (Statistical Methodology)*, *82*(5), 1249–1271.
10. Wang, J., Sun, H., & **Li**, **D.** (2017). A geodesic-based Riemannian gradient approach to averaging on the Lorentz group. *Entropy*, *19*(12), 698.
11. Cao, L., **Li**, **D.**, Zhang, E., Zhang, Z., & Sun, H. (2014). A statistical cohomogeneity one metric on the upper plane with constant negative curvature. *Advances in Mathematical Physics*, *2014*.

Preprints/under revision

1. Jones, A., Townes, F. W., **Li**, **D.**, & Engelhardt, B. E. (2022a). Alignment of spatial genomics and histology data using deep Gaussian processes. BioRxiv.
2. Luo, H. & **Li**, **D.** (2022). Spherical rotation dimension reduction with geometric loss functions. arXiv:2204.10975.
3. **Li**, **D.**, Jones, A., Banerjee, S., & Engelhardt, B. E. (2021). Multi-group Gaussian processes. arXiv:2110.08411.
4. **Li**, **D.**, Tang, W., & Banerjee, S. (2021). Fixed-domain inference for Gausian processes with Matérn covariogram on compact Riemannian manifolds. arXiv:2104.03529.
5. Wang, T., Huang, Y., & **Li**, **D.** (2021). From the Greene–Wu convolution to gradient estimation over Riemannian manifolds. arXiv:2108.07406.
6. **Li***, D., Jones*, A., & Engelhardt, B. (2020). Probabilistic contrastive principal component analysis. arXiv:2012.07977.
7. **Li**, **D.**, Lu, Y., Chevallier, E., & Dunson, D. (2020). Density estimation and modeling on symmetric spaces. arXiv:2009.01983.
8. **Li**, **D.** & Mukherjee, S. (2020). Random Lie brackets that induce torsion: A model for noisy vector fields. arXiv:2007.07309.
9. Paul, D., Chakraborty, S., **Li**, **D.**, & Dunson, D. (2020). Principal Ellipsoid Analysis (PEA): Efficient non-linear dimension reduction & clustering. arXiv:2008.07110.
10. **Li**, **D.** & Dunson, D. (2019). Geodesic distance estimation with spherelets. arXiv:1907.00296.

Invited Talks

Aug. 2022 — **Inference for Gaussian Processes on Compact Riemannian Manifold**, Joint Statistical Meeting 2022, Washington D.C.

Jun. 2022 — **Probabilistic Contrastive Principal Component Analysis**, The 5th International Conference on Econometrics and Statistics (EcoSta 2022), Ryukoku University, Kyoto, Japan.

*: co-first authors

Invited Talks (continued)

Nov. 2021 — **Inference for Gaussian Processes on Compact Riemannian Manifold**, The Fifth EAC-ISBA Conference: A Satellite Meeting of the 2020 ISBA World Meeting in Celebrating James O Berger's 70th Birthday, Dali, China.

Aug. 2021 — **Density Estimation and Modeling on Riemannian Symmetric Spaces**, Joint Statistical Meeting 2021, Seattle, WA.

Jul. 2021 — **Efficient Manifold Approximation with Spherelets**, IMS Annual Meeting/ Bernoulli-IMS 10th World Congress in Probability and Statistics, Seoul, South Korea.

Jun. 2021 — **Manifold Learning in High Dimensional Spaces**, The 4th International Conference on Econometrics and Statistics (EcoSta 2020) , Yonsei University, Seoul, South Korea.

Jun. 2021 — **Density Estimation and Modeling on Riemannian Symmetric Spaces**, ISBA World Meeting 2020, Kunming, China.

Aug. 2020 — **Efficient Manifold Approximation with Spherelets**, Bernoulli-IMS One World Symposium, Online.

Jan. 2019 — **Manifold Approximation with Spherelets**, Joint Mathematical Meeting 2019, Baltimore, MD.

Jul. 2018 — **Efficient Manifold and Subspace Approximations with Spherelets**, Workshop on Computational strategies for large-scale statistical data analysis, ICMS, Edinburgh, UK.

May 2017 — **Efficient Manifold Learning via Spherelets**, International Workshop in Applied and Computational Topology in Data Science, Beijing Institute of Technology, Beijing, China.

Contributed Conference Talks and Seminars

Jun. 2022 — **Inference for Gaussian Processes on Compact Riemannian Manifold**, Keio University, Applied Mathematical Sciences Colloquium.

Apr. 2022 — **Multi-group Gaussian Processes**, Fudan University, Shanghai Center for Mathematical Sciences Seminar.

Feb. 2022 — **Multi-group Gaussian Processes**, University of Carolina at Chapel Hill, Department of Biostatistics Seminar.

Feb. 2022 — **Multi-group Gaussian Processes**, University of California, Davis, Department of Statistics Seminar.

Jan. 2022 — **Multi-group Gaussian Processes**, North Carolina State University, Department of Statistics Seminar.

Jan. 2022 — **Multi-group Gaussian Processes**, University of Notre Dame, Department of Applied and Computational Mathematics and Statistics Seminar.

Jan. 2022 — **Multi-group Gaussian Processes**, University of California, Irvine, the Department of Statistics Seminar.

Dec. 2021 — **Multi-group Gaussian Processes**, University of Hong Kong, Department of Statistics and Actuarial Science.

Nov. 2021 — **Gaussian Process on Compact Riemannian Manifold**, University of Virginia, Probability Seminar.

Sept. 2021 — **Probabilistic Contrastive Principal Component Analysis**, Bayesian Young Statisticians Meeting.

Contributed Conference Talks and Seminars (continued)

July. 2021 — **Efficient Manifold and Density Estimation with Spherelets**, Northeast Normal University, Webinar.

May. 2021 — **Fixed-domain Inference for Gaussian Process on Compact Riemannian Manifold**, Seminar "Industrial Mathematics" at Chebyshev Laboratory, Saint Petersburg State University, Webinar.

Dec. 2020 — **Density Estimation on Manifold with Curved Kernel**, University of Macau, Webinar.

Nov. 2020 — **Learning & Exploiting Low-Dimensional Structure in High-Dimensional Data**, Collegio Carlo Alberto, Webinar.

Oct. 2020 — **Density Estimation and Modelling on Symmetric Spaces**, Beijing Institute of Technology, Webinar.

Oct. 2020 — **Learning & Exploiting Low-Dimensional Structure in High-Dimensional Data**, Institute of Natural Sciences Data Science Seminar, Shanghai Jiao Tong University, Webinar.

Feb. 2020 — **Learning & Exploiting Low-Dimensional Structure in High-Dimensional Data**, Joint Duke-UNC probability seminar, Duke University, Durham, NC.

Jan. 2020 — **Efficient Manifold and Density Estimation with Spherelets**, Statistics Department Seminar, Stanford University, Stanford, CA.

Nov. 2019 — **Density Estimation on Manifolds with Fisher-Gaussian Kernels**, MIDAS Annual Symposium, University of Michigan-Ann Arbor, Ann Arbor, MI.

Jul. 2019 — **Efficient Manifold Approximation with Spherelets**, Joint Statistical Meeting 2019, Denver, CO.

Jun. 2019 — **Density Estimation with Mixture of Spherelets**, Bayesian Nonparametric 2019 Meeting, University of Oxford, Oxford, UK.

Apr. 2018 — **Subspace Approximations with Spherelets**, Graduate-Faculty Seminar, Duke University, Durham, NC.

Nov. 2017 — **Efficient Manifold and Subspace Approximations with Spherelets**, Triangle Area Graduate Mathematics Conference, North Carolina State University, Raleigh, NC.

Jun. 2017 — **Bayesian Manifold Learning Using Locally Curved Basis Functions**, Bayesian Nonparametric 2017 Meeting, École Normale Supérieure, Paris, France.

Nov. 2015 — **Information Geometry**, Graduate Students Geometry Seminar, Duke University, Durham, NC.

Posters

Aug. 2022 — **Inference for Gaussian Processes with Matérn Covariogram on Compact Riemannian Manifolds**, Expressing and Exploiting Structure in Modeling, Theory, and Computation with Gaussian Processes, Institute of Mathematical and Statistical Innovation, Chicago, IL.

Nov. 2019 — **Learning and Exploiting Low-Dimensional Structure in High-Dimensional Data**, MIDAS Annual Symposium, Univerity of Michigan-Ann Arbor, Ann Arbor, MI.

Oct. 2019 — **Learning and Exploiting Low-Dimensional Structure in High-Dimensional Data**, Office of Naval Research PI meeting, Duke University, Durham, NC.

Posters (continued)

Jun. 2019 — **Manifold Approximation with Spherelets**, Statistics Conference in honor of Aad van der Vaart's 60th birthday, Leiden, The Netherlands.

May. 2019 — **Manifold Approximation with Spherelets**, Geometric Data Analysis, Chicago, IL.

Oct. 2018 — **Manifold Approximation with Spherelets**, Theoretical Foundations of Deep Learning, Georgia Institute of Technology, Atlanta, GA.

Jun. 2018 — **Bayesian Subspace Approximation via Mixtures of Spherelets**, ISBA World Meeting 2018, University of Edinburgh, Edinburgh, UK.

Dec. 2017 — **Bayesian Subspace Approximation via Mixtures of Spherelets**, Objective Bayes Meeting 2017, University of Texas-Austin, Austin, TX.

Oct. 2017 — **Efficient Manifold and Subspace Approximations with Spherelets**, Office of Naval Research PI meeting, Duke University, Durham, NC.

Teaching Experience

Summer 2019 — **Summer@Duke Statistical Science Program**, mentor, Nonlinear Dimensionality Reduction, led by Professor David B. Dunson and Professor Amy Herring, Duke University.

Summer 2018 — **DOmath**, project manager, Local Affinity Construction for Dimension Reduction Methods, led by Professor Xiuyuan Cheng and Professor Hau-Tieng Wu, Duke University.

Fall 2016 — **Laboratory Calculus and Functions I**, instructor, Duke University.

Fall 2015 — **Introductory Calculus II with Applications**, teaching assistant, Duke University.

Fall 2012 — **Linear Algebra**, teaching assistant, Beijing Institute of Technology.

Awards

Jul. 2022 — **Recruitment Award**, UNC Center for Environmental Health and Susceptibility (CEHS).

Oct. 2019 — **Inaugural IMS Lawrence D. Brown Ph.D. Student Award**, Institute of Mathematical Statistics (IMS).

Jul. 2019 — **Finalist for the Student Paper Award in the Nonparametric Section**, Joint Statistical Meeting, Denver, CO.

Jun. 2019 — **ISBA travel award**, Bayesian Nonparametric Meeting, University of Oxford, Oxford, UK.

Jun. 2018 — **Travel Award**, ISBA World Meeting, University of Edinburgh, Edinburgh, UK.

Dec. 2017 — **NSF Travel Award**, Objective Bayes Meeting, University of Texas-Austin, Austin, TX.

Jul. 2017 — **Travel Award**, Annual Summer Institute in Statistics for Big Data (SISBID), University of Washington-Seattle, Seattle, WA.

Jun. 2017 — **Travel Award**, Bayesian Nonparametric 2017 Conference, ECOLE NORMALE SUPÉRIEURE, Paris, France.

May 2016 — **NSF-CBMS Travel Support Award**, NSF-CBMS Conference: Topological Data Analysis, University of Texas-Austin, Austin, TX.

Refereeing

- **Editorial Board**, Journal of Machine Learning Research, 2020 ∼
- Annals of Applied Statistics
- Annals of Statistics
- Conference on Neural Information Processing Systems (NeurIPS) 2021
- Electronic Journal of Statistics
- IEEE Transactions on Neural Networks and Learning Systems
- International Conference on Artificial Intelligence and Statistics (AISTATS) 2020, 2021
- Journal of the American Statistical Association
- Journal of Computational and Graphical Statistics
- Statistica Sinica