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Summary

Mathematics undergraduate at Cuiying Honors College (Top 5% Rank), Lanzhou University. My research bridges rigorous mathematics with modern deep learning, spanning AI for PDEs and Bioinformatics. Equipped with strong engineering proficiency, I am driven by a relentless passion for scientific discovery. I maintain a high-intensity schedule (60+ hours/week) and aspire to advance World Models and Embodied Intelligence in my future Ph.D. studies.

Education

- **Cuiying Honor College, Lanzhou University** — Lanzhou, China
  B.Sc. in Mathematics and Applied Mathematics; GPA: 4.02 / 5 — *2023 – Present*

Research Interests

World Models, AI for Science (Deep BSDE), Embodied AI, Bioinformatics

Research Experience

- **Deep BSDE Solver for Spherical PDEs in Biomolecular Dynamics** — Lanzhou, China
  Lead Researcher — *Feb 2025 – Present*
  - **Framework Design**: Proposed a neural network solver based on Backward Stochastic Differential Equations (BSDEs) to address high-dimensional Spherical Fokker-Planck and Feynman-Kac equations in biomolecular dynamics.
  - **Mathematical Derivation**: Derived stochastic formulations on spherical manifolds to resolve geometric singularity issues; validated the method's effectiveness via comparative analysis with Monte Carlo simulations.
  - **Model Optimization**: Integrated a Fourier Feature Mapping layer to mitigate the spectral bias of Multi-Layer Perceptrons (MLPs), effectively capturing high-frequency components and accelerating convergence speed by 3x.
  - **Key Results**: Achieved stable loss convergence (order of 10^{-3}) with a low absolute error of 0.0014 (relative error: 5.7%).
  - **Funding**: Supported by Cuiying Fund, Lanzhou University.
  - **Supervision**: Supervised by Prof. Weihua Deng, Lanzhou University.
  - **Academic Outcomes**: Preparing a manuscript for a JCR Q2 journal as First Author; developing an open-source implementation to be released on GitHub.
- **Interpretable DNA Methylation Prediction Model via Bio-Prism** — Hong Kong, China
  Lead Researcher — *May 2025 – Present*
  - **Architecture Design**: Architected a dual-stream framework by fine-tuning DNABERT2 and DNABERT-6mer; innovatively integrated Feature-wise Linear Modulation (FiLM) for dynamic feature fusion and Mixture of Experts (MoE) for adaptive representation learning.
  - **Efficiency & Performance**: Achieved state-of-the-art (SOTA) performance across 17 benchmark datasets, while reducing parameter size by 50% compared to existing SOTA models, ensuring high training efficiency.
  - **Hierarchical Interpretability Framework**: Pioneered a three-level interpretability system to address the logical reasoning gap in the field: Predictive Effect $\rightarrow$ Decision Mechanism $\rightarrow$ Biological Significance.
  - **Scientific Discovery**: Designed algorithms to deconstruct statistical patterns into biological motifs, enabling the generation of novel, verifiable biological hypotheses from model decisions.
  - **Supervision**: Supervised by Dr. Tianchi Lu, City University of Hong Kong.
  - **Academic Outcomes**: Targeting submission to *Nature Communications* (or equivalent top-tier journal) as First Author; preparing to release open-source code, model weights, and a dedicated web server for public access.
- **3D Equivariant Representation Learning for Industrial Part Recognition** — Zhuhai, China
  Core Developer — *Jun 2025 – Nov 2025*
  - **Problem Scope**: Addressed the challenge of recognizing and analyzing disordered 3D industrial parts by mitigating rotation sensitivity in point cloud processing.

- **Core Implementation**: Engineered the low-level operators for a Quaternion Neural Network (REQNN) to enable 3D equivariant representation learning.
- **Method Integration**: Integrated the equivariant backbone with Contrastive Learning paradigms to enhance geometric robustness against arbitrary poses of industrial parts.
- **Project Role & Context**: Served as a core developer in this Provincial Major Research Project, bridging the gap between theoretical quaternion algebra and executable deep learning code.
- **Supervision**: Supervised by Prof. Tieyong Zeng, Beijing Normal University - Hong Kong Baptist University United International College (BNU-HKBU UIC).

• **Computational Analysis of Order & Orientation Preserving Semigroups** Lanzhou, China
Key Member *Oct 2025 – Present*

- **Algorithmic Construction**: Developed computational frameworks for constructing O_n (order-preserving) and OP_n (orientation-preserving) semigroups on finite chains, building on the theoretical foundations proposed by Catarino & Higgins (1999).
- **Efficient Implementation**: Implemented combinatorial generation algorithms using Python iterators; constructed OP_n via conjugation with cyclic group generators, realizing efficient enumeration of transformation sets.
- **Numerical Verification**: Designed algorithms to compute fixed-point distributions and verify algebraic inclusion relationships across different values of n, validating theoretical conjectures through large-scale numerical evidence.
- **Pattern Discovery & Theoretical Support**: Analyzed statistical regularities from computational results, directly supporting the derivation of closed-form counting formulas for semigroup orders and fixed points.
- **Supervision**: Supervised by Prof. Wentting Zhang, Lanzhou University.
- **Academic Outcomes**: Targeting publication in a JCR Q2 journal as Second Author.

Technical Stack

- **Programming**: Python, C/C++, MATLAB, LaTeX
- **Deep Learning**: PyTorch, CUDA (Basic), GPU Monitoring, Cloud GPU Scheduling (Aliyun/AutoDL)
- **Tools**: Linux, GitHub, VSCode (Remote-SSH), Tmux, Conda
- **Numerical Algorithms**: Monte Carlo Methods, FFT/IFFT, Remes Algorithm, Nonlinear Solvers

Awards

- **Finalist (Top 2%)**: Mathematical Contest in Modeling (MCM/ICM) 2025
- **Second Prize**: National College Student Mathematics Competition (Provincial Level) 2024
- **Outstanding Team Leader**: College Sports Team (Swimming & Track) 2023 - 2024
- **Excellence Award**: Social Practice & Community Service 2023