

# Dexuan Hu

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## Summary

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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

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**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. Böttig 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

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**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

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**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  $K_\sigma$ -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

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

## Skills

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

**Tools:** LaTeX