

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 (UNCCH)	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

- **Multi-fidelity modeling** [2, 4, 5, 6] (UNCCH) Addressed the **probability density estimation** of high-fidelity (random) outputs by leveraging low-fidelity (lower-cost) outputs through (i) nonparametric kernel density estimation with importance sampling [4] and (ii) a parametric ensemble estimator approach [2], optimizing for uncertainty reduction. Performed simulations using **R**.

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

- **Physics-informed Neural Networks** [3] (UNCCH) Developed physics-informed reduced-order modeling for approximating (spatio-temporal) PDE solutions. Latent state dynamics were modeled with Neural ODEs. Used coordinate-based NNs to encode/decode the space and apply insights from 3D graphics to impose boundary conditions. AI research using **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
• Extracted and analyzed large-scale ML model data using SQL to simulate and infer outcomes.	May 2022 – Aug 2022
• Researched on reinforcement learning and distribution shifts for real-time bidding price prediction for online ads (link).	
Lawrence Livermore National Laboratory (LLNL) , NSF Mathematical Sciences Graduate Intern ([1], [3])	remote, Livermore, CA
• Contributed to libROM , a lightweight, scalable C++ library for nonlinear dynamical problems.	May 2021 – Jul 2021
• Gained hands-on experience in data-driven large-scale physics simulation with MPI-based parallel computing and HPC clusters .	

Selected Honors and Awards

- **Cambanis-Hoeffding-Nicholson Award (2022)** UNCCH, for outstanding academic performance in first-year doctoral program.
- **NSF Mathematical Sciences Graduate Internship (2022, \$12,000)** 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 (2024F, UNCCH)
Teaching Assistant: Introduction to Deep Learning (2022Sp, UNCCH), Methods of Data Analysis (2022Sp, 2021F, UNCCH), Sampling Design and Survey (2020F, SNU), Design and Analysis of Experiments (2020Sp, SNU), Lab (2020Sp, 2019F, SNU)

Technologies

Languages: Julia, R, Python, C++, C, Java, SQL. **Development Tools:** Git, Linux, Bash, LaTeX, slurm, CUDA.
Machine Learning: PyTorch, TensorFlow, scikit-learn, glmnet. **Data Analysis:** dplyr, NumPy, ggplot2, Matplotlib, Seaborn.

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
- [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.