Mingyu Yu

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Education

University of California, Berkeley Aug 2022 – May 2024 (Expected)
B.A. (Hons) Applied Mathematics; GPA: 3.83/4.00 *Berkeley, CA*
Senior Thesis: A numerical self-similar study of singularity formation of the slender-jet model

University of California, San Diego Sept 2020 – June 2022
Transferred to UC Berkeley *La Jolla, CA*

Research Experience

Summer Undergraduate Research Fellowships (Research in numerical PDEs) May 2023 – Present
Mentor: Federico Pasqualotto *UC Berkeley*

- Studied the self-similar approach and implemented basic numerical methods for partial differential equations and conservation laws in MATLAB
- Performed numerical simulations for the slender-jet model and conducted dimensional analysis for the self-similar scheme in the slender-jet model
- Implementing a numerical simulation of the slender-jet model around the singularity formation using the self-similar scheme

Faculty Mentor Program (Research in combinatorics) Jan 2022 – Present
Mentor: Reuven Hodges *Remote & UC San Diego*

- Studied combinatorial Coxeter theories and the pattern avoidance criterion for maximal sphericality in type A_n Coxeter groups (symmetric groups)
- Conjectured that maximal sphericality of Schubert varieties indexed by the elements in type B_n Coxeter groups can be characterized by its associated pattern avoidance criterion
- Implemented algorithms in SageMath to provide heuristic evidence for the above conjecture
- Proving the above conjecture by introducing the notion of divisible pairs for signed permutations and partitioning the patterns to be avoided in the criterion

Academic Service

Supplemental Instruction Leader July 2021 – June 2022
University of California, San Diego *La Jolla, CA*

- Directed four one-hour discussion sessions in Math 20C (Calculus & Analytic Geometry For Science & Engineering) every week, with about 20 students in each session
- Attended various training workshops and completed session plans to improve the quality of sessions
- Created a thriving environment during sessions to promote diversity, equity, and inclusion

Projects

Tikhonov regularization and the L-curve (MATLAB) Fall 2023
Course project for MATH 221 (Advanced Matrix Computations) at UC Berkeley

- Studied the Tikhonov regularization and the L-curve model for numerically solving the ill-posed problem $\min \|Ax - b\|$ by selecting the best regularization parameter for the problem
- Explored the potential applications of the L-curve model in the settings of machine learning and partial differential equations in Newtonian mechanics

Numerical fluid dynamics with deep neural network (Python, TensorFlow) Fall 2023

Course project for MATH 154/254 (Modern Statistical Prediction and Machine Learning) at UC Berkeley

- Studied the physics-informed neural network and the hidden physics models with implementations
- Applied the above networks to the examples in fluid dynamics to achieve simulations with high accuracy

Circulant matrices and fast Fourier transforms (MATLAB) Spring 2023

Course project for MATH 128B (Numerical Analysis 2) at UC Berkeley

- Developed an $O(N \log N)$ algorithm for performing `matvec` via circulant matrices by applying the fast Fourier transform algorithm to circulant matrices
- Applied the above `matvec` algorithm to solve discretized 1-dimensional Schrödinger equation with zero potential based on the finite difference on the Laplacian

Modified `zero-in` method for root-finding (MATLAB) Fall 2022

Course project for MATH 128A (Numerical Analysis 1) at UC Berkeley

- Presented a modified root-finding algorithm with a combination of bisection method and inverse quadratic interpolation (IQI) method
- Improved the root-bracketing procedure to decrease the function calls and improve the method's efficiency

Huffman encoding (C++) Spring 2022

Course project for CSE 100 (Advanced Data Structures) at UC San Diego

- Constructed the Huffman encoding and decoding scripts based on the method of serialization to achieve lossless compression with high performance

Technical Skills

Programming Skills: Python, Java, R/RStudio, C/C++, MATLAB