

Luocheng Liang

☎ +86 13308402223 • ✉ 122090307@link.cuhk.edu.cn
<https://notdesigned.github.io>

Education

The Chinese University of Hong Kong, Shenzhen

Guangdong, China

B.S. major in Computer Science, minor in Mathematics expected May 2026 Sep.2022 – Present

Cumulative GPA of **3.817/4.0**. I am selected for **Bachelor-Ph.D. Class** with **Scholarship** (top ~3% students on basis of outstanding performance) and **Dean's List** of the School of Data Science in both AY2022-23 and AY2023-24

University of California, Berkeley

United States

Visiting student in GLOBE program

Aug.2024 – Dec.2024

GPA: **4.0/4.0**, for **A** in Computer Security; Programming Language and Compiler; **A⁺** in Differential Topology

Core Courses in CS:

Data Structures; Machine Learning; Operating System; Computer Architecture; Design and Analysis of Algorithms

Core Courses in Math:

Ordinary Differential Equation; Optimization; Probability; Complex Variables; Stochastic Processes; Abstract Algebra; Differential Topology. (All A in these classes)

Research Interests

My research interests are gradually shifting from algorithm design and optimization toward the theoretical foundations of artificial intelligence. My previous work on graph algorithms and optimization has provided me with a solid background in algorithmic analysis and computational complexity. At the same time, my studies in differential topology, abstract algebra, and optimization have sparked my curiosity about the deeper mathematical and geometrical principles underlying intelligent systems. This interdisciplinary background allows me to build a bridge between practice and theory, moving toward a more systematic and rigorous understanding of the essence of intelligence.

Currently, my research focuses mainly on the following directions:

- **Machine Learning Theory:** Building on my experience in optimization and algorithm analysis, I aim to investigate the mathematical structure and theoretical limits of learning algorithms, with a focus on generalization, convergence, and complexity.
- **Mathematical and Geometric Foundations of Generative Models:** I am particularly interested in employing tools from optimal transport theory, differential geometry, and statistical physics (e.g., renormalization group methods) to study the dynamical mechanisms of generative models such as diffusion models, flow matching, continuous normalizing flows (CNFs), and Schrödinger bridges.

I believe that there remain many profound connections between mathematics, physics, and artificial intelligence yet to be uncovered. My practical experience in algorithm competition, design, and implementation complements my theoretical training, providing a strong foundation for tackling these fundamental questions. More importantly, I view AI not merely as an engineering discipline but as a nascent scientific field that, like physics or mathematics, will ultimately mature into a discipline with a well-established theoretical framework. My long-term goal is to contribute to this process: to

advance a rigorous mathematical and physical understanding of AI, uncover its underlying principles, and thereby enhance the reliability and interpretability of intelligent systems.

Research

- **A Gradient Projecting-based Approach for Efficient Densest Subgraph Discovery**
Yingli Zhou, [Luocheng Liang](#) and Yixiang Fang
Accepted on SIGMOD 2026
Applying the FISTA algorithm to existing approaches and introducing key algorithmic improvements to gives better time complexity guarantee
- **Accelerated Coordinate Descent for Directed Densest Subgraph Discovery**
[Luocheng Liang](#), Yingli Zhou and Yixiang Fang
Excepted to submit on SIGKDD 2026
Designed randomized coordinate descent algorithms leveraging optimization theory (Lovász extension and submodular optimization) with a novel linear programming formulation. Achieved the first SOTA algorithm with runtime complexity proportional to $\log(1/\epsilon)$ for the densest subgraph approximation problem

Experience

The Chinese University of Hong Kong, Shenzhen **Guangdong, China**
Research Assistant, advised by Prof. Yixiang Fang *May. 2024 – Present*
I developed novel approaches with strong theoretical guarantees to solve the **Densest Subgraph Problem** approximately and exactly. I implemented them as open-source practical tools in C++. We accelerate the finding of an approximate solution to the densest subgraph by a factor of **100x~1000x** faster.

The Chinese University of Hong Kong, Shenzhen **Guangdong, China**
Research Assistant, advised by Prof. Hongyuan Zha and Prof. Jie Wang *Aug. 2025 – Present*
Conducting theoretical research on generative modeling, with a focus on diffusion models, score-based generative models (SGMs), and Schrödinger bridge formulations. Exploring connections between these frameworks and optimal transport theory, aiming to develop rigorous mathematical foundations and novel algorithmic insights for generative modeling.

Contest Awards

The 48th ICPC Asia Hefei Regional Bronze Medalist **Hefei, China**
Trio-teamed programming contest *2023*
2024 GDCPC Silver Medalist **Guangdong, China**
Trio-teamed programming contest *2024*

Technical Skills

- **Programming Languages:** Python, C++, with extensive experience in algorithm implementation and optimization
- **Machine Learning:** PyTorch, NumPy, Pandas, MATLAB
- **Mathematical Tools:** Optimization algorithms, graph theory, statistical analysis
- **Development Tools:** Git, Linux, data preprocessing and visualization

Languages

- **English:** Fluent (IELTS 7.5)
- **Japanese:** Reading and daily dialogues level
- **Chinese:** Native