Shitao Fan

University of Maryland, College Park

Ph.D. Candidate in Statistics

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Summary

Ph.D. candidate in Statistics specializing in Variational Bayesian methods. Experienced with generative AI, deep learning, and nonparametric statistics; strong emphasis on reproducible pipelines and theory–practice integration.

Technical Skills

Programming: R, Python, SAS
Languages: Chinese (native), English (fluent), Japanese (intermediate)
Core Areas: Bayesian statistics, Deep learning, Generative AI, Nonparametric statistics

Selected Research Project

Implementation of Krylov Subspace Methods
- Implemented GMRES for large sparse linear systems and analyzed convergence under varying conditioning and stopping criteria; explored simple preconditioning.

Variational Bagging: A Robust and Scalable Approach for Bayesian Uncertainty Quantification
- Addressed Mean-field VI's covariance underestimation and lost dependencies by proposing an ensemble-style variational bagging correction.
- Demonstrated reliable uncertainty quantification under model misspecification.
- Improved posterior predictive performance and coverage in extensive experiments.
- Applied to Gaussian mixtures, sparse linear regression, deep neural networks, manifold learning, and variational autoencoders.

Robust and Scalable Variational Bayes
- Proposed a geometric-median VM-posterior by aggregating split-data variational posteriors, yielding strong outlier robustness.
- Established posterior contraction rates and a Bernstein–von Mises theorem for the VM-posterior.
- Demonstrated performance on contaminated Gaussian models and topic models.

Amortized Structured Variational Inference
- Developed time-dependent structured variational families with learned inference maps, capturing temporal and cross-component dependencies beyond Mean-Field VI/Structured VI.
- Derived risk bounds for the amortized posterior and decomposed approximation error due to amortization; showed that structure and local neighborhood context substantially reduce the amortization gap.
- Achieved higher ELBO, better posterior calibration, and stronger predictive accuracy on AR(3) latent time series and nonlinear dynamics; on real data, built a VAE and performed predictions on Moving-MNIST.

Simulation-Based Variational Inference
- Performed likelihood-free posterior learning for complex data where the likelihood is intractable (e.g., high-dimensional images).
- Used a forward-KL objective for approximation and optimization. Established statistical guarantees for the resulting approximate posterior.

Education

University of Maryland	*Aug. 2023 – May 2026*
Ph.D. in Statistics	GPA: 4.00/4.00
University of Notre Dame	*Aug. 2021 – May 2023*
Ph.D. in Statistics	GPA: 4.00/4.00
North Carolina State University	*Aug. 2019 – May 2021*
M.S. in Statistics	GPA: 3.97/4.00
Zhejiang University	*Aug. 2015 – Jun. 2019*
B.S. in Mathematics	GPA: 3.59/4.00

Awards

- Excellent Social Work Scholarship, Social Practice Scholarship, Outstanding Student Leader at Zhejiang University.
- Dean's Fellowship; Herbert A. Hauptman Endowed Graduate Fellowship at UMD.

Presentations

2024 The International Society for Bayesian Analysis (ISBA) World Meeting. Poster sessions: Robust Bayesian inference via variational bagging.

The 14th International Conference on Bayesian Nonparametrics (BNP). Poster sessions: Robust and Scalable Variational Bayes.

The 3rd Joint Conference on Statistics and Data Science (JCSDS 2025). Contributive Talks: Amortized Structured Variational Inference.

Teaching experiences

Courses at University of Maryland

Teaching assistant: STAT 100: Elementary Statistics and Probability; STAT 400: Applied Probability and Statistics I; MATH 240: Introduction to Linear Algebra.

Grader: STAT 401: Applied Probability and Statistics II; STAT 410: Introduction to Probability Theory; STAT 430: Introduction to Statistical Computing with SAS; STAT 741: Linear Model II.

Courses at University of Notre Dame

Teaching assistant: ACMS 60888: Statistical Computing and Monte Carlo Methods; ACMS 60890: Statistical Foundations of Data Science

Publications and Preprints

[1] Shitao Fan. An introduction to krylov subspace methods. *arXiv preprint arXiv:1811.09025*, 2018.

[2] Shitao Fan, Ilsang Ohn, David Dunson, and Lizhen Lin. Variational bagging: a robust approach for bayesian uncertainty quantification. *arXiv preprint arXiv:2511.20594*, 2025. Under review.

[3] Carlos Misael Madrid Padilla, Shitao Fan, and Lizhen Lin. Robust and scalable variational bayes. *arXiv preprint arXiv:2504.12528*, 2025. Under review.

[4] Shitao Fan, Carlos Padilla Madrid, Yun Yang, and Lizhen Lin. Amortized structural variational inference. 2025. Under review.

[5] Ilsang Ohn, Shitao Fan, and Lizhen Lin. Early stopped aggregation for variational bayes adaptation. In preparation, 2025+.

[6] Shitao Fan, Yun Yang, and Lizhen Lin. Simulation-based variational inference for additive likelihood estimation. In preparation, 2025+.