Dexuan Hu

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Summary

I am a PhD candidate in mathematics, specializing in the foundations of mathematics. In addition to my primary research, I have a sustained interest in computer science and statistics. I am looking forward to joining a collaborative, research-driven environment and contributing to real-world impact.

Education

Cornell University, Ph.D. in Mathematics 2019 - 2025 (expected)
Advisor: Sławomir Solecki
Specialization: descriptive set theory and its connections to model theory and commutative algebra
Dissertation title: Polish modules, topological complexity, and singletons
GPA: 3.724/4.00 | **Computer science coursework:** advanced programming languages, analysis of algorithms, applied logic, machine learning, foundations of modern machine learning
Robert J. Bättig Graduate Prize for excellent papers and significant contributions

University of Oxford, MMath, Upper Second Class Honor (2:1) 2015 - 2019
Fourth year dissertation topic: Morley's Categoricity Theorem
Relevant coursework: probability, statistics, numerical analysis, measure theory, martingales, stochastic calculus, information theory
Lady Margaret Hall Scholarship for strong academic performance in mathematics

Work Experience

Machine Learning Intern (Game Operations Team), Tencent Games Jun 2018 - Aug 2018
- Built classification models in Python to analyze gameplay data from over 50,000 Path of Exile players, contributing $\sim 30\%$ of the codebase with a focus on model design and evaluation.
- Worked closely with the technical team on feature engineering, enabling accurate user profiling and supporting targeted player engagement strategies.

Selected Projects

Complexity of Lascar strong types, Cornell University Oct 2022 – present
- Proposed a new notion of complexity–called the zigzag relation–based on topology rather than classical Borel measurability, between K_σ-equivalence relations. Investigated the structure of zigzag among compact zero-dimensional Polish spaces.
- Refined the classification for Lascar strong types of complete countable theories and constructed new examples demonstrating strict separation of complexity.

Fast matrix multiplication research, Cornell University Oct 2020 - Dec 2020
- Explored fast matrix multiplication algorithms and their computational complexity using group-theoretic methods.
- Produced a joint expository paper with two co-authors on the above algorithm which improves the time complexity of matrix multiplication $O(n^\omega)$ from $\omega = 3$ to a number near 2.

Topological methods in ML with Python, University of Oxford Aug 2018 - Oct 2018
- Investigated persistent homology in Topological Data Analysis (TDA). Using Python library Gudhi, computed topological features of datasets, including real-world medical data and Scikit-learn-generated data.
- Validated the theoretical limitation of neural networks due to topological constraints by producing two-dimensional objects that are hard to classify.

Publications

Polish modules over subrings of $\mathbb{Q}$, *accepted, Israel Journal of Mathematics, 2024*, with S. Solecki. [arXiv:2210.07989]

Skills

Programming: Python (Pandas, NumPy, Scikit-learn, Gudhi, PyTorch), C, MATLAB
Tools: LaTeX