# Jian Cao

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## Education

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|---|---|
| 2020 | *Ph.D.* in Statistics, King Abdullah University of Science and Technology |
| 2016 | *M.Sc.* in Finance, Shanghai Jiaotong University |
| 2014 | *B.Sc.* in Applied Mathematics, University of Science and Technology of China |

## Areas of Specialization

*Computational Statistics, Gaussian Processes, Multivariate Normal Probabilities, Scientific Computing, Truncated Multivariate Normal Distribution*

## Journal Articles

2024    Cao, J., & Katzfuss, M. "Scalable Sampling of Truncated Multivariate Normals Using Sequential Nearest-Neighbor Approximation," *Submitted*

2023    Cao, J., & Katzfuss, M. "Linear-Cost Vecchia Approximation of Multivariate Normal Probabilities," *Submitted*

2023    Cao, J., Zhang, J., Sun, Z., & Katzfuss, M. (2023). "Locally Anisotropic Covariance Functions on the Sphere," accepted by *Journal of Agricultural, Biological and Environmental Statistics*

2023    Cao*, J., Kang, M.*, Jimenez, F., Sang, H., Schäfer, F., & Katzfuss, M. (2023). "Variational Sparse Inverse Cholesky Approximation for Latent Gaussian Processes via Double Kullback-Leibler Minimization," accepted by the 40th International Conference on Machine Learning

2023    Abdulah, S., Li, Y., Cao, J., Ltaief, H., Keyes, D. E., Genton, M. G., & Sun, Y. (2022). "Large-scale Environmental Data Science with ExaGeoStatR," *Environmetrics*, 31.3

2022    Cao, J., Guinness, J., Genton, M. G., & Katzfuss, M. (2022). "Scalable Gaussian-process Regression and Variable Selection using Vecchia Approximations," *Journal of Machine Learning Research*, 2022, **23**(348), pp.1-30

2022    Cao, J., Durante, D., Genton, M. G. (2022). "Scalable Computation of Predictive Probabilities in Probit Models with Gaussian Process Priors," accepted by *Journal*

*of Computational and Graphical Statistics* 2022, **31**(3), pp.709-720

2022    Cao, J., Genton, M. G., Keyes, D. E., & Turkiyyah, G. M. (2022). "tlrmvnmvt: Computing High-Dimensional Multivariate Normal and Student-$t$ Probabilities with Low-rank Methods in R," *Journal of Statistical Software*, **101**, pp.1-25

2021    Cao, J., Genton, M. G., Keyes, D. E., & Turkiyyah, G. M. (2021). "Exploiting Low Rank Covariance Structures for Computing High-Dimensional Normal and Student-$t$ Probabilities," *Statistics and Computing*, **31**(1), pp.1-16

2021    Cao, J., Genton, M. G., Keyes, D. E., & Turkiyyah, G. M. (2021). "Sum of Kronecker Products Representation and Its Cholesky Factorization for Spatial Covariance Matrices from Large Grids," *Computational Statistics & Data Analysis*, **157**, pp.107165

2021    Huang, J., Fang, F., Turkiyyah, G., Cao, J., Genton, M. G., & Keyes, D. E. (2021). "An $O(N)$ Algorithm for Computing Expectation of $N$-dimensional Truncated Multi-variate Normal Distribution I: Fundamentals," *Advances in Computational Mathematics*, **47**(5), pp.1-34

2019    Cao, J., Genton, M. G., Keyes, D. E., & Turkiyyah, G. M. (2019). "Hierarchical-block Conditioning Approximations for High-dimensional Multivariate Normal Probabilities," *Statistics and Computing*, **29**, pp.585-598

## Invited Seminars

2023    **Department of Statistics, University of Nebraska, Lincoln**
Linear-Cost Vecchia Approximation of Multivariate Normal Probabilities

2023    **Department of Management Science and Statistics, The University of Texas at San Antonio**
Linear-Cost Vecchia Approximation of Multivariate Normal Probabilities

## Talks & Posters

2024    *2024 The Eastern Chapter of the International Society for Bayesian Analysis Conference* Hong Kong, China
Invited Session: Scalable Estimation of Multivariate Normal Probabilities and Sampling of Truncated Multivariate Normal Distributions

2023    *2023 International Conference on Machine Learning* Honolulu, HI, USA
Poster: Variational sparse inverse Cholesky approximation for latent Gaussian processes via double Kullback-Leibler minimization

2023

**2023** ***2023 Spatial Statistics*** Boulder, CO, USA
Contributed Session: Variational sparse inverse Cholesky approximation for latent Gaussian processes via double Kullback-Leibler minimization

**2023** ***2023 International Indian Statistical Association Conference*** Golden, CO, USA
Invited Session: Variational sparse inverse Cholesky approximation for latent Gaussian processes via double Kullback-Leibler minimization

**2023** ***ASA/IMS SPRING RESEARCH CONFERENCE 2023*** Banff, Canada
Contributed Session: Variational sparse inverse Cholesky approximation for latent Gaussian processes via double Kullback-Leibler minimization

**2022** ***ENVR 2022 Workshop*** Provo, UT, USA
Poster: Scalable Gaussian Process Regression and Variable Selection under Automatic Relevance Determination Kernels

**2022** ***IMSI Gaussian Processes Workshop*** Chicago, IL, USA
Poster: Scalable Gaussian Process Regression and Variable Selection under Automatic Relevance Determination Kernels

**2022** ***Joint Statistical Meetings*** Washington D.C., USA
Contributed Session: Scalable Gaussian Process Regression and Variable Selection under Automatic Relevance Determination Kernels

**2022** ***ISBA World Meeting*** Montreal, Quebec, Canada
Contributed Talk: Scalable Gaussian Process Regression and Variable Selection under Automatic Relevance Determination Kernels

**2022** ***SETCASA Poster Competition*** College Station, TX, USA
Poster: Scalable Gaussian Process Regression and Variable Selection under Automatic Relevance Determination Kernels

**2022** ***Texas A&M Statistics Cafe*** College Station, TX, USA
Presentation: Scalable Gaussian Process Regression and Variable Selection under Automatic Relevance Determination Kernels

**2021** ***TAMIDS Research Conference*** College Station, TX, USA
Presentation: Scalable Gaussian Process Regression and Variable Selection under Automatic Relevance Determination Kernels

**2020** ***Joint Statistical Meetings*** Virtual Conference
Contributed Session: Sum of Kronecker Products Representation for Spatial Covariance Matrices and Its Factorization

**2019** ***Joint Statistical Meetings*** Denver, CO, USA
Topic-Contributed Session: Exploiting Low Rank Covariance Structures for Computing High-Dimensional Normal and Student-$t$ Probabilities

| 2018 | ***Big Data Meets Large-Scale Computing*** IPAM, Los Angeles, CA, USA |
| | Poster: Exploiting Low Rank Covariance Structures for Computing High-Dimensional Normal and Student-$t$ Probabilities |

| 2018 | ***Joint Statistical Meetings*** Vancouver, BC, Canada |
| | Poster: Hierarchical-block Conditioning Approximations for High-dimensional Multivariate Normal Probabilities |

| 2017 | ***Joint Statistical Meetings*** Baltimore, MD, USA |
| | Contributed Session: Hierarchical-block Conditioning Approximations for High-dimensional Multivariate Normal Probabilities |

## Awards

| 2020 | ***Al-Kindi Statistics Student Research Award*** |
| | King Abdullah University of Science and Technology |

| 2019 | ***Winner of the Student Paper Competition***, Section on Statistical Computing and the Section on Statistical Graphics of ASA |
| | Title: "Exploiting Low Rank Covariance Structures for Computing High-Dimensional Normal and Student-$t$ Probabilities" |

## Short Courses

| 2019 | ***A Short Course on Deep Learning***, KAUST Saudi Arabia |
| 2017 | ***Winter School on Hierarchical Matrices***, Kiel Germany |

## Teaching

| 2024 Spring | Lecturer for Math 3339 "Statistics for the Sciences", University of Houston |
| 2023 Fall | Lecturer for Math 3339 "Statistics for the Sciences", University of Houston |
| 2022 April | TAMIDS Webinar "Scalable Gaussian Process Approximation and Optimization |
| 2018 Fall | Teaching Assistant for MS level *Probability and Statistics* |
| 2017 Fall | Teaching Assistant for MS level *Probability and Statistics* |

## Programming Languages

R, C++, and Python

## R Package

***tlrmvnmvt, published on CRAN***
Compute high-dimensional multivariate normal (MVN) and multivariate Student-$t$

(MVT) probabilities with tile-low-rank and block reordering ([LINK](#))