

## RESEARCH INTEREST

- **Optimization:** Federated Learning, Distributed Optimization, SGD Analysis
- **Machine Learning and Deep Learning:** Efficient LLM, Machine Learning System, Deep Learning Theory

## EDUCATION

### Peking University

Beijing, China

- *B.A. in Mathematics, School of Mathematical Sciences* *Sep. 2022–Jul. 2026 (Expected)*
  - **Mathematics Courses:** Mathematical Analysis, Advanced Algebra, Complex Analysis, Probability Theory, Mathematical Statistics, Stochastic Processes, Stochastic Analysis, Basic Numerical Method, Basic Optimization Method.
  - **Computer Science Courses:** Basic Artificial Intelligence and Deep Learning, Parallel and Distributed Computing, Introduction to Computer Vision, Introduction to Multi-model(auditor).
  - **Honors and Awards:** [Applied Mathematics Elite Program](#) (The program accepted only 15 people this year)

## RESEARCH EXPERIENCE

### Convergence and Speedup Analysis of Distributed Optimization Algorithms

Peking University

- *Undergraduate Research Assistant* *Nov. 2023 – Present*
  - **Advisor:** [Kun Yuan](#)
  - **Project 1: Analysis of Push-Pull Algorithm**
    - \* **Push-Pull Algorithm Provably Achieves Linear Speedup Over Arbitrary Network Topologies**  
[Liyuan Liang\\*](#), [Gan Luo\\*](#), [Kun Yuan](#) (\*Equal contribution) [coming soon to Arxiv]
    - \* **Currently finalizing this paper for submission to SIOPT.**
    - \* Conducted research on the [Push-Pull Algorithm](#), focusing on convergence and linear speedup properties in non-convex and stochastic settings on arbitrary topology.
    - \* First to prove convergence and linear speedup properties of the [Push-Pull Algorithm](#) under non-convex and stochastic settings on arbitrary topology.
    - \* Validated the proposed theoretical results by conducting distributed optimization numerical experiments on the MNIST and CIFAR10 datasets.
  - **Project 2: Analysis on Decentralized Optimization over Row-stochastic Networks**
    - \* **Achieving Linear Speedup and Optimal Complexity for Decentralized Optimization over Row-stochastic Networks**  
[Liyuan Liang\\*](#), [Xinyi Chen\\*](#), [Gan Luo\\*](#), [Kun Yuan](#) (\*Equal contribution) [coming soon to Arxiv]
    - \* **Accepted to ICML2025, Spoghtlight**
    - \* Introduced effective metrics to capture the influence of row-stochastic mixing matrices
    - \* Established the first convergence lower bound for decentralized learning over row-stochastic networks
    - \* Incorporated a multi-step gossip (MG) protocol, to attain the lower bound, achieving optimal complexity.
    - \* Proposed a novel analysis framework demonstrating that [PULL-DIAG-GT](#) achieves linear speedup, which is the first such result for row-stochastic decentralized optimization.
    - \* Conducted numerical experiments to validate theoretical results.

### Online Scheduling on LLM Inference

Massachusetts Institute of Technology

- *Undergraduate Research Assistant* *Oct. 2024 – Present*
  - **Advisor:** [David Simchi-Levi](#)
  - **Project 1: Online Batching Algorithm on LLM Inference**
    - \* **Optimizing LLM Inference: Fluid-Guided Online Scheduling with Memory Constraints**  
( $\alpha$ - $\beta$ ) [Ruicheng Ao\\*](#), [Gan Luo\\*](#), [David Simchi-Levi](#), [Xinshang Wang](#), available on [SSRN] and [Arxiv]
    - \* **This paper is submitted to Operations Research.**
    - \* Formulated the LLM inference as a multi-stage online scheduling task with stochastic queueable requests.
    - \* Proposed a novel online batching algorithm for LLM inference.
    - \* Proved that the algorithm achieves near-optimal throughput while controlling latency and Time to First Token (TTFT).
    - \* Conducted numerical experiments on synthetic and real-world datasets with Llama-7B on A100 GPU to validate theoretical results.