

Hyunseok Seung

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Professional Appointments

2025 – Present **Postdoctoral Research Associate**, *Department of Statistics, University of Wisconsin–Madison*, Madison, WI
Advisor: [Matthias Katzfuss](#)

Education

2025 **Ph.D.** in Statistics, *University of Georgia*, Athens, GA
Advisors: [Jaewoo Lee](#) and [Yuan Ke](#)
Dissertation: *Scalable and Efficient Learning: Algorithmic Advances for Time Series and Deep Neural Models*

2018 **M.A.** in Applied Statistics, *Yonsei University*, Seoul, South Korea
Advisor: [Sangun Park](#)
Thesis: *Modified Likelihood Ratio Tests for Extreme Value Distributions*

2016 **B.A.** in Applied Statistics, *Yonsei University*, Seoul, South Korea

Research Interests

Scalable statistical machine learning with gradient and curvature information:

- Gaussian processes/Bayesian optimization with derivative observations.
- Curvature-aware optimization for deep learning.

Publications

Under Review

R1. **Hyunseok Seung** & Katzfuss, M. *Scalable Derivative Gaussian Processes via Exact Gradient Reduction* 2026+.

Conference Proceedings

- C1. **Hyunseok Seung**, Lee, J. & Ko, H. *Low-Rank Curvature for Zeroth-Order Optimization in LLM Fine-Tuning* in *AAAI Conference on Artificial Intelligence* (2026).
- C2. **Hyunseok Seung**, Lee, J. & Ko, H. *MAC: An Efficient Gradient Preconditioning using Mean Activation Approximated Curvature* in *IEEE International Conference on Data Mining (ICDM)* (2025).
- C3. **Hyunseok Seung**, Lee, J. & Ko, H. *An Adaptive Method Stabilizing Activations for Enhanced Generalization* in *IEEE International Conference on Data Mining Workshop (ICDMW)* (2024).
- C4. **Hyunseok Seung**, Lee, J. & Ko, H. *NysAct: A Scalable Preconditioned Gradient Descent using Nystrom Approximation* in *IEEE International Conference on Big Data* (2024).

Journal Articles

- J1. **Hyunseok Seung**, Han, K., Shen, Y. & Ke, Y. Enhancing COVID-19 Mortality Prediction with Online Autocovariance Change Points Detection. *Stat* (2026).
- J2. **Hyunseok Seung**, Lee, J. & Ko, H. Mean Activation Curvature for Scalable Second-Order Optimization in Deep Networks. *Knowledge and Information Systems*. (Invited journal extension from the IEEE ICDM 2025 best-ranked paper selection) (2026).
- J3. **Hyunseok Seung** & Park, S. Modified Likelihood Ratio Tests for Extreme Value Distributions. *Communications in Statistics–Theory and Methods* **52**, 5742–5751 (2023).

Research

Core Research Areas

- 2025 – Present **Postdoctoral Researcher**, *Department of Statistics, University of Wisconsin–Madison*
Scalable Gaussian Process Inference with Derivative Observations (advised by [Matthias Katzfuss](#))
- Developed a target-specific gradient reduction framework for derivative Gaussian processes, enabling scalable function-value prediction from gradient observations while preserving the exact gradient information required by each local predictive factor.
- 2022 – 2025 **Research Assistant**, *School of Computing, University of Georgia*
Curvature-Aware Optimization for Deep Learning (advised by [Jaewoo Lee](#))
- Developed a curvature-aware zeroth-order optimizer for LLM fine-tuning, improving convergence and test accuracy over MeZO-Adam while reducing memory usage by up to 27%.
 - Developed scalable second-order optimization methods using activation covariance, improving vision transformer test accuracy by 3.6 percentage points over AdamW.

Collaborative and Earlier Research

- 2025 – Present **Postdoctoral Researcher**, *Department of Statistics, University of Wisconsin–Madison*
Hyperspectral Foundation Models (collaboration with [Townsend Lab](#))
- Developing hyperspectral foundation models by pre-training vision transformers on hyperspectral data and fine-tuning them for downstream trait prediction, with conformal prediction used for uncertainty quantification.
- 2023 – 2024 **Research Assistant**, *Department of Educational Psychology, University of Georgia*
Topic Modeling (collaboration with [NPDA Lab](#))
- Analyzed video and text data using automatic speech recognition and topic modeling, collaborating with researchers in mathematics education and psychology.
- 2021 – 2023 **Research Assistant**, *Department of Statistics, University of Georgia*
Time Series Forecasting (advised by [Yuan Ke](#))
- Developed hybrid COVID-19 mortality forecasting models using online autocovariance change point detection, improving prediction accuracy by 6% and reducing training time by 99% compared to standard rolling-window cross validation.
- 2018 **Associate Researcher**, *SK hynix Inc.*

Wafer Failure Early Detection System (supervised by [Sangun Park](#))

- Identified key predictors of wafer failure using statistical models for high-dimensional semiconductor fabrication data.

2017 – 2018

Research Assistant, *Department of Applied Statistics, Yonsei University*

Modified Likelihood Ratio Tests (advised by [Sangun Park](#))

- Developed modified likelihood ratio test statistics tailored to highly skewed settings to improve sensitivity to tail departures.

Software

2026

TERA: Scalable Derivative Gaussian Process Inference

PyTorch/GPyTorch/BoTorch implementation of target-specific gradient reduction for function-value prediction from gradient observations, with reproducible regression and Bayesian optimization experiments. Repository: github.com/hseung88/tera

2025

LOREN: Low-Rank Curvature for Zeroth-Order LLM Fine-Tuning

PyTorch implementation of low-rank curvature-aware zeroth-order optimization for memory-efficient LLM fine-tuning. Repository: github.com/hseung88/loren

MAC: Gradient Preconditioning using Mean Activation Curvature

PyTorch implementation of mean-activation covariance preconditioning for scalable curvature-aware optimization in deep neural networks. Repository: github.com/hseung88/mac

2024

NysAct: Nyström Activation-Covariance Preconditioning

PyTorch implementation of Nyström-approximated activation covariance for scalable preconditioned training of deep neural networks. Repository: github.com/hseung88/nysact

AdaAct: Adaptive Activation Stabilization

PyTorch implementation of adaptive activation stabilization methods for improving generalization in deep neural networks. Repository: github.com/hseung88/adaact

Awards & Honors

2019 – 2024

Teaching Assistantship (Stipend), *University of Georgia*

2018

Industry-Sponsored Scholarship Recipient, *SK hynix Inc.*

2018

Best Paper Presentation Award, *Korean Data and Information Science Society*

2017 – 2018

Brain Korea 21 Fellowship, *Korean Government-Funded Graduate Program*

2015

Honors Award, *Yonsei University*

Conference Presentations

Oral

- T1. *An Efficient Gradient Preconditioning using Mean Activation Approximated Curvature* 2025 IEEE International Conference on Data Mining (Washington, DC, USA). Nov. 2025.
- T2. *A Scalable Preconditioned Gradient Descent using Nystrom Approximation* 2024 IEEE International Conference on Big Data (Washington, DC, USA). Dec. 2024.

T3. *Modified Likelihood Ratio Tests for Extreme Value Distributions* The Korean Data and Information Science Society (Pukyong University, Busan, South Korea). May 2018.

Posters

P1. *Low-Rank Curvature for Zeroth-Order Optimization in LLM Fine-Tuning* AAAI Conference on Artificial Intelligence (Singapore). Jan. 2026.

P2. *A Scalable Preconditioned Gradient Descent using Nystrom Approximation* AI Research Day, Institute for Artificial Intelligence (Athens, GA, USA). Apr. 2025.

P3. *An Adaptive Method Stabilizing Activations for Enhanced Generalization* AI Research Day, Institute for Artificial Intelligence (Athens, GA, USA). Apr. 2024.

P4. *Modified Likelihood Ratio Tests for Extreme Value Distributions* The Korean Statistical Society (Pusan National University, Busan, South Korea). May 2018.

Service

Reviewer

2026 Advances in Neural Information Processing Systems (NeurIPS), 2026

Teaching

2019 – 2023 **Teaching Assistant, University of Georgia**

Graduate Courses

STAT6430 Design and Analysis of Experiments	Spring 2023
STAT6315 Statistical Methods for Researchers	Spring 2023
STAT8330 Advanced Statistical Applications and Computing	Fall 2022
STAT6420 Applied Linear Models	Fall 2022
STAT8440 Statistical Inference in Bioinformatics	Fall 2020
STAT6210 Introduction to Statistical Methods	Fall 2020
STAT6210 Statistical Methods	Fall 2019

Undergraduate Courses

STAT4230 Applied Regression Analysis	Spring 2022
STAT2360 Programming and Data Literacy using R	Fall 2021
STAT4210 Statistical Methods	Spring 2021
STAT3110 Introduction to Statistics for Life Sciences	Summer 2020
STAT3120 Introduction to Probability for Life Sciences	Spring 2020

2018 **Lecturer, Instructor of Record, Yonsei University**

STAT1001 Introduction to Statistics	Fall 2018
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2017 – 2018 **Teaching Assistant, Yonsei University**

STAT1001 Introduction to Statistics	Spring 2018
STAT1001 Introduction to Statistics	Fall 2017
STAT1001 Introduction to Statistics	Spring 2017

Last updated: May 11, 2026