Joonha Park

Assistant Professor
University of Kansas
Department of Mathematics
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Resesarch interests

Computational statistics, Sequential Monte Carlo (SMC), Markov chain Monte Carlo (MCMC), Simulation-based inference, Inference for spatio-temporal dynamics, Applications to public health/epidemiological data analysis, Bayesian statistics, Use of deep neural networks in the context of statistical inferences.

Education

University of Michigan, Ann Arbor, MI

Ph.D., Statistics, Sep. 2012 – May 2018

Advisor: Edward L. Ionides

Thesis: *Computational inference algorithms for spatiotemporal processes and other complex models*

Korea Advanced Institute of Science and Technology (KAIST), Daejon, Korea

M.A., Mathematical Sciences, Aug. 2010 – May 2012

Thesis: *A statistical theory of long-range target tracking and sensor formation*

Massachusetts Institute of Technology, Cambridge, MA

B.S., Mathematics, Sep. 2003 – May 2007

Academic positions

University of Kansas, Lawrence, KS

Assistant Professor at the Department of Mathematics, Aug 2020 – present.

Boston University, Boston, MA

Postdoctoral Associate at the Department of Mathematics and Statistics, Jul 2018 – Jun 2020. Supervisor: Yves Atchadé

Research Publications

Peer-reviewed

Park, J. (2025) *Scalable simulation-based inference for implicitly defined models using a metamodel for Monte Carlo log-likelihood estimator.* Accepted for publication in SIAM / ASA Journal on Uncertainty Quantification. `https://arxiv.org/abs/2311.09446`.

Asfaw, K., Park, J., King, A. A., and Ionides, E. L. (2024) spatPomp: An R package for spatiotemporal partially observed Markov process models. *Journal of Open Source Software*, 9(104), 7008. doi:10.21105/joss.07008.

Ionides, E. L., Asfaw, K., Park, J., and King, A. A. (2021) Bagged filters for partially observed interacting systems. *Journal of the American Statistical Association*, doi: 10.1080/01621459.2021.1974867.

Park, J. and Ionides, E. L. (2020) Inference on high-dimensional implicit dynamic models using a guided intermediate resampling filter. *Statistics and Computing*, doi: 10.1007/s11222-020-09957-3, `https://rdcu.be/b5bMj`

Park, J. and Atchadé, Y. (2020) Markov chain Monte Carlo algorithms with sequential proposals. *Statistics and Computing*, doi:10.1007/s11222-020-09948-4, `https://rdcu.be/b494g`

Ionides, E. L., Breto, C., Park, J., Smith, R. A. and King, A. A. (2017) Monte Carlo profile confidence intervals for dynamic systems. *Journal of The Royal Society Interface*, **14**, 20170126. `https://doi.org/10.1098/rsif.2017.0126`

Koopman, J. S., Henry, C. J., Park, J., Eisenberg, M. C., Ionides, E. L. and Eisenberg, J. N. (2017) Dynamics affecting the risk of silent circulation when oral polio vaccination is stopped. *Epidemics*. `https://doi.org/10.1016/j.epidem.2017.02.013`

Kim, S.-H., Park, J. H., Yoon, W., Ra, W.-S. and Whang, I.-H. (2017) A note on sensor arrangement for long-distance target localization. *Signal Processing*, **133**, 18–31. `https://doi.org/10.1016/j.sigpro.2016.10.011`

Works Submitted and other preprints

Park, J. *Sampling from high-dimensional, multimodal distributions using automatically tuned, tempered Hamiltonian Monte Carlo .* Under revision. `https://arxiv.org/abs/2111.06871`.

Manuscripts in preparation

Park, J. Module-assembly Markov chain Monte Carlo. Manuscript in preparation.

Park, J. and Wang, M. A novel method for testing composite null hypotheses. Manuscript in preparation.

Park, J. and Tu, X. Bias correction for the block particle filter using Gibbs sampling. Manuscript in preparation.

Park, J. A Bayesian metamodel-based approach to inference for implicitly defined simulation models. Manuscript in preparation.

Park, J. Data-conditional mixing in partially observed Markov processes and theoretical limitations of particle filters. Manuscript in preparation.

Park, J., Le, Q. Improving the predictive performance of bootstrap aggregating by Dirichlet resampling. Manuscript in preparation.

Park, J. Ralston, J. Modified Hamiltonian dynamics for multimodal sampling. Manuscript in preparation.

Software and Digital Media

R pakcage spatPomp: Inference for Spatiotemporal Partially Observed Markov Processes. `https://cran.r-project.org/web/packages/spatPomp/index.html`

R package sbi: simulation based inference. `https://github.com/joonhap/sbi`

R source code for automatically-tuned, tempered Hamiltonian Monte Carlo (ATHMC). `https://github.com/joonhap/athmc`

R source code for sequential-proposal Markov chain Monte Carlo methods. `https://github.com/joonhap/spMCMC`

R/C++ source code for Guided Intermediate Resampling Filter `https://github.com/joonhap/GIRF`

Talks and presentations

Talk, *Sampling from high-dimensional, multiimdal distributions using tempered Hamiltonian Monte Carlo*, The Bayesian Young Statistician's Meeting, Online, Apr. 2025

Talk, *Parameter inference for partially observed, implicitly defined simulation models*, The 18th International Joint Conference on Computational and Financial Econometrics (CFE) and Computational and Methodological Statistics (CMStatistics), King's College London, UK/virtual hybrid, Dec. 2024

Talk, *Monte Carlo methods for state space models*, Federal Reserve Bank of Kansas City, Dec. 2024

Talk, *Sampling from high-dimensional, multimodal distributions using automatically-tuned, tempered Hamiltonian Monte Carlo*, Monte Carlo and quasi-Monte Carlo methods in scientific computing (MCQMC), University of Waterloo, Canada, Aug. 2024

Talk, *Simulation-based inference for implicitly defined models*, Bernoulli-IMS 11th World Congress in Probability and Statistics, Ruhr University Bochum, Germany, Aug. 2024

Talk, *Sampling from high-dimensional, multimodal distributions using automatically-tuned, tempered Hamiltonian Monte Carlo*, The 7th International Conference on Econometrics and Statistics (EcoSta), Beijing Normal University, China/virtual hybrid, Jul. 2024

Talk, *Simulation-based inference for implicitly defined models*, 2024 WNAR/IMS Meeting, Colorado State University, Jun. 2024

Talk, *Simulation-based inference for implicitly defined models*, 2024 Symposium on Data Science and Statistics (SDSS), Richmond, VA, Jun. 2024

Poster presentation, *Simulation-based inference for implicitly defined models using a likelihood metamodel*, The 17th Annual Innovations in Design, Analysis, and Dissemination: Frontiers in Biostatistics & Data Science Meeting (IDAD), University of Kansas Medical Center Department of Biostatistics & Data Science, Overland Park, KS, Apr. 2024

Poster presentation, *Sampling from high-dimensional, multimodal probability distributions using adaptively-tuned, tempered, Hamiltonian Monte Carlo*, The 17th Annual Innovations in Design, Analysis, and Dissemination: Frontiers in Biostatistics & Data Science Meeting (IDAD), University of Kansas Medical Center Department of Biostatistics & Data Science, Overland Park, KS, Apr. 2024

Talk, *Sampling from high-dimensional, multimodal distributions using automatically-tuned, tempered Hamiltonian Monte Carlo*, Computational and Applied Mathematics (CAM) Seminar, University of Kansas, Apr. 2024

Poster and lightning presentation, *Sampling from high-dimensional, multimodal probability distributions using adaptively-tuned, tempered, Hamiltonian Monte Carlo*, Seminar on Stochastic Processes (SSP), Rice University, Houston, TX, Mar. 2024

Talk, *Simulation-based inference for implicitly defined models with application to partially observed Markov processes*, Joint Statistical Meetings, Toronto, Canada, Aug. 2023

Talk, *Sampling from multimodal distributions using tempered Hamiltonian transitions*, New England Statistics Symposium (NESS), Boston University, Jun. 2023

Talk, *Simulation-based inference for implicitly defined models with application to partially observed Markov processes*, Probability and Statistics Seminar, University of Kansas, Apr. 2023

Talk, *Simulation-based inference for high dimensional implicit models and application to partially observed processes*, The 15th International Conference of the European Consortium for Information and Mathematics working group on Computational and Methodological Statistics (CMStatistics 2022), hybrid (virtual and at King's College London), Dec. 2022

Talk, *Sampling from multimodal target distributions using tempered Hamiltonian transitions*, WNAR 2022, Jun. 2022

Talk, *Sampling from multimodal target distributions using tempered Hamiltonian transitions*, Innovations in Design, Analysis, and Dissemination (IDAD): Frontiers in Biostatistics and Data Science, Apr. 2022

Talk, *Sampling from multimodal target distributions using tempered Hamiltonian transitions*, The 14th International Conference of the European Consortium for Information and Mathematics working group on Computational and Methodological Statistics (CMStatistics 2021), hybrid (virtual and at King's College London), Dec. 2021

Research presentation, *Monte Carlo methods in Statistics*, KU Math Sneak Peek event (designed to give information about the department for potential applicants for graduate program), Nov. 2021

Poster presentation, *Sampling from multimodal distributions using mass-modulated Hamiltonian transitions*, Bayesian Young Statisticians Meeting (BAYSM, virtual) Sep. 2021

Talk, *Mass-enhanced Hamiltonian Monte Carlo with sequential proposals for multimodal target distributions*, Joint Statistical Meetings, Virtual, 2021

Talk at KU Math Club meetings (undergraduate), *Independence, statistical models, and Bayesian inference*, University of Kansas, May 2021

Talk at *Teaching matters seminar*, *My experiences of teaching statistics at KU*, University of Kansas, Apr 2021

Talk, *Sequential-proposal Hamiltonian Monte Carlo with mass scaling for multimodal target distributions*, Smith Colloquium, Department of Mathematics, University of Kansas, Feb. 2021

Talk, Probability and Statistics seminar, *Inference on coupled stochastic dynamic models using a guided intermediate resampling filter*, University of Kansas, Dec. 2020

Talk, *Markov chain Monte Carlo methods with sequential proposals*, Bayesian Young Statisticians Meeting: Online (BAYSM:O), Nov. 2020

Poster presentation, *Markov chain Monte Carlo methods with sequential proposals*, IMA workshop on Optimal Control, Optimal Transport, and Data Science (virtual) Nov. 2020

Talk, *Inference on coupled stochastic dynamic models using a guided intermediate resampling filter*, Computational and Applied Mathematics (CAM) Seminar, University of Kansas, Oct. 2020

Contributed paper presentation, *Markov chain Monte Carlo algorithms with sequential proposals*, Joint Statistical Meetings, Aug. 2020

Online lecture, *A selective review of Markov chain Monte Carlo methods and some recent developments*, Korea Advanced Institute of Science and Technology (KAIST), Daejon, South Korea, Jul. 2020

Talk, *Inference on high-dimensional implicit dynamic models using a guided intermediate resampling filter*, Workshop on Mathematical Modeling and Statistical Analysis of Infectious Disease Outbreaks, CIRM Luminy, Marseille, France, Feb. 2020

Talk, *Markov chain Monte Carlo methods with sequential proposals*, The University of Kansas, Lawrence, Jan. 2020

Poster presentation, *Markov chain Monte Carlo methods with sequential proposals*, Bayes Comp 2020, The University of Florida, Gainesville, Jan. 2020

Talk, *Sequential proposal Markov chain Monte Carlo sampling algorithms*, New England Statistics Symposium (NESS) 2019, Hartford, May 2019

Speed oral and poster presentation, *A guided intermediate resampling particle filter for inference on high dimensional systems*, Michigan Student Symposium for Interdisciplinary Statistical Sciences (MSSISS), University of Michigan, Apr. 2018

Poster presentation, *A guided intermediate resampling particle filter for inference on high dimensional systems*, SMC workshop 2017, Uppsala, Sweden, Aug. 2017

Poster presentation, *Particle filter in high dimension via intermediate resampling and its application to the analysis of the measles epidemic in the UK, 1949-1964*, World Congress in Probability and Statistics, Toronto, Jul. 2016

Poster presentation, *Estimation of epidemic parameters by sequential Monte Carlo: a case study in measles*, Joint Statistical Meetings, Seattle, Aug. 2015

Talk, *Determinants of Silent Polio Circulation during the Eradication Endgame*, Workshop on analyzing the polio eradication endgame, Fred Hutchinson Cancer Research Center, Jul. 2015

Talk, *Computational sampling methods in high dimension and applications to modeling of infectious diseases*, Workshop on Statistics and Nonlinear Dynamics in Biology and Medicine, Banff International Research Station, Jul. 2014

Poster presentation, *Estimation of epidemic parameters by sequential Monte Carlo: a case study in measles*, Michigan Student Symposium for Interdisciplinary Statistical Sciences (MSSISS), University of Michigan, Mar. 2014

Poster presentation, *A statistical theory of long-range target tracking and sensor formation*, Michigan Student Symposium for Interdisciplinary Statistical Sciences (MSSISS), University of Michigan, Mar. 2013

Talk, *A statistical theory of long-range target tracking and sensor formation*, SIAM student conference, University of Michigan, Feb. 2013

Talk, *Multi-sensor statistical target tracking based on range difference data*, Graduate Seminar, KAIST, Nov. 2011

Teaching

Courses taught at the University of Kansas:

MATH 717 Nonparametric Statistics, Fall 2024.

MATH 728 Statistical Theory, Spring 2024, Spring 2025.

MATH 996 Special Topics: Computational Methods in Statistical Learning, Spring 2023.

MATH 605 Applied Regression Analysis, Fall 2022, Fall 2024.

MATH 526 Applied Mathematical Statistics, Fall 2020, Spring 2021, Fall 2021, Spring 2022, Fall 2022, Fall 2023 (2).

MATH 699 Directed Reading, Summer 2021, Spring 2022, Summer 2023, Spring 2025.

PhD advisees

Ming Wang, Fall 2021 – present.

Sungmin Won, Mar. 2022 – Dec. 2023.

Undergraduate research mentorship

Reeny Huang (Spring 2025 – present)

Directed Reading, Topic: Ensemble learning methods.

Viet Le (Spring 2022 – Spring 2024)

Honor's thesis. Research title: Dependent sampling forest. Received the KU Undergraduate Research Award (Sep. 2023)

Directed Reading, Topic: Markov chain Monte Carlo algorithms and applications to image reconstruction. (Spring 2022)

TaeSung Cho (Summer 2023)

Directed Reading, Topic: Actuarial analysis using R.

Shahab Mirza (Spring 2021 – Summer 2022)

Directed Reading, Topic: Markov chain Monte Carlo algorithms and the sequential-proposal strategy. (Fall 2021)

Led *Statistics reading group on Bayesian data analysis*, University of Kansas, Fall 2021.

Lab instructor for *MA 213 Basic Statistics and Probability*, Boston University, Spring 2019 and Fall 2019.

Awards and Honors

General Research Fund, University of Kansas Office of Research, Title: *Developing novel computational algorithms: scalable inference for simulation models and spatiotemporal models*. Jul. 2023 – Jun. 2024. Award: $14,470

Rackham Research Grant, University of Michigan Rackham Graduate School, 2017. Award: $1,613 for travel support to SMC workshop 2017, Uppsala, Sweden.

Rackham Predoctoral Fellowship, University of Michigan Rackham Graduate School, 2016 – 2017. Award: $32,000

Outstanding Teaching Award, University of Michigan Department of Statistics, 2013 – 2014

Rackham International Student Fellowship, University of Michigan Rackham Graduate School, 2013. Award: $10,000

Outstanding First-Year Ph.D. Student Award, University of Michigan Department of Statistics, 2012 – 2013

Samsung Scholarship, Full tuition and living expenses for undergraduate education. 2003 – 2007

Other Services

Refereed papers for journals, including *Statistics and Computing, Journal of Computational and Graphical Statistics, Computational Statistics and Data Analysis, American Journal of Epidemiology, Stochastic Environmental Research and Risk Assessment, Journal of the Korean Statistical Society, Austrian Journal of Statistics, Bernoulli, Journal of the American Statistical Association, Sankhya B, Risks, Symmetry, Journal of Risk and Financial Management*

Panelist for the National Science Foundation, 2022.

Coached undergraduate students for the William Lowell Putnam Mathematical Competition. University of Kansas, AY 2022-2025.

Coached undergraduate students for the Kansas Collegiate Mathematics Competition (Spring 2023, 2024).

Graded problems for the Kansas Collegiate Mathematics Competition Bethany College, Lindsborg, KS, April 15, 2023.

Proposed competition problems and graded exams for KU Mathematics and Statistics Awareness Month Math Competition (3rd-12th graders), Lawrence, KS, 2020-2024.

Led *Seminar on Advances in Machine Learning*, University of Kansas, Summer 2022, Fall 2022.

Center for Teaching Excellence (CTE) Ambassador, University of Kansas, Fall 2020 – 2024.

Co-organizer of the KU Probability and Statistics Conference on Stochastic Analysis and Related Areas, Department of Mathematics, University of Kansas, November 2024.

Co-organizer of the Smith Colloquium at the Department of Mathematics, the University of Kansas. AY 2021-2024.

Co-organizer of the probability/statistics seminar at the University of Kansas, Mathematics department. Fall 2020 - Spring 2021.

Gave research area presentations at the KU Sneak Peek events. Fall 2021, Fall 2023.

Member, Undergraduate Upper Division Committee. AY 2024-2025.

Member, Graduate Studies Commitee. AY 2023-2024.

Member, Computer Advisory Committee, Fall 2020 - present.

Graduate Student Consultant at Consulting for Statistics, Computing, and Analytics Research (CSCAR), University of Michigan. Provided consultation for various research-related statistical questions. Jan. 2016 – Apr. 2016.

Organizer for Michigan Student Symposium for Interdisciplinary Statistical Sciences (MSSISS) 2016, University of Michigan, Sept. 2015 – Mar. 2016.

Organizer for Graduate Student Statistical Topics Seminar Series (GSSTSS), Statistics Department, University of Michigan. Invited speakers and organized seminars. Sept. 2013 – May 2015

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