Minji Kim

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Summary

• Multidisciplinary researcher ("investigator") with expertise in statistical modeling and data-driven simulations. • Proven track record of delivering scalable solutions for high-impact challenges and actively 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 2022 – Aug 2022
- Extracted bidding price data using **SQL** and ran simulation, drew inference, and visualized data using **Python**.
- Researched on *exploration strategies and distribution shifts* for real-time bidding price prediction for online ads (link).

Lawrence Livermore National Laboratory | NSF Mathematical Sciences Graduate Intern | remote May 2021 – Jul 2021
- Contributed to *libROM*, a lightweight, scalable **C++** library for nonlinear dynamical problems. ([1], [3]) Livermore, CA
- Worked on sampling nodes in data-driven **physics simulation** with MPI-based parallel computing and **HPC clusters**.

Research Experience

Statistical Machine Learning and Methodologies
- **Uncertainty quantification in multi-fidelity system** [3–6] (UNC, 21-24) **Probability density estimation** of high-fidelity (expensive) outputs by leveraging (cheap) surrogate models through (i) nonparametric kernel density estimation with *importance sampling* [4] and (ii) a parametric ensemble estimator approach [3], optimized for uncertainty reduction. Simulations via **R**.

Spatio-temporal Modeling in Latent Space, Time-series Analysis
- **Physics-informed neural networks (PINNs)** [2] (UNC, '24) Developed physics-informed reduced-order modeling to approximate PDE solutions. Latent-state dynamics were modeled with neural ODEs. Used *implicit neural representation* as a **decoder** and applied insights from 3D graphics to impose boundary conditions. AI research with **PyTorch** and **Python**.
- **Spatio-temporal analysis of particular matter** (SNU, '21) Applied dynamic factor model and the EM algorithm for forecasting, missing data imputation, and quantile analysis. Latent state modeling with linear projection and time-series model.
- **Multi-scale time-series clustering** [7] (SNU, 19–20) applied to step count data from wearable devices and COVID-19 data.

Course Project / Undergraduate Research
- Generative diffusion models (UNC '23) for Advanced Machine Learning class project
- **MRI Stroke Lesion Segmentation** (SNU, '18) Used **ensemble** of FCN and **U-Net** architecture via **Keras** and **Python**.

Teaching Experience

Instructor UNC: STOR 155 Introduction to Data Models and Inference (24F)

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**, 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**

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

[4] **M. Kim**, K. O'Connor, V. Pipiras, T. Sapsis, (2024+), '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**

[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.