Yiming Fan

Email: yif319@lehigh.edu Tel: (+1) 484-510-3996 LinkedIn: www.linkedin.com/in/yimingffff

I'm a PhD candidate in Applied Mathematics with research focus on numerical methods, uncertainty quantification, machine learning and deep learning. I'm looking for a challenging position where I can leverage my strong background in academia to provide data-driven insights towards advanced products and business decision making.

Education

PhD Candidate in Applied Mathematics (qualifying exams passed) Aug 2019 - Present
Department of Mathematics, Lehigh University

Bachelor of Science in Mathematics Sep 2015 - Jul 2019
School of Mathematical Science, University of Science and Technology of China (USTC)
Thesis: Robust Analysis of Trimmed Estimator for High-Dimensional Covariance Matrix

Minor in Business and Management Feb 2017 - Jan 2019
School of Management, University of Science and Technology of China (USTC)

Awards

- 2023 CAS Graduate Student Research Prize (1st in STEM fields) 2023
- NSF Math Sciences Graduate Internship Fellowship 2021, 2022
- USNCCM16 Conference Award 2021
- Dr. Hyo Sang Lee Graduate Fellowship 2019-2022
- Honorable Mention of COMAP's Mathematical Contest in Modeling (30%) 2018
- Guanghua Education Scholarship (2/120) 2017, 2018
- Outstanding Student Scholarship (30%) 2015, 2016

Professional Skills

Skilled in **Python, MATLAB, C++, R;** Proficient in Microsoft Office, C, Mathematica, SQL, LAMMPS, NEOS, Origin.

Research Experiences

Research Assistant **Lehigh University** Apr 2023 - Present
Advisor: Associate Professor **Yue Yu**, Department of Mathematics, **Lehigh University**

- Designed a divergence-free neural operator learning algorithm while preserving its invariant properties.
- Implemented the differential-form neural operators in Python which handles the derivatives for unstructured mesh.
- Trained the neural network through parameter tuning.

This work has been submitted to International Conference of Learning Representations (ICLR) 2024.

Mathematical Science Graduate Internship **Sandia National Labs** Jun 2021 - Present
Mentor: Dr. Mart D'Elia, **Sandia National Labs, CA**; and Dr. Habib Najm, **Sandia National Labs, CA**

- Designed a two-phase learning algorithm for uncertainty quantification in material response when using nonlocal models, enabling UQ in nonlocal model predictions. Implement the proposed algorithm in Python and MATLAB
- Generated 5,000 effective samples for both the periodic and disordered cases, numerically verified the group velocity and made predictions for different wave types.
- Conducted literature research on embedded model and multi-level MCMC. Implemented several embedded-error models in Python, test the feasibility of the implementations.

Research Assistant **Lehigh University** Aug 2020 - Aug 2022
Advisor: Associate Professor **Yue Yu**, Department of Mathematics, **Lehigh University**

- Designed an asymptotically compatible meshfree algorithm that could solve nonlocal diffusion problems, and a meshfree peridynamics model for brittle fractures in random heterogeneous materials.
- Developed solvers in C++ which could manage 2D in physical space and high dimension in parametric space.
- Derived the spatial and parametric convergence properties through the numerical simulation.
- Conducted numerical simulation for glass-ceramics material with different crystal volume fraction by applying the proposed algorithm and generated the crack pattern and the fracture toughness.

Research Assistant **University of Michigan – Ann Arbor** Jul 2018 - Mar 2019
Advisor: Research Assistant Professor **Kevin He**, Department of Biostatistics, **University of Michigan – Ann Arbor**

- Proposed a data-adaptive gene-selection method to assign p-values for a group of variables (single nucleotide polymorphisms, SNP) to identify important genes and individual SNPs.
- Examined the gene-selection method, and modified and ran the R code for up to 24 settings; each setting considered a small gene (10 SNPs) and a large gene (100+ SNPs).
- Compared the performance and elapsed time of different methods on real-world data to analyze their weakness.

Undergraduate research assistant **University of Science and Technology of China** Mar 2018 - May 2019
Advisor: Associate Professor **Xiao Guo**, Department of Statistics & Finance, **USTC**

- Wrote R codes to calculate the average losses and standard deviation for 3 types of estimator matrices, considering hard thresholding and adaptive Lasso thresholding. Build a simple 2-folded cross validation function in R.
- Theoretically calculated the breakdown point of an estimator then validated it with numerical simulations.

Publications

1. **Fan, Y.**, You, H., & Yu, Y. (2022). OBMeshfree: An optimization-based meshfree solver for nonlocal diffusion and peridynamics models. *arXiv preprint arXiv:2211.14953*. (to appear *on Journal of Peridynamics and Nonlocal Modeling*)
2. **Fan, Y.**, D'Elia, M., Yu, Y., Najm, H. N., & Silling, S. (2022). Bayesian Nonlocal Operator Regression (BNOR): A Data-Driven Learning Framework of Nonlocal Models with Uncertainty Quantification. *arXiv preprint arXiv:2211.01330*. (to appear on *ASCE's Journal of Engineering Mechanics*)
3. **Fan, Y.**, You, H., Tian, X., Yang, X., Li, X., Prakash, N., & Yu, Y. (2022). A meshfree peridynamic model for brittle fracture in randomly heterogeneous materials. *Computer Methods in Applied Mechanics and Engineering*, *399*, 115340.
4. **Fan, Y.**, Tian, X., Yang, X., Li, X., Webster, C., & Yu, Y. (2022). An asymptotically compatible probabilistic collocation method for randomly heterogeneous nonlocal problems. *Journal of Computational Physics*, *465*, 111376.

Conference Presentations

1. Bayesian Nonlocal Operator Regression (BNOR): A Data-Driven Learning Framework of Nonlocal Models with Uncertainty Quantification. SIAM Conference on Mathematics in Data Science (SIAMMDS22), Oct, 2022.
2. Bayesian Nonlocal Operator Regression (BNOR): Towards the Characterization of Uncertainty in Heterogeneous Materials. NSF Mathematical Sciences Summer Research Symposium, Aug, 2022.
3. Bayesian Nonlocal Operator Regression (BNOR): Towards the Characterization of Uncertainty in Heterogeneous Materials. SIAM Conference on Uncertainty Quantification (SIAMUQ22), Apr, 2022.
4. An asymptotically compatible meshfree quadrature rule for nonlocal problems. Nonlocal Code Event, Dec, 2021.
5. Nonlocal Operator Learning with Uncertainty Quantification. NSF Mathematical Sciences Summer Research Presentations, Aug, 2021.
6. An asymptotically compatible probabilistic collocation method for randomly heterogeneous nonlocal problems. Minisymposium on Multiscale Methods and Data-Driven Models, 16th U.S. National Congress on Computational Mechanics (USNCCM16), Jul, 2021.

Selected Coursework

• Numerical Methods • Statistical Machine Learning • Deep Learning • Optimization Methods in Machine Learning • Probability Theory • Stochastic Process • Regression Analysis • Data Structure (C/C++) and Database (SQL) • Stochastic Calculus • Multivariate Analysis • Numerical Analysis of PDE • Real Analysis • Functional Analysis • Mathematical Analysis • Linear Algebra • Introduction to Algorithm

Teaching Experience

Graduate Teaching Assistant, Lehigh University, Bethlehem, Pennsylvania, United States
Course: Calculus 1 (MATH-021), 2022 Fall and 2023 Fall.
Undergraduate Teaching Assistant, University of Science and Technology of China (USTC), Hefei, Anhui, China
Course: Mathematics Analysis A1, 2018 Fall; Regression Analysis, 2019 Spring.

Leadership & Activities

White Room the band | Band Founder & Leader — Mar 2022 - present
Pop Music Association, USTC| *Vice President* — Sep 2016 - Jul 2017
Student Union of the School of Mathematics, USTC | *Vice Secretary* — May 2016 - Jul 2017
Science and Technology Week |*Volunteer* — May 2016 & May 2017
Chinese Higher Education Development Network (CHED) | *Volunteer* — Oct 2016