

# Zixun Huang

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

## PROFILE

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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

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### 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 (94), Advanced Algebra (97.5), Mathematical Modeling (91), Numerical Methods (88), Deep Learning Theory (87), Learning Data Science with Python (90), Mathematical Statistics (97)

### University of California, Berkeley

Jan 2025 – Aug 2025

Visiting Student, GPA: 4.0/4.0

Core Coursework: Theoretical Statistics (A+), Advanced Topics in Probability and Stochastic Processes (A), Modern Statistical Prediction and Machine Learning (A+), Structure and Interpretation of Computer Programs (A+)

## PUBLICATIONS

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- 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

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### Functional Scaling Laws for Learning Rate Schedules (Core)

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 (Core)

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

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|---|------|
| 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

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### 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

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|---------------------|--|
| Languages           | Chinese (Native), English (Fluent, TOEFL 101)      |
| Quantitative Skills | GRE (160+170+3.5), GRE Math (970, 95th percentile) |
| Programming         | Python, MATLAB, LaTeX, PyTorch, C++                |