Zixun Huang

alexpku@stu.pku.edu.cn — (+86) 18952009927 — alexhuang13.github.io

Profile

I am an undergraduate student in Statistics at Peking University and participated in an academic exchange at the University of California, Berkeley. Throughout my academic journey, I have been fortunate to work closely with Professors Lei Wu, Zeyu Zheng, and Junfeng Hu. My research focuses on the theoretical foundations of machine learning, including scaling laws, and reinforcement learning theory.

Education

Peking University, School of Mathematical Sciences *Sept 2022 – Present*
B.S. in Statistics, GPA: 3.68/4.0
Member of Elite Undergraduate Program for Applied Mathematics (Top 10%)
Core Coursework: Mathematical Analysis, Advanced Algebra, Data Structure, Mathematical Modeling, Probability Theory, Machine Learning, Deep Learning Theory, Numerical Methods, Applied Stochastic Calculus, Functional Analysis

University of California, Berkeley *Jan 2025 – Aug 2025*
Visiting Student, GPA: 4.0/4.0
Core Coursework: Theoretical Statistics, Advanced Topics in Probability and Stochastic Processes, Modern Statistical Prediction and Machine Learning, Structure and Interpretation of Computer Programs, Great Ideas in Computer Architecture, Computer Security

Publications

- Binghui Li*, Fengling Chen*, **Zixun Huang***, Lean Wang*, Lei Wu. *Unveiling the Role of Learning Rate Schedules via Functional Scaling Laws.* **NeurIPS 2025** (Spotlight).
- **Zixun Huang***, Jiayi Sheng*, Zeyu Zheng. *OBLR-PO: A Theoretical Framework for Stable Reinforcement Learning.* Submitted to **AISTATS 2026**.

Research Experience

Functional Scaling Laws for Learning Rate Schedules Jun 2024 – May 2025
– Advisor: Prof. Lei Wu
– Proposed a novel Functional Scaling Law (FSL) by modeling SGD as an intrinsic-time SDE
– Analyzed learning-rate schedules under data and compute constraints, revealing efficiency trade-offs
– Validated FSL through kernel regression and LLM pre-training, producing optimal schedules

OBLR-PO: Theory for Stable Reinforcement Learning Feb 2025 – Oct 2025
– Advisor: Prof. Zeyu Zheng
– Established theoretical guarantees for policy optimization, including variance bounds and convergence
– Introduced gradient-weighted baselines for principled variance reduction
– Implemented OBLR-PO and demonstrated superior performance on Qwen3-4B/8B vs. GRPO

Efficiently Combining Simulation with Linear Algebra: COSIMLA May 2025 – Jul 2025
– Advisor: Prof. Zeyu Zheng
– Implemented and evaluated five COSIMLA estimators across diverse parameter regimes
– Analyzed variance–bias–efficiency trade-offs, confirming improved stability and speed

Saturation Phenomenon Under Kernel Method Feb 2024 – May 2024

– Advisor: Prof. Lei Wu

– Derived loss functions for kernel ridge regression and gradient descent; analyzed the saturation phenomenon through bias–variance tradeoff and Fourier perspective

– Identified a noiseless setup saturation effect previously overlooked in prior work

Cross Modal Alignment May 2024 – Jun 2024

– Advisor: Prof. Junfeng Hu

– Developed an alignment strategy for movie posters and text introductions using vector embeddings

– Established baseline accuracy and reported insights on model and network pre-training effects

Analysis for Grokking Phenomenon Nov 2023 – Jan 2024

– Advisor: Prof. Lei Wu

– Replicated grokking phenomenon experiments (MLP, LSTM) on modular addition task

– Conducted theoretical and empirical analysis from training-dynamics and landscape perspectives

Honors and Awards

Hong Sheng Scholarship (Top 12%)	2024
First Prize, Chinese Mathematics Contest (Top 1%)	2024
Yau Contest Groups Prize (Top 5%)	2024
Xiaomi Scholarship (Top 12%)	2023
Gold Prize, Chinese Mathematical Olympiad	2021
Silver Prize, Chinese Mathematical Olympiad	2020

Extracurricular Activities

Applied Mathematics Seminar, Peking University Jun 2024 – Jul 2024

– Teaching Assistant for Prof. Zhi-Qin John Xu

– Assisted in developing and organizing lecture materials

Peking University Runners Association Oct 2022 – Dec 2023

– Core Team Member

– Organized and coordinated running events; participated in volunteer activities

– Completed the Nanjing Half Marathon

Skills and Other

Languages	Chinese (Native), English (Fluent, TOEFL 101)
Quantitative Skills	GRE (160+170), GRE Math (97th percentile)
Programming	Python, MATLAB, LaTeX, PyTorch, C++