Minji Kim

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Summary

- Multidisciplinary researcher with expertise in statistical methodologies and physical AI for modeling physical phenomena.
- Proven record of delivering impactful solutions for real-world challenges and contributing to cross-functional collaborations.

Education

University of North Carolina at Chapel Hill (UNC) | Ph.D. in Statistics and Operations Research — *Chapel Hill, NC* — *Aug 2021 – May 2026*
- Advisor: Dr. Vladas Pipiras (Qualification Exam: Probability theory, Statistical theory)
- *Cambanis-Hoeffding-Nicholson Award* ↗ for outstanding academic performance in first-year doctoral program.
- *Korean Government Scholarship for Overseas Study ($80K)*: 5 students in Intelligent Infrastructure selected nationwide.

Seoul National University (SNU) | M.S. in Statistics — *Seoul, South Korea* — *Mar 2019 – Feb 2021*
- Advisor: Dr. Hee-Seok Oh

Seoul National University (SNU) | B.S. in Statistics, Minored in Computer Science and Engineering — *Mar 2015 – Feb 2019*
- *The Presidential Science Scholarship (Tuitions and incentives)*: 24 students in the Mathematics field selected nationwide.

Work Experience

Moloco | Software Engineer Research Intern | Seattle, WA — May 2023 – Aug 2023
- Extracted large-scale ML model data using **SQL**. Run simulation, draw inference, and visualize data using **Python**.
- Researched on *exploration strategies and distribution shifts* for real-time bidding price prediction for digital ads (link ↗).

Lawrence Livermore National Laboratory | NSF Mathematical Sciences Graduate Intern | remote — May 2022 – Jul 2022
- Contributed to *libROM* ↗, a lightweight, scalable **C++** library for data-driven **physics simulation** ([1], [3]) — Livermore, CA
- Worked on hyper-reduction sampling for nonlinear dynamical (e.g., diffusion, hyperelasticity, hydrodynamics) problems.

Research Experience

Modeling physical phenomena (UNC)
- **Statistical methodologies in multi-fidelity system** [2,3,5,6]: Developed importance sampling for extremes [3] and semi-supervised estimation methods [2] for naval ship motion simulations (while treating the codes as black-box models) to estimate the **probability density function** of limited high-fidelity data by leveraging surrogate model outputs. Tools: **R**.
- **Physical AI, spatio-temporal modeling in latent space** [4]: Physics-informed neural networks (PINNs) to approximate PDE solutions. Modeled latent-state dynamics with neural ODEs, employed *implicit neural representation* as a **decoder** and applied insights from 3D graphics to impose boundary conditions. Tools: **PyTorch** and **Python**, **HPC**, **GPU clusters**.

Spatio-temporal Modeling in Latent Space, Time-series Analysis (SNU)
- **Spatio-temporal analysis of particular matter**: Forecasting, missing data imputation, and quantile analysis ↗ using dynamic factor model and the EM algorithm. Latent states were modeled with linear projection and vector autoregressive model.
- **Multi-scale time-series clustering** [7]: Applied to large-scale step count data from wearable devices and COVID-19 data.

Course Projects (UNC) / Undergraduate Research Intern (SNU)
- Generative diffusion models ↗ for Advanced Machine Learning, Talk ↗ for High-Dimensional Time-Series class. (UNC)
- **MRI Stroke Lesion Segmentation**: Used **ensemble** of MLP and U-Net architecture via **Keras** and **Python**. (SNU)

Teaching Experience

Instructor UNC: STOR 155 Introduction to Data Models and Inference (24F), Qualification Exam Mentor (23Sp)

Teaching Assistant UNC: Introduction to Deep Learning (22Sp, Led labs on **SVM, CNN, LSTM, VAE, GAN**, etc), Methods of Data Analysis (22Sp, 21F), SNU: Sampling Design and Survey (20F), Design and Analysis of Experiments (20Sp), Lab (20Sp, 19F)

Publications

[1] S. Cheung et al., 'Survey on quadrature point selection in hyper-reduced order models for finite element methods' (In prep).

[2] M. Kim, B. Brown, V. Pipiras, 'Parametric multi-fidelity Monte Carlo estimation with applications to extremes' ↗, submitted to *Technometrics*.

[3] M. Kim, K. O'Connor, V. Pipiras, T. Sapsis, (2025), 'Sampling low-fidelity outputs for estimation of high-fidelity density and its tails' ↗, *SIAM/ASA Journal on Uncertainty Quantification*. keywords: kernel density estimation, importance sampling, extreme value theory

[4] M. Kim, T. Wen, K. Lee, Y. Choi, (2024), 'Physics-informed reduced order model with conditional neural fields' ↗, *NeurIPS 2024 Workshop on Machine Learning and the Physical Sciences*. keywords: implicit neural representation, physics-informed neural network, autoencoder

[5] M. Kim, V. Pipiras, T. Sapsis. (2024), 'Statistical Reduced-Order Modeling of Peaks of Vertical Bending Moment in Irregular Waves', *Proceedings of the 35th Symposium on Naval Hydrodynamics (SNH)*, Nates, France.

[6] M. Kim, V. Pipiras, A. Reed, K. Weems, (2023), 'Calibration of low-fidelity ship motion programs through regressions of high-fidelity forces' ↗, *Ocean Engineering* 290, 116321.

[7] M. Kim, H. Oh, and Y. Lim, (2023), 'Zero-Inflated Time-Series Clustering Via Ensemble Thick-Pen Transform' ↗, *Journal of Classification* 40.

Technologies

Programming and Tools: Python, C++, Julia, R, SQL, Git, Bash, slurm, CUDA.   **Machine Learning:** PyTorch, TensorFlow, dplyr, NumPy, ggplot2.