

Ji Won Park

Research Scientist

San Francisco Bay Area

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Research Areas

- **Decision making under uncertainty**

- Designing acquisition functions for multi-objective Bayesian optimization tailored for molecular property spaces
- Productionalizing machine-guided design of antibodies, small molecules, and molecular glues

- **Robust inference in high dimensions**

- Non/semi-parametric Bayes, adaptation, targeted learning
- Post-hoc calibration methods including conformal prediction
- Causality-inspired domain generalization methods for out-of-distribution robustness

- **Sampling in high dimensions**

- Sampling algorithms for non-log-concave distributions
- Exploring diffusion models as sampling tools for Bayesian inference
- Hybridizing MCMC with variational methods to balance accuracy and computational cost

Education

Stanford University

Ph.D. Physics

- Co-advised by Philip J. Marshall, Aaron Roodman

Stanford, CA

Sept 2017 – March 2022

Duke University

B.S. Physics, B.S. Math

- Honors thesis advisor: Christopher Walter
- Graduation with High Distinction

Durham, NC

Aug 2013 – May 2017

Professional Experience

Genentech

Principal Machine Learning Scientist

South San Francisco, CA

Nov 2023 - Present

Senior Machine Learning Scientist II

Nov 2021 - Nov 2023

- Developing algorithms to improve uncertainty quantification in active, machine-guided molecular design
- Advising experimental and applied machine learning scientists on data acquisition and analysis strategies
- Worked with Kyunghyun Cho, Saeed Saremi, Nataša Tagasovska.

Stanford University / SLAC National Accelerator Laboratory

Graduate Research Assistant

Stanford, CA

April 2018 - Present

My thesis developed approximate inference methods under a hierarchical Bayesian framework. I applied this approach to large, multi-modal astronomical datasets to infer the Hubble constant—a key cosmological parameter governing the Universe’s accelerated expansion. Dissertation: “All the Lenses: Hierarchical Inference of the Hubble Constant from Strong Gravitational Time Delays with Bayesian Deep Learning”

Simons Foundation Flatiron Institute, Center for Computational Astrophysics (CCA)

Visiting Researcher (Supervisor: Shirley Ho)

New York City, NY

April-July 2021

Extended latent stochastic differential equations to reconstruct the multivariate time series of active galactic nuclei (AGNs) and infer their black hole properties. Among the Universe’s most extreme objects, AGNs are luminous galactic centers hosting black holes, whose physical attributes trace the Universe’s evolutionary history.

Developed a Pix2Pix video-to-image model to predict solar flux emergence from time-series magnetograms. Forecasting solar flux emergence is critical for astronaut safety below low-Earth orbit.

Publications

* indicates equal contribution.

Published

- [19] Bazgir, O., Wang, Z., **Park, J. W.**, Hafner, M., Lu, J. 2024. Integration of Graph Neural Network and Neural-ODEs for Tumor Dynamic Prediction. International Conference on Learning Representations MLGenX Workshop. [\[arXiv\]](#)
- [18] Griffiths, R. and 24 others including **Park, J.W.**. 2024. GAUCHE: a library for Gaussian processes in chemistry. Advances in Neural Information Processing Systems, 36. [\[arXiv\]](#)
- [17] Fagin, J., **Park, J. W.**, Best, H., Chan, J. H., Ford, K. S., Graham, M. J., ..., O'Dowd, M. 2024. Latent Stochastic Differential Equations for Modeling Quasar Variability and Inferring Black Hole Properties. The Astrophysical Journal, 965(2), 104. [\[arXiv\]](#) [\[ADS\]](#)
- [16] Saremi, S., **Park, J. W.**, Bach, F. 2024. Chain of Log-Concave Markov Chains. International Conference on Learning Representations. [\[arXiv\]](#)
- [15] **Park, J.W.***, Tagasovska, N.*, Maser, M., Ra, S., Cho, K. 2024. BOtied: Multi-objective Bayesian optimization with tied multivariate ranks. International Conference on Machine Learning. [\[arXiv\]](#)
- [14] Ng, N., **Park, J.W.**, Lee, J.H., Kelly, R., Cho, K. 2023. Blind Sequence Denoising with Self-Supervised Set Learning. Transactions on Machine Learning Research.
- [13] **Park, J.W.**, Birrer, S., Ueland, M., Cranmer, M., Wagner-Carena, S., Marshall, P.J., Roodman, A. 2021. Hierarchical Inference of Weak Lensing Convergence from Photometric Catalogs with Bayesian Graph Neural Networks. The Astrophysical Journal, 953 (2): 178. [\[arXiv\]](#) [\[ADS\]](#) [\[ApJ\]](#)
- [12] Maser, M., **Park, J.W.**, Lin, J.Y.Y., Lee, J.H., Frey, N., Watkins, A. 2023. SupSiam: Non-contrastive Auxiliary Loss for Learning from Molecular Conformers. International Conference on Learning Representations, *Machine Learning for Drug Discovery* Workshop. [\[arXiv\]](#)
- [11] Fagin, J.* **Park, J.W.***, Best, H., Ford, S., Graham, M., Villar, A., Ho, S., Chan, J., O'Dowd, M. 2023. Latent Stochastic Differential Equations for Modeling Quasar Variability and Inferring Black Hole Properties. International Conference on Learning Representations, *Physics for Machine Learning* Workshop. Spotlight. [\[arXiv\]](#)
- [10] **Park, J.W.**, Stanton, S., Saremi, S., Watkins, A., Dwyer, H., Gligoričević, V., Bonneau, R., Ra, S., Cho, K. 2022. PropertyDAG: Multi-objective Bayesian Optimization of Partially Ordered, Mixed-Variable Properties for Biological Sequence Design. Conference on Neural Information Processing Systems, *AI for Science* Workshop. [\[arXiv\]](#)
- [9] Berenberg, D., Lee, J.H., Kelow, S., **Park, J.W.**, Watkins, A., Gligoričević, V. Bonneau, R., Ra, S., Cho, K. 2022. Multi-Segment Preserving Sampling for Deep Manifold Sampler. International Conference on Learning Representations, *Machine Learning for Drug Discovery* Workshop. Spotlight. [\[arXiv\]](#)
- [8] Morgan, R., Nord, B., Bechtol, K., Gonzalez, J., Buckley-Geer, E., Moller, A., **Park, J.W.** followed by 38 others. 2022. Deepzipper: A Novel Deep-Learning Architecture for Lensed Supernovae Identification. The Astrophysical Journal, 927(1): 109-9. [\[ADS\]](#)
- [7] **Park, J.W.**, Villar, A., Li, Y., Jiang, Y.F., Ho, S., Lin, J.Y.Y., Marshall, P.J., Roodman, A. 2021. Inferring Black Hole Properties from Astronomical Multivariate Time Series with Bayesian Attentive Neural Processes. International Conference on

Machine Learning, *Uncertainty and Robustness in Deep Learning* and *Time Series* Workshops. [\[arXiv\]](#) [\[ADS\]](#)

[6] **Park, J.W.**, Wagner-Carena, S., Birrer, S., Marshall, P.J., Lin, J.Y.Y., Roodman, A. (LSST Dark Energy Science Collaboration). 2021. Large-scale Gravitational Lens Modeling with Bayesian Neural Networks for Accurate and Precise Inference of the Hubble Constant. *The Astrophysical Journal*, 910(1): 39. [\[arXiv\]](#) [\[ADS\]](#)

[5] Wagner-Carena, S., **Park, J.W.**, Birrer, S., Marshall, P.J., Roodman, A., Wechsler, R.H. (LSST Dark Energy Science Collaboration). 2021. Hierarchical Inference with Bayesian Neural Networks: An Application to Strong Gravitational Lensing. *The Astrophysical Journal*, 909(2): 187. [\[arXiv\]](#) [\[ADS\]](#)

[4] LSST Dark Energy Science Collaboration including **Park, J.W.** 2021. The LSST DESC DC2 Simulated Sky Survey. *The Astrophysical Journal Supplement Series*, 253(1): 31-34. [\[arXiv\]](#) [\[ADS\]](#)

[3] Ding, X., Treu, T., and 26 others including **Park, J.W.** Time Delay Lens Modeling Challenge. 2021. *Monthly Notices of the Royal Astronomical Society*, 503(1): 1096-1123. [\[arXiv\]](#) [\[ADS\]](#)

[2] Birrer S., Shajib, A.J., Gilman, D., Galan, A., and 16 others including **Park, J.W.** 2021. Lenstronomy II: A Gravitational Lensing Software Ecosystem. *The Journal Open Science Software*, 03283. [\[arXiv\]](#) [\[ADS\]](#)

[1] Birrer S., Shajib, A.J., Galan, A., Millon, M., Treu, T. and 22 others including **Park, J.W.** 2020. TDCOSMO IV: Hierarchical Time-Delay Cosmography — Joint Inference of the Hubble Constant and Galaxy Density Profiles. *Astronomy and Astrophysics*, 643(A165): 40. [\[arXiv\]](#) [\[ADS\]](#)

In Prep

[24] Lahiri, P., **Park, J.W.**, Vasilaki, S., Dreyer, F., Stanton, S., Seeger, F., Kelly, R. (Author list and ordering TBD.) High-throughput affinity characterization with AffiMapper. In prep.

[23] Kim, K., **Park, J.W.**. Bayesian optimization with control functionals. In prep.

[22] Nerli, S.*, **Park, J.W.***, Lu, C., Davidson, D., Kelow, S., Bonneau, R., Cho, K., Watkins, A. Combined physics and ML-based approach for modeling peptide conformational flexibility in pHLA-I molecules. In prep.

[21] **Park, J.W.**, Tibshirani, R., Cho, K. 2024. Semiparametric conformal prediction. In prep.

[20] Tagasovska, N.*, **Park, J.W.***, Kirchmeyer, M., Frey, N., Ismail, A., Jamasb, A., Lee, E., Bryson, T., Ra, S., Cho, K. 2023. Antibody DomainBed: Out-of-Distribution Generalization in Therapeutic Protein Design. In prep. [\[arXiv\]](#)

Patents

Provisional applications

Six patent applications under review (details withheld for confidentiality)

Published patents

[1] Berenberg, D., Lee, J.H., Kelow, S., **Park, J.W.**, Watkins, A., Gligorijevic, V. Bonneau, R., Ra, S., Cho, K. 2022. "Multi-Segment Preserving Sampling for Deep Manifold Sampler." [068893-506P01US] [GNE Ref. P37421-US]

Presentations

External presentations

November 2024. Poster presentation, "Semiparametric conformal prediction for molecular property prediction ." Cambridge, MA.

October 2024. Invited panelist at the CMG AI Summit, "How to win in the age of AI." South San Francisco, CA.

June 2024. *Finding Signal in the Noise for Lab-in-the-Loop Molecular Design*. Invited talk: Stanford University Bio-X (Interdisciplinary Biosciences Institute).

June 2024. *Multi-objective optimization for molecular design using multivariate ranks and quantiles*. Invited talk: Cradle.ai. Zurich, Switzerland.

March 2024. *BOtied: Multi-objective Bayesian optimization with tied multivariate ranks*. Invited talk: Neural Concept and EPFL. Lausanne, Switzerland.

February 2024. *BOtied: Multi-objective Bayesian optimization with tied multivariate ranks*. Invited talk: 2024 SIAM Conference on Uncertainty Quantification. Trieste, Italy.

January 2024. *Multi-Objective Bayesian Optimization for Molecular Design*. Invited talk: KASBP-SF Annual Symposium. South San Francisco, CA.

January 2024. Invited plenary panelist at the American Physical Society 2024 Conference for Undergraduate Women in Physics (APS CUWiP) at Stanford University. The goal of CUWiP is to encourage undergraduate women and gender minorities to continue in physics.

November 2023. *Multi-Objective Bayesian Optimization for Molecular Design*. Industry Research Workshop: Machine Learning for Health Care and Life Sciences. ETH Zurich, Zurich, Switzerland.

June 2023. *A Tail of Many Tails: Multi-Objective Bayesian Optimization for Molecular Design*. Invited talk: Seoul National University, Seoul, South Korea.

June 2023. *A Tail of Many Tails: Multi-Objective Bayesian Optimization for Molecular Design*. Invited talk: Korea Advanced Institute of Science & Technology, Daejeon, South Korea.

May 2022. *Inferring the Hubble Constant from Strong Lensing Time Delays with Bayesian Deep Learning*. Departmental tea talk: Kavli Institute of Particle Astrophysics and Cosmology, Stanford, CA.

May 2021. *Inferring the Hubble Constant from Strong Lensing Time Delays with Bayesian Deep Learning*. Departmental tea talk: Kavli Institute of Particle Astrophysics and Cosmology, Stanford, CA.

April 2021. *Large-Scale Gravitational Lens Modeling with Bayesian Neural Networks for Accurate and Precise Inference of the Hubble Constant*. Oral presentation, competitive. Time-Domain Cosmology with Strong Gravitational Lensing Workshop, virtual.

July 2021. *Inferring Black Hole Properties from Astronomical Multivariate Time Series with Bayesian Attentive Neural Processes*. Poster presentation, competitive. International Conference on Machine Learning (ICML) Uncertainty and Robustness in Deep Learning and Time Series Workshops, virtual.

July 2021. *Joint Light Curve Reconstruction and Parameter Inference from LSST-like Active Galactic Nuclei (AGN) Light Curves with Bayesian Neural Networks*. Oral presentation, competitive. Supermassive Black Hole Studies with the Legacy Survey of Space and Time – The 2021 Summer Meeting of the LSST AGN Science Collaboration, virtual.

February 2020. *Validation of AGN Variability in DC2 (the Second Data Challenge)*. Oral presentation: Winter 2020 DESC Collaboration Meeting, Tucson, AZ.

November 2019. *Inference of the Hubble Constant Using Bayesian Neural Networks*. Oral presentation: Bay Area Likelihood-Free Inference Workshop, Berkeley, CA.

July 2019. *Hierarchical Inference of the Hubble Constant: Simulation Design*. Oral presentation: Summer 2019 DESC Collaboration Meeting, Paris, France.

July 2019. *Catalog-Level Detection of Strong Lenses with Probabilistic Machine Learning*. Oral presentation: Summer 2019 DESC Collaboration Meeting, Paris, France.

February 2019. Emulating LSST Catalogs with Deep Learning. Invited keynote. Plenary session at the Winter 2019 DESC Collaboration Meeting, Berkeley, CA.

July 2018. *Catalog-Level Lens Finding with Variational Recurrent Autoencoders*. Oral presentation: Summer 2018 DESC Collaboration Meeting, Pittsburgh, PA.

Research Mentoring

2024	Kyurae Kim Graduate Student	University of Pennsylvania
2023	Taro Makino Graduate Student	New York University
2022	Nathan Ng Graduate Student	University of Toronto
2022-2023	Joshua Fagin Graduate Student	City University of New York
2021-2020	Madison Ueland Undergraduate Summer Research Student	Stanford University
2019	Alex Fegghi Undergraduate Intern	NASA Ames Research Center

Outreach

February 2024	US Particle Physics Featured in periodical <i>Particle Physics Builds STEM Leaders</i>	Online
January 2024	APS Conferences for Undergraduate Women in Physics (CUWiP) Invited Plenary Panelist	Stanford, CA
2019-2021	Stanford Physics Peer Mentoring Program Graduate Peer Mentor	Stanford, CA

Professional Development

2024-Present	Korean American Society in Biotech and Pharmaceuticals (KASBP) Organizing Committee, San Francisco Chapter	San Francisco Bay Area
2021-Present	Prescient Design Machine Learning Journal Club Organizer	South San Francisco, CA
2019-2021	Breakfast Club (journal club on probabilistic ML for high energy physics) Organizer	Stanford, CA
2020	Summer 2020 DESC Collaboration Meeting Scientific Organizing Committee	Virtual
2016-2017	Korean-American Scientists and Engineers Association (KSEA) Co-President, Duke Chapter	Durham, NC
2013-2017	CHANCE (volunteer tutoring organization) Tutor, Vice President of Treasury	Durham, NC