# Zhi Wang

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## Education

**University of Science and Technology of China, Hefei**     *B.S. in Mathematics*
**School of Gifted Young**
*Sept. 2021 - Expected Graduation: Jun. 2025*     *GPA: 3.78 / 4.3*

**Visiting student, University of California, Berkeley**     *Jan. 2023 - Dec. 2023*

## Research Interests

Learning theory, over-parameterized models, and feature learning. I'm also generally interested in optimization and computational neuroscience.

## Research Experience

### *Ehrhart Theory of Special Order Polytopes, June 2023 to Sept 2024*

- **Mentor:** *Andrés R. Vindas Meléndez, at UC Berkeley*
- Obtained closed formulas which serve as base cases for a recurrent formula, a combinatorial formula for general cases, and several monotonicity results.
- I found a lattice path coloring method that is central to most of the proofs, relating geometric objects and combinatorial enumerations.

### *Accelerating Grokking via Low-Rank Structures, April 2024 to ongoing*

- **Mentor:** *Difan Zou, at University of Hong Kong*
- Further explored the transition from NTK kernel regime to rich regime, and used low-rank structures to accelerate grokking in both MLPs and transformers, for various tasks.
- I designed and conducted most experiments under a PyTorch framework.

### *Non-normal connectivity and sequential activity generation, Sept 2024 to ongoing*

- **Mentor:** *Quan Wen, at University of Science and Technology of China*
- The goal is to obtain a principled understanding of how the brain generates sequential actions, by studying how the non-normal connectivity of RNNs contributes to the generation mechanism. Experimentally, and analyzing data from the organism *C. elegans*.

## Publications

1. Eon Lee, Andrés R. Vindas-Meléndez, and Zhi Wang, *Generalized Snake Posets, Order Polytopes, and Lattice-Point Enumeration*, 2024. Preprint.

## Projects

- (UC Berkeley Math Department) Directed Reading Program on game theory from a rigorous pure math point of view, with a final presentation to the mentors.

- Various projects either done for or started from classes:

  1. (C++, Python) Position based dynamics simulation and accompanying Manim expository video.
  2. (Java) Build Your Own World. Designed and implemented a 2D tile-based world exploration game from scratch, with a UI interface.
  3. (Matlab) Implementations of Image compression and Loop lifting wavelets algorithm.
  4. (Python) Machine learning models for movie recommendation systems. I collaborated with fellow students as a project leader.
  5. (Review Paper) *On Ehrhart Polynomial of Birkhoff Polytopes.* Literature review.
  6. (Python, Review Paper) *Numerical Methods for Differential Equations.* I investigated several ODE solvers and implemented basic ones in Python.

## Skills

- **Programming Languages:** Java, Python, C, C++, Lean.
- **Software and Tools:** Matlab, LaTeX
- **Languages:** Mandarin Chinese, English, French (B1), Spanish (A2).

## Volunteering and Seminars

- APEC 2023 volunteer, San Francisco; Berkeley AI Hackathon 2023 volunteer.
- AI for Mathematics: Formalization and Theorem Proving Seminar. Peking University BICMR, Jan 14th - 27th, 2024.