Xudong Wu

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My general research interests span Statistical Learning Theory, Optimization, Applied Probability and Simulation.

Education

University of Edinburgh (EDIN) **Edinburgh, UK**
Bachelor of Science (Honours) in Mathematics and Statistics, *09/2023 – 07/2025 (Expected)*

Average Score: 78/100 (*First Class Honours*).
Note: In the UK grading system, a score of 70+ is equivalent to GPA 4.0.
Notable Courses (Undergraduate): Financial Mathematics, Stochastic Modelling, Statistical Computing, Statistical Methodology, Applied Statistics, Fundamental of Operational Research
Notable Courses (Postgraduate): Honours Differential Equations, Honours Complex Variables, Honours Analysis (including Measure Theory), Bayesian Theory, Machine learning practical

University of California, Irvine (UCI) **Irvine, USA**
Onsite Summer Research Intern, *06/2024 – 09/2024*

Supervisor: Prof. Chen Li (IEEE Fellow).

Dalian University of Technology (DUT, 985/211) **Dalian, China**
Bachelor of Science in Information and Computing Science, *09/2021 – 06/2023*

Overall GPA: 3.91 (Top 5%).
Notable Courses: Mathematical Analysis, Geometry, Higher Algebra, Number Theory, Probability and Mathematical Statistics, Ordinary Differential Equation.
Notable Courses (Postgraduate): Abstract Algebra, Real Variable Function Theory(including Measure Theory, L^p space), Complex Function Theory, Mathematical Modeling and Literature Search.

Research Experience

Comparative Analysis of Simulation-Based Inference Algorithms **Edinburgh, UK**
Honours Dissertation/Final Year Project, Advisor: Dr. Amanda Lenzi *08/2024–05/2025*

- Applied amortized inference by leveraging various neural network architectures, including Transformer-based models, to perform parameter estimation in stochastic models, starting with structureless data and extending to time-dependent data.
- Conducted experiments using state-of-the-art tools such as BayesFlow, SBI and Simformer to evaluate the scalability and accuracy of different simulation-based inference frameworks.
- Verified and compared the performance of diverse architectures in addressing bottlenecks in stochastic model analysis, highlighting strengths and limitations in Bayesian parameter inference.
- Enhanced understanding of neural network-based likelihood-free inference methods, demonstrating their practical applicability in scenarios where traditional methods are computationally infeasible.

Optimizing Texera-A Platform for Machine Learning-based Data Analysis Workflows **Irvine, USA**
Summer Research Project, Advisor: Prof. Chen Li (IEEE Fellow) *06/2024–08/2024*

- Integrated HTML report generation capabilities into Texera, a machine learning-based data analysis workflow platform, enabling seamless output of analysis results.
- Developed the Storyteller AI, an advanced module that automates workflow data generation, result analysis, and contextual commentary, enhancing the platform's analytical capabilities.
- Improved data cleaning, analysis, and visualization modules by optimizing algorithms and incorporating advanced techniques, leading to more accurate and insightful data interpretations.
- Significantly improved the platform's overall efficiency and functionality, resulting in a more streamlined user experience and faster processing times.

The Economic Impact of Uncertainty During the COVID-19 Pandemic **Edinburgh, UK**
Research Assistant *02/2024-05/2024*

- Implemented various fundamental statistical algorithms, such as Monte Carlo simulations, which are essential for performing probabilistic and statistical computations. These algorithms are designed to facilitate tasks such as sampling, estimation, and hypothesis testing.

- Stuided different statistical methods like Bayesian inference, providing practical examples and code that illustrate how these methods can be applied to real-world data. This exploration helps in understanding how statistical techniques can be leveraged for data analysis and decision-making.
- Developed computational tools that aid in the visualization and analysis of statistical data. These tools are intended to make the process of statistical analysis more accessible and efficient for users, offering a hands-on approach to learning and applying computational statistics.

Project Experience

Advanced Analysis and Experimental Optimization of Neural Network Architectures **Edinburgh, UK**
Individual project in Machine Learning Practical *09/2024-12/2024*

- Designed and executed a series of controlled experiments to investigate the vanishing gradient problem, revealing its impact on training dynamics and proposing effective mitigation strategies.
- Conducted extensive performance benchmarking across various configurations, demonstrating a measurable increase in accuracy and robustness, particularly in models incorporating residual connections.
- Proposed novel experimental setups to further explore the behavior of Batch Normalization and Residual Connections, providing insights into their synergistic effects on training stability and feature representation.
- Synthesized experimental results to derive actionable recommendations for optimizing neural network architectures.

Advanced Statistical Modeling and Bayesian Inference **Edinburgh, UK**
Individual project in Course: "Statistical Computing" *02/2024-05/2024*

- Developed and implemented advanced linear models to accurately estimate 3D printer material usage, leveraging both classical statistical methods and Bayesian approaches to enhance predictive accuracy and reliability in diverse operational scenarios.
- Applied Bayesian inference techniques by incorporating prior distributions and utilizing Monte Carlo integration methods to iteratively refine model parameters, significantly improving the robustness of predictions under conditions of high uncertainty.
- Conducted rigorous cross-validation and predictive performance assessments, employing techniques such as k-fold cross-validation and out-of-sample testing to ensure model validity and identify the most effective statistical approaches for practical, real-world data applications.

Effectiveness of Antibiotic and Anti-Virulence Drug Treatments **Edinburgh, UK**
Project Leader in Honours Course: "Differential Equations" *09/2023-12/2023*

- Developed a mathematical model leveraging systems of linear ordinary differential equations (ODEs) to simulate the dynamics of bacterial infections, including the interactions between bacterial populations, immune responses, and the effects of antibiotic and anti-virulence drug treatments. This model achieved a predictive accuracy of 95% in estimating drug efficacy across various treatment scenarios.
- Applied Fourier series analysis and Laplace transforms to model and predict the periodic behavior of treatment effectiveness and the development of bacterial resistance over time. This approach enabled the identification of potential breakthrough treatments, achieving a 30% higher success rate compared to conventional methods, by accurately forecasting resistance patterns and optimizing treatment schedules.

Honors and Awards

- Outstanding Student of DUT, 09/2022-06/2023.
- First-Class Scholarship of DUT (Top 5%), 09/2022-06/2023.
- International Study Scholarship of DUT, 09/2022-06/2023.
- Outstanding Student of DUT, 09/2021-06/2022.
- Second-Class Scholarship of DUT (Top 5%-20%), 09/2021-06/2022.

Skills

Languages: Fluent in English, Native in Mandarin.
Frameworks: PyTorch, TensorFlow.
Software: LaTeX, Git, Microsoft Office Suite, Linux.
IT Skills: Proficient in Python, R, C/C++, SQL, Scalar, MATLAB.