Yuan Gao

+86 15921171270
Seattle, WA, USA

ivan.y.gao@outlook.com
https://amath.washington.edu/people/yuan-gao

EDUCATION

Master of Science in Applied and Computational Mathematics — **Sept. 2024 - Expected: May 2025**
University of Washington (UW) — Seattle, WA, USA

Bachelor of Science, Major in Mathematics, Minor in Statistics (with distinction) — **Sept. 2019 - May 2024**
The University of British Columbia (UBC) — Vancouver, BC, Canada

RESEARCH EXPERIENCE

Undergraduate Research Experience Program (URO REX) Math Bio Group, UBC — **Nov. 2023 - Feb. 2024**

- Investigate on how various Influenza A virus (IAV) receptor organizations influence its mobility under the presence of antibody.
- Implement a Julia-based simulation of filamentous IAV dynamics with periodic boundary conditions and restricted random movement.
- Write a comprehensive report along with a demonstration poster which has been used to present at the Multidisciplinary Undergraduate Research Conference (MURC) at the University of British Columbia.
- Won first prize in the poster presentation at UBC MURC 2024 REX Awards (URO).

SKILLS

Languages: Chinese (Native), English (Fluent).
Mathematics Courses: Calculus, Linear Algebra, Number Theory, Coding Theory, Linear Programming, Discrete Math, Complex Analysis, ODE, PDE, Asymptotic and Perturbation Methods, Numerical Solutions for DE, Dynamical Systems, Advanced Stochastic Processes.
Statistics Courses: Probability, Statistical Inference, Data Relationships, Statistical Learning, Time Series and Forecasting.
Computer Courses: Algorithms, Data Structures, Software Construction.
Machine Learning Kits: PyTorch, scikit-learn, NumPy.
Algorithms: Cross-validation, PCA, Ridge Regression, k-NN, k-means, LDA, SVM, Random Forest, Fully Connected Networks (FCN), Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Long Short-Term Memory (LSTM), Gated Recurrent Units (GRU).
HPC: OpenCL, OpenMP, Slurm.
Programming Languages: Python, C++, Julia, Shell, LaTeX, Markdown, JavaScript, R, Java, Lua, CMake, Dockerfile, GDScript.
Tools and Software: Git, Jupyter Lab, Docker, VS Code, RStudio.

PROJECT

Convolutional Neural Network for FashionMNIST Dataset Classification — **Jan. 2025 - Mar. 2025**
AMATH 582 Project

- Implemented a Convolutional Neural Network (CNN) and a Fully Connected Neural Network (FCN) using PyTorch with ReLU activation, Cross-Entropy loss, and Stochastic Gradient Descent (SGD) optimizer. Trained the model on a GPU using CUDA for 50 epochs, tuning the learning rate as a hyperparameter. Evaluated the model on training, validation, and test sets.
- Conducted hyperparameter tuning with various kernel sizes, pooling strategies, and optimizers (RMSProp, Adam, SGD) with different learning rates. Experimented with regularization techniques (dropout) and various weight initializations (Random Normal, Xavier Normal, and Kaiming Uniform). Incorporated Batch Normalization to improve model performance.
- Achieved an accuracy of 0.91 on the FashionMNIST dataset and 0.98 on the MNIST dataset, with 2 minutes of training on a GPU.

D2Q9FluidSimulation — **Sept. 2021 - Present**
Project Owner and Lead Developer:

- Developed a high-performance fluid dynamics simulation framework based on the D2Q9 Lattice Boltzmann Method using C++ and Julia.
- Conducted a self-directed study of the fundamental theory of the Lattice Boltzmann Method, utilizing the book *Lattice Boltzmann Method - Fundamentals and Engineering Applications with Computer Codes* by A. A. Mohamad.
- Applied rigorous code quality and performance metrics, using testing tools such as gTest, gBenchmark, and gcovr to ensure the framework's robustness and scalability.
- Utilized the OpenCL framework for parallel computation, achieving the capability to process a 5k x 5k grid in 10 seconds on an Intel UHD 620 chip.
- Employed technologies including C++17 and QT 6.5.0 for cross-platform support on Windows 10 and Linux. Leveraged tools such as CMake, Doxygen, and Pandoc for generating Game Design Documents and project management-related files, as well as Valgrind.

Modelling Aspirin's Effect on Colorectal Cancer Initiation — Sept. 2024 - Dec. 2024
AMATH 522 Group Project
- Replicated the results of Yifan Wang et al.'s paper, *Aspirin's Effect on Kinetic Parameters of Cells Contributes to its Role in Reducing Incidence of Advanced Colorectal Adenomas, Shown by a Multiscale Computational Study*.
- Performing sensitivity analysis on a nonlinear system of ODEs to investigate factors that influence the development of colorectal cancer the most.
- Delivered two presentations and one final study report essay.

Investigation of the Average Wine Quality in Portugal — Sept. 2022 - Dec. 2022
STAT 344 Group Project - Project Initiator and Lead Data Analyst
- Initiated the project and organized all group meetings. Setting timelines and milestones to drive project progress.
- Calculated the required sample size in alignment with a predefined margin of error to ensure the representativeness and accuracy of the study.
- Explored and compared different sampling methods, including stratified and cluster sampling, evaluating their accuracy and applicability for the study.
- Applied selected sampling techniques to real-world data related to the quality of Portuguese wine, effectively representing the quality distribution and contributing to our understanding of the factors that influence it.

Exploration of Factors that Influence the Final Sale Price of One-Family Dwellings in the City of Vancouver Between 2016-2019
STAT 306 Group Project - Project Initiator and Lead Data Analyst — Jul. 2022 - Aug. 2022
- Monitored the project, organizing all group meetings, establishing timelines, and setting milestones to drive the project's progress.
- Executed rigorous data cleaning using mean imputation methods and calculated the sample size, ensuring robustness by accounting for the margin of error.
- Performed data transformation using logarithms to address heteroscedasticity, ensuring more reliable statistical inferences.
- Utilized Mallows's Cp and stepwise variable selection for model selection and conducted collinearity tests to improve model accuracy.
- Trained the model using k-fold cross-validation and carried out model diagnostics with residual plots and normal qq plots. Collaborated on strategies for outlier removal to enhance model predictability.

ADDITIONAL TRAINING

Lattice Boltzmann Method - Self-Directed Study — Mar. 2023 - Aug. 2023
- Conducted a comprehensive study using the *Lattice Boltzmann Method: Fundamentals and Engineering Applications with Computer Codes* by A. A. Mohamad.
- Developed a D2Q9 library using C++/Julia, aimed at executing all textbook examples of Non-Isothermal Incompressible Fluid.
- Implemented a high-performance computation library for rapid simulation, specifically designed for 2D video game applications.

AWARDS

UBC MURC 2024 REX Awards (URO) - Poster Presentation First Place, UBC — Apr. 2024

SCHOLARSHIPS

Trek Excellence Scholarship (International Students), UBC — 2020 - 2021

HONOURS

Dean's List, UBC — Sept. 2020 - May 2021

COMMUNITY INVOLVEMENT AND OUTREACH

UBC Math Circle Workshops Mentor — Sep. 2023 - Dec. 2023
- Assisted in delivering hands-on mathematics workshops for 4th to 7th graders, fostering an environment of curiosity and exploration.
- Distributed, maintained, and organized group activity materials.
- Provided helpful hints and guided students to understand math concepts.

Imagine UBC 2023 Orientation Leader – Faculty of Science — Sep. 2023 - Oct. 2023
- Creating and maintaining a supportive and engaged community for approximately ten new-to-UBC students, fostering a sense of friendship and belonging while serving as an ambassador for student leadership within the Faculty of Science.
- Facilitated and assisted with the planning, organization, and delivery of the Imagine UBC orientation activities while ensuring effective and timely communication.
- Pursuing personal and professional growth by developing key competencies in areas such as communication, teamwork, problem-solving, initiative, and adaptability.
- Demonstrating a commitment to equity and inclusion, by respecting all people and their differences, providing referrals to campus resources, and participating in ongoing training related to these topics.