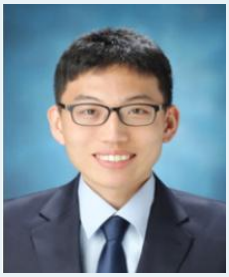
KWANGMIN LEE, Ph.D.

Assistant Professor | Bayesian Statistics

Department of Big Data Convergence, Chonnam National University, Republic of Korea

RESEARCH & COLLABORATION PROFILE



KEY WORDS: Bayesian Inference, High-dimensional Covariance, Dimension Reduction, Manifold-Constrained Inference, Scalable Bayesian Computation

Research Snapshot. Prof. Lee develops Bayesian methods for high-dimensional and structured data, with an emphasis on uncertainty quantification, theoretical justification, and scalable computation. His research spans high-dimensional covariance estimation (sparse, banded, and spiked covariance models), sufficient dimension reduction via Bayesian envelope models, manifold-constrained inference such as reflective Hamiltonian Monte Carlo on the Stiefel manifold, scalable Bayesian computation, and Bayesian nonparametrics. He has also worked on applied problems, including Bayesian estimation of SARS-CoV-2 seroprevalence and data-driven assessment of extreme particulate-matter risk.

RESEARCH EXPERTISE

- **High-dimensional covariance estimation:** Bayesian inference for sparse, banded, and spiked covariance matrices, including eigenvalue-bias correction and estimation of the number of spikes.
- **Sufficient dimension reduction:** Bayesian envelope models for dimension reduction and efficient estimation in multivariate linear and probit regression.
- **Manifold-constrained inference:** posterior sampling for parameters with orthogonality constraints, e.g., reflective Hamiltonian Monte Carlo on the Stiefel manifold.
- **Scalable Bayesian computation:** variational inference, efficient posterior sampling, and open-source software (bspcov R package).
- **Bayesian nonparametrics:** conditional Dirichlet processes, functional condition models, and Indian buffet processes.

RECENT RESEARCH HIGHLIGHTS

- **Manifold sampling (ICML 2026):** established the first non-asymptotic mixing-time bounds for reflective HMC through a convex-container-plus-thinning framework, and applied it to Stiefel-manifold sampling via a polar reparameterization.
- **Envelope models (Biometrics 2024):** proposed a multivariate probit model with a latent envelope, extending the response envelope model to multivariate binary responses.
- **Covariance estimation (J. Econom. 2023; Bayesian Anal. 2023):** introduced post-processed posteriors that map conjugate inverse-Wishart posterior samples to sparse or banded covariance estimates, attaining (near-)minimax convergence rates at low computational cost.

POTENTIAL COLLABORATION RESEARCH

Best-fit collaborator areas: machine learning & AI | biomedical data | environmental & public health | statistical computing

- **1. Joint Bayesian methodology development:** new priors, models, and theory for high-dimensional structured data with uncertainty quantification.
- **2. Bayesian computation for machine learning:** scalable posterior sampling (e.g., HMC) and variational inference for uncertainty quantification.
- **3. Biomedical & multivariate data analysis:** dimension reduction and covariance estimation for correlated multivariate biomedical outcomes.
- **4. Environmental & public-health applications:** Bayesian public-health modeling and data-driven environmental risk assessment (e.g., SARS-CoV-2 seroprevalence, particulate matter).

SELECTED RECENT PUBLICATIONS

- **Proc. ICML 2026 —** Reflective Hamiltonian Monte Carlo: mixing analysis and application to sampling on the Stiefel manifold.
- **SoftwareX 2025, 32, 102338 —** bspcov: an R package for Bayesian sparse covariance matrix estimation.
- **Biometrics 2024, 80(3), ujae059 —** Bayesian inference for multivariate probit model with latent envelope.
- **J. Econometrics 2023, 236(1), 105475 —** Post-processed posteriors for sparse covariances.

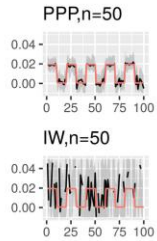
CONTACT

klee564@jnu.ac.kr | +82-62-530-3496

https://sites.google.com/view/klee564

REPRESENTATIVE RESEARCH FIGURES / SCHEMES

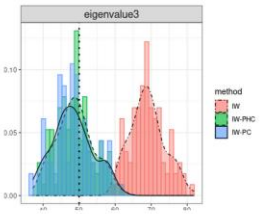
Sparse Covariance



GMVP weights: PPP vs. IW (red = true)

Lee & Lee, arXiv:2108.09462v1, Fig. 2 (cropped)

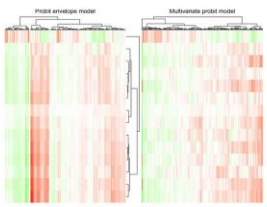
Spiked Covariance Model



IW vs. bias-corrected posteriors

Lee et al., arXiv:2412.10753v2, Fig. 2 (cropped)

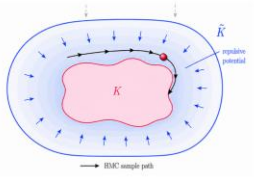
Bayesian Envelope Model



coefficients: probit envelope vs. MVP

Lee & Park, Biometrics 2024, Fig. 5 (cropped)

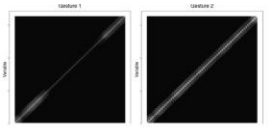
Reflective HMC



convex container + repulsive potential

Lee et al., ICML 2026, Fig. 1 (cropped)

bspcov (R package)



bandPPP estimates (eRing gesture data)

Lee et al., SoftwareX 2025, Fig. 4 (cropped)