JIAYUAN LIU

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Education

Carnegie Mellon University   **Aug 2023 – present**
Ph.D. student in Computer Science at Computer Science Department, School of Computer Science   *Pittsburgh, USA*

Tsinghua University   **Aug 2019 – June 2023**
Bachelor's in Computer Science and Technology at IIIS (<u>Yao Class</u>), summa cum laude   *Beijing, China*
- GPA: 4.0/4.0, National Scholarship Winner, Outstanding Graduate of Tsinghua University

No.2 High School of East China Normal University   **Sept 2016 – July 2019**
High School. Admitted to Tsinghua for Gold Medal in China Physics Olympiad   *Shanghai, China*

Research Interests

- Game Theory
- Economics and Computation
- Incentives in Blockchain System
- Information and Mechanism Design
- Multi-agent System
- Online Algorithm

Publications and Manuscripts

- Jiayuan Liu, Canhui Chen, Lulu Zhou, Zhixuan Fang, "Real-Time Recursive Routing in Payment Channel Network: A Bidding-based Design," the twentieth International Symposium on Modeling and Optimization in Mobile, Ad Hoc and Wireless Networks (WiOpt), September 2022. [pdf].
- Jiayuan Liu, Siwei Wang, Zhixuan Fang, "Policy Gradient Algorithm for Multi-armed Bandits Robust to Adversarial Corruptions," (in submission).
- Jiayuan Liu, Shuran Zheng, Yiling Chen, "Cost-Efficient Information Aggregation in Hierarchical Information Structure," [pdf] (in submission).
- Heng Dong, Tonghan Wang, Jiayuan Liu, Chongjie Zhang, "Low-Rank Modular Reinforcement Learning via Muscle Synergy," the thirty-sixth Conference on Neural Information Processing Systems (NeurIPS), November 2022. [pdf].
- Heng Dong, Tonghan Wang, Jiayuan Liu, Chi Han, Chongjie Zhang, "Birds of a Feather Flock Together: A Close Look at Cooperation Emergence via Multi-Agent RL," [pdf] (in submission).

Research Experience

Research Intern, Microsoft Research Asia | *Advised by Dr. Siwei Wang*   **Dec 2022 – Mar 2023**
- Research Topic – Online Algorithm and Corruption in Multi-armed Bandits
- Applied policy gradient algorithm to corrupted bandits setting, theoretically analyzed its regret upper bound and proved it is asymptotically optimal, empirically showed its performance advantage through simulations

Research Intern, University of Chicago | *Advised by Prof. Haifeng Xu*   **Sept 2022 – May 2023**
- Research Topic – Pricing a Machine Learning Model
- Designed pricing schemes capturing the uncertainty of the quality-cost relationship in training ML models

Research Intern, EconCS Group, Harvard University | *Advised by Prof. Yiling Chen*   **Feb 2022 – Aug 2022**
- Research Topic 1 – Cost-efficient Information Aggregation in Hierarchical Information Structure
  - ∗ Formally defined a mathematical model and the class of mechanisms in hierarchical information structures
  - ∗ Derived necessary conditions for identifying the optimal aggregation result from hierarchical information structures, and designed a novel class of successful mechanisms that minimizes the aggregator's expected payment
- Research Topic 2 – Analysis of Extremization Methods in Information Aggregation
  - ∗ Theoretically analyzed and visualized how extremization schemes help information aggregation
  - ∗ Analyzed the Bayesian aggregator's performance advantage in conditionally independent setting with respect to the extent of extremization and verified it using practical data

Research Intern, Shanghai Qizhi Institute (founded by Andrew Yao) | *Advised by Prof. Zhixuan Fang*   **2021 & 2023**
- Research Topic – Mechanism and Protocol Design in Blockchain Systems
- Proposed a novel real-time recursive transaction routing scheme (RTRR) in payment channel networks (PCN) and designed a transaction protocol HTLC-bid compatible with RTRR while ensuring security
- Theoretically analyzed the actual dynamics of RTRR in PCN, verified it with Lightning Network data; extended our protocol from an economics perspective, incorporated different bidding and transaction fee mechanisms

Project Leader of College Students' Innovative Training Program (National Program)   **Dec 2021 – Dec 2022**
- Research Topic – Platform Economics: Design, Optimization and Regulation
- Analyzed user patterns on platforms, optimized the user evaluation mechanism with security and privacy guarantees

Student Research Training Program, Tsinghua University | *Advised by Prof. Zhixuan Fang*   **Sept 2021 – Jan 2022**
- Research Topic – Crowdsourcing and Online Learning, with Practical Applications
- Applied combinatorial multi-armed bandit framework to crowdsourcing and weighted majority voting, analyzed the case where corruption among participants exists as an aggravating factor

Research Intern, the University of Hong Kong | *Advised by Prof. Zhiyi Huang*   **July 2021 – Sept 2021**
- Research Topic – AdWords in Recommendation Systems and Online Bipartite Matching
- Reasoned the difficulty in AdWords w.r.t. *Ranking* algorithm family, improved the online correlated selection method

Research Intern, Tsinghua University | *Advised by Prof. Chongjie Zhang*   **Apr 2020 – Mar 2021**
- Research Topic – A Close Look at Cooperation Emergence and Leadership Emergence
- Formally analyzed second-order social dilemmas from the perspective of evolutionary game theory and theoretical RL
- Used homophily to incentivize cooperation emergence, experimented in multi-agent reinforcement learning environments

Awards

- Excellent Graduation Thesis Award, Tsinghua University, 2023
- Second Prize for Outstanding Project in the 2022 Student Research Training (SRT) Program, Tsinghua University, 2022
- Gold Medal in the National Finals of the thirty-fifth China Physics Olympiad (CPhO), 2018
- Ranked 1st among 400 finalists (selected from over 50,000 contestants nationwide through two rounds of preliminaries) in the experiment section of the thirty-fifth CPhO, 2018
- First Prize in the thirty-second Shanghai Adolescent Science and Technology Innovation Contest, 2017

Honors and Scholarships

- Outstanding Graduate of Beijing, Beijing Municipal Commission of Education, 2023
- Outstanding Graduate of Tsinghua University (top 2% university-wide), Tsinghua University, 2023
- Departmental Outstanding Graduate, Institute for Interdisciplinary Information Sciences, Tsinghua University, 2023
- China National Scholarship (top 0.2% nationwide), Ministry of Education of the People's Republic of China, 2022
- Yao Award for Academic and Research Achievements, presented by Dean Andrew C. Yao of IIIS, Tsinghua, 2022
- Tang Lixin Scholarship for Merit Student, Tang Lixin Education Foundation, 2021
- Comprehensive Merit Award (three times), Tsinghua University, 2020, 2021, 2022
- ICBC Scholarship, Industrial and Commercial Bank of China, 2020
- Freshman Scholarship, Tsinghua University, 2019
- Xuetang Scholarship for Merit Student (four times), Tsinghua University, 2019, 2020, 2021, 2022
- Merit Student of No.2 High School of East China Normal University, 2018

Talks and Teaching Experiences

- Teaching Assistant to Prof. Zhixuan Fang in *Game Theory* course at Tsinghua University, 2023
- Teaching Assistant to Prof. Ran Duan in *Theory of Computation* course at Tsinghua University, 2023
- Gave a talk titled "Two Tracks of Solutions to Blockchain Scalability Problem and Their Economic Implications" at Yao Seminar, Tsinghua University, 2023
- Gave a presentation of my accepted paper titled "Real-Time Recursive Routing in Payment Channel Network: A Bidding-based Design" at WiOpt 2022 conference [slides] [video]

Certificates and Skills

Programming Skills: Python, C++, Java, MATLAB, Go, SQL

Tools and Frameworks: LaTeX, MySQL, Matplotlib, PyTorch, Git

Language – English: Intermediate Interpreters, Shanghai Interpretation Accreditation

Others: GRE, 170/170 (quantitative) + 165/170 (verbal) + 4.0 (writing)

Leadership / Extracurricular

Voluntary Works
- Volunteer at Tsinghua University Undergraduate Admissions Committee

Student Leader
- Class President of Yao Class 2023, Sept 2021 – June 2023