

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

Ph.D. in Statistics and Operations Research , University of North Carolina at Chapel Hill (UNC)	Chapel Hill, NC
• Advisor: Dr. Vlasdas Pipiras	Aug 2021 – May 2026
M.S. in Statistics , Seoul National University (SNU)	Seoul, South Korea
• Advisor: Dr. Hee-Seok Oh	Mar 2019 – Feb 2021
B.S. in Statistics, Minored in Computer Science and Engineering , Seoul National University (SNU)	Mar 2015 – Feb 2019

Research Experience

Statistical Machine Learning and Methodologies

- **Uncertainty Quantification in Multi-fidelity system** [2, 4, 5, 6] (UNC) **Probability density estimation** of high-fidelity (random) outputs by leveraging (lower-cost) surrogate models through (i) nonparametric kernel density estimation with **importance sampling** [4] and (ii) a parametric ensemble estimator approach [2], both optimized for uncertainty reduction. Simulations with R.

Spatio-temporal modeling in latent space, time-series analysis

- **Physics-informed Neural Networks** [3] (UNC) Developed physics-informed reduced-order modeling for approximating (spatio-temporal) PDE solutions. Latent state dynamics were modeled with Neural ODEs. Used **implicit neural representation** to encode/decode the space and apply insights from 3D graphics to impose boundary conditions. AI research with **PyTorch** and **Python**.
- **Spatio-temporal analysis of particular matter** (SNU) Applied dynamic factor model and the EM algorithm for forecasting and missing data imputation. Latent state dynamics were modeled with time-series model and a linear subspace projection.

Work Experience

Moloco Software Engineer Research Intern Seattle, WA	May 2022 – Aug 2022
• Extracted bidding price data using SQL and ran simulation, drew inference, tested hypotheses, and visualized data using Python .	
• Researched on reinforcement learning and distribution shifts for real-time bidding price prediction for online ads (link).	
Lawrence Livermore National Laboratory NSF Mathematical Sciences Graduate Intern remote ([1], [3])	Livermore, CA
• Contributed to libROM , a lightweight, scalable C++ library for nonlinear dynamical problems.	May 2021 – Jul 2021
• Worked on sampling nodes in data-driven large-scale physics simulation with MPI-based parallel computing and HPC clusters .	

Selected Honors and Awards

- **Cambanis-Hoeffding-Nicholson Award (2022)** UNC, for outstanding academic performance in first-year doctoral program.
- **NSF Mathematical Sciences Graduate Internship (2022)** Oak Ridge Institute for Science and Education.
- **Korean Government Scholarship for Overseas Study (2021, \$80,000)** Korean Government, 5 students in the Intelligent Infrastructure field selected nationwide for a doctoral study abroad program.
- **The Presidential Science Scholarship (2015, Tuitions and incentives)** Top national scholarship for outstanding STEM students.

Teaching Experience

Instructor: STOR 155 Introduction to Data Models and Inference (24F, UNC)
Teaching Assistant: Introduction to Deep Learning (22Sp, UNC, Led labs on SVM, CNN, LSTM, VAE, GAN , etc), Methods of Data Analysis (22Sp, 21F, UNC), Sampling Design and Survey (20F, SNU), Design and Analysis of Experiments (20Sp, SNU), Lab (20Sp, 19F, SNU)

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**, 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, neural ODE, Autoencoder
- [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* (to appear). **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)*, Nantes, 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**, 407–431. **keywords:** 1440-dimensional step count data from wearable device, COVID-19 data

Technologies

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