YAN HUANG

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RESEARCH INTERESTS

Numerical Analysis, Scientific Computing, Applied Mathematics, Scientific Machine Learning

EDUCATION

Southern University of Science and Technology (SUSTech) Shenzhen, China
B.S. Mathematics and Applied Mathematics (Honors Program) Expected Jun. 2023
GPA: 3.80/4 (90.92/100), Ranking: 7/47

SELECTED COURSES

- **Undergraduate Courses**: Mathematical Analysis I-III, Complex Analysis, Real Analysis, Functional Analysis, ODE, PDE, Advanced Linear Algebra I-II, Abstract Algebra, Elementary Number Theory, Topology, Differential Geometry, Probability Theory, Applied Stochastic Processes, Mathematical Statistics, Operations Research, Numerical Analysis, Numerical Solution of PDEs, Introduction to Theoretical and Practical Data Science
- **Graduate Courses**: Algorithms for Convex Optimization, Methods of Applied Math, Advanced Probability, PDE I, PDE II, Advanced Functional Analysis, Computational Fluids Dynamics and Deep Learning

SCHOLARSHIPS & AWARDS

- SUSTech Second Class of the Merit Student Scholarship Nov. 2022
- First Class Award of the 13^{th} National College Students Mathematics Competition (Guangdong) Dec. 2021
- SUSTech Second Class of the Merit Student Scholarship Nov. 2021
- SUSTech Third Class of the Merit Student Scholarship Nov. 2020
- SUSTech Third Class of the Freshman Scholarship Nov. 2019

SKILLS

- **Computer**: MATLAB, Python, PyTorch, Java, LaTeX
- **Language**: Chinese (native), TOEFL (Reading 28, Listening 25, Writing 23, Speaking 23)

ACADEMIC EXPERIENCE

Micro-Macro Decomposition Based Deep Learning Approach for Discrete-velocity Kinetic Equations
Dec. 2022 - Present

- Undergraduate thesis advised by Prof. Zhen Zhang at SUSTech and Prof. Tao Xiong at Xiamen University.
- Based on micro-macro decomposition in kinetic theory, combine high-resolution schemes and neural networks to solve discrete-velocity kinetic equations. Expect a better performance than the existing APNN method.

Acceleration of Variable Frequency Fourier Transform Jul. 2022 - Present

- Worked with Prof. Zhen Zhang at SUSTech on a research project on the acceleration of a computing problem. Completed the acceleration of variable frequency Fourier transform part.
- Accomplished partial theoretical deduction and implemented the acceleration algorithm with MATLAB and Python. Currently works on accelerating other parts.

Regarding Neural Networks as Gaussian Processes Jun. 2022

- Studied the connection between infinitely wide neural networks and Gaussian processes and completed a literature review as a course project for *Applied Stochastic Processes*.

Numerical Solution of Allen-Cahn Equation May. 2022

- Wrote a MATLAB program to solve the Allen-Cahn equation subject to periodic boundary conditions and the random initial values by semi-implicit Euler method with a stabilized term as a course project for *Numerical Solution of PDEs*.

Diagnosing and Forecasting PM2.5 Pollutant Levels in Beijing May. 2022

- Wrote a Python program to diagnose and forecast PM2.5 pollutant levels in Beijing as a course project for *Introduction to Theoretical and Practical Data Science*.
- Preprocessed the hourly data between 2010 to 2014, used a machine learning algorithm (XGBoost) to fit the training data, and achieved $R^2 = 0.71$ on the test data; made feature selection and dimensionality reduction; classified the PM2.5 data into three classes. Completed a 50-page slide and successfully passed the defense.

Data-driven Scientific Computing Feb. 2022

- Studied literature *PINN*, *DeepRitz*, *DeepONet*, *FNO*, and *SINDy*.

Prediction of Decomposition Rates and Interspecific Interactions of Fungi Feb. 2021

- Built mathematical models and wrote a MATLAB program to quantify the decomposition rates and the interspecific interactions of fungi in various environments.
- Used the Lotka-Volterra model to quantify the fungal interspecific interactions on their hyphal length in various environments; found that increasing biodiversity in the tropical rainforest can double the decomposition rate after four days. Entered the Mathematical Contest in Modeling and completed a 21-page paper.

Checkers Programming Project Jun. 2020

- Wrote a Java program to implement the checkers game as a course project for *Introduction to Computer Programming A*
- The game supports multiplayer and man-machine games. We archived game progresses, enabled built-in sound effects and other features, and designed and implemented a GUI for visualization. Presented a 10-page slide report and successfully passed the defense.

SEMINARS ATTENDED

Neural Differential Equations Mar. - May. 2022

- Studied Patrick Kidger's doctoral thesis *On Neural Differential Equations* and other relevant publications.
- Presented and led the discussion on Numerical Solvers for Neural Differential Equations; studied ResNet, VAE, Variational Inference, GAN, W-GAN, Neural ODE, and Neural SDE.

Machine Learning Jul. - Aug. 2021

- Studied Trevor Hastie et al.'s book *The Element of Statistical Learning* and Shai Shalev-Shwartz et al.'s book *Understanding Machine Learning*.
- Presented and led the discussion on Ridge Regression and Lasso; studied Probably Approximately Correct (PAC) learning covering VC-dimension, Rademacher Complexity, and convergence analysis of classical machine learning algorithms.

Fourier Analysis Jul. 2021

- Studied Elias M. Stein et al.'s book *Fourier Analysis*.
- Presented and led the discussion on the Convergence of Fourier Series and Fourier Transforms of d-dimensional Euclidean Spaces.

TEACHING EXPERIENCE

Department of Mathematics, SUSTech

- Teaching Assistant, MA327 Differential Geometry Spring 2022