Mengshi Zhao

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EDUCATION

The University of Hong Kong — *Hong Kong*
PhD in Computer Science — *Sep 2022 - present*
- **Research Topics:** Algorithm in machine learning with theoretical analysis.

Tongji University — *Shanghai, China*
BSc in Computer Science, GPA:4.7/5.0, ranking: 2/153 (1.3%) — *Sep 2018 - Jun 2022*
- **Relevant Course:** Data Structures (A), Algorithm (A), Machine Learning (A), Artificial Intelligence (A).
- **Honors:** **First-Class Scholarship** of Tongji University Outstanding Student Scholarship.

Tongji University — *Shanghai, China*
Minor in Mathematics, GPA:4.8/5.0 — *Sep 2018 - Jan 2019*
- **Relevant Courses:** Mathematical Analysis (A), Advanced Algebra (A), Probability (A), Statistics (A).
- **Honors:** **Third-Class Scholarship** of Tongji University Outstanding Student Scholarship.

University of Manchester — *Manchester, UK*
International Summer School in Computer Science — *Jul 2019 - Aug 2019*
- **Relevant Courses:** Machine Learning, Artificial Intelligence, Computer Vision.

PUBLICATION

(Authors are sorted **alphabetically** for theoretical work and **randomly** for security work.)

- T.-H. Hubert Chan, Shaofeng H.-C. Jiang, Tianyi Wu, and **Mengshi Zhao**. "Online Clustering with Nearly Optimal Consistency". In: *The Thirteenth International Conference on Learning Representations (ICLR)*. 2025

- Enze Sun, Bo Wang, Quan Xue, **Mengshi Zhao**, and Zixuan Zhu. "MPMD on Two Sources with Lookahead". In: *The 30th International Computing and Combinatorics Conference (COCOON)*. 2024. **Best Student Paper**

- T.-H. Hubert Chan, Hao Xie, and **Mengshi Zhao**. "Privacy Amplification by Iteration for ADMM with (Strongly) Convex Objective Functions". In: *Thirty-Eighth Conference on Artificial Intelligence, AAAI*. 2024

- Mingxun Zhou, **Mengshi Zhao**, T.-H. Hubert Chan, and Elaine Shi. "Advanced Composition Theorems for Differential Obliviousness". In: *15th Innovations in Theoretical Computer Science Conference, ITCS*. 2024

- Junqi Zhang, Huan Liu, Peng Zu, **Mengshi Zhao**, Cheng Wang, Aiiad Albeshri, Abdullah Abusorrah, and Mengchu Zhou. "Using Tabu Search to Avoid Concave Obstacles for Source Location". In: *IEEE Transactions on Intelligent Transportation Systems* 24.11 (2023)

- **Mengshi Zhao**, Pengzhan Qiu, and Junqi Zhang. "A Hybrid Obstacle Avoidance Strategy Based on PSO in Source Location". In: *13th International Conference on Advanced Computational Intelligence, ICACI*. 2021

- **For more details, please see section Research Projects.**

RESEARCH PROJECTS

Privacy Amplification for ADMM Algorithm — *Sep 2022 - Feb 2023*
Boosting privacy in iterative ML systems, making distributed optimization more private
- **Challenge:** How to protect sensitive data when coordinating between multiple users in iterative ADMM optimization systems.
- **Solution:** Proved repeated interactions naturally enhance privacy defenses polynomially/exponentially for convex/strongly convex objective function. Provide the quantitative measure for the utility-privacy trade-off for one of the most popular optimization methods.

Advanced Composition Theorems for Differential Obliviousness — *Mar 2023 - Jun 2023*
Stronger privacy guarantees for complex workflows with private output
- **Challenge:** Existing privacy rules don't stack well in multi-step systems with private output.
- **Solution:** Established new mathematical frameworks (using coupling and hypothesis testing) enabling reliable privacy predictions for connected systems with private output.

Adaptive Composition Theorems for Differential Obliviousness — *Sep 2024 - Jan 2025*
Privacy against adaptive attacks, securing real-time data streams

- - **Challenge:** Guaranteeing privacy when attackers adjust strategies based on the interaction history.
  - **Solution:** Established the first mathematical framework for adaptive privacy protection. Proved fundamental rules for combining privacy mechanisms, enabling the development of practical tools for secure data aggregation in streaming applications.

- **Online Clustering with Nearly Optimal Consistency** *Jul 2023 - Jun 2024*
  Efficient real-time data grouping, dynamic clustering with minimal adjustments
  - **Challenge:** Updating data clusters efficiently as new points arrive.
  - **Solution:** Created algorithm needing only $O(k \log n)$ adjustments (which is tight) to maintain near-optimal groups (80% better than prior work on datasets with 1M+ data)

- **Real-Time Matching with Delay Optimization** *Jul 2024 - Sep 2024*
  Smart pairing in dynamic systems
  - **Challenge:** Designed algorithms for matching dynamic requests between two locations in real-time, balancing immediate matching costs against penalties for delayed decisions.
  - **Solution:** Developed matching strategies that leverage limited future visibility to improve decision quality. Created both deterministic and randomized approaches with mathematically guaranteed performance bounds, demonstrating how even small predictive capabilities enhance operational efficiency.

WORKING EXPERIENCE

- **Research Assistant at Peking University, advisor: Shaofeng H.-C. Jiang** *Jun 2023 - Aug 2023*
  Constructed both theoretical and practical research on dynamic clustering problems. Proposed the first algorithm reaching both near-optimal utility and near-optimal recourse with strong theoretical support. Conducted algorithm in real datasets, showing an 80% improvement in performance.

- **Research Internship at The University of Hong Kong, advisor: T.-H. Hubert Chan** *Jun 2022 - Aug 2022*
  Conducted theoretical research on social network optimization. Provided the hardness and the inapproximability for the problem.

- **Research Assistant at Tongji University, advisor: Junqi Zhang** *Jun 2021 - Jan 2022*
  Participated in the research of swarm intelligence. Proposed a concave-obstacle avoidance strategy for source location problems. Improved 90% performances for concave-obstacle avoidance.

COMPETITIONS

- 1st **Prize** in 2021 National College Student Computer Design Competition *Sep 2021*
- 1st **Prize** in 2021 Shanghai College Student Computer Design Competition *Jun 2021*
- 1st **Prize** in 2019 National College Student Mathematics Competition *Sep 2019*
- 2nd **Prize** in 2019 Contemporary Undergraduate Mathematical Contest in Modeling *Apr 2019*

SKILLS

- **Mathematical Modeling.** Proficient in theory-backed problem formalization, algorithm design, theory proof and complexity analysis (time/space/utility). Deliver rigorous solutions through systematic performance evaluation, avoiding heuristic dependencies.
- **Programming.** Proficient in Python, MATLAB, R, C/C++. Developed high-performance STL-equivalent toolkits (e.g. vector, set, map), achieving 90% native library efficiency through optimized memory management and data structures.
- **Machine Learning and Data Analysis.** Strong experimental design and Python implementation skills. Scaled algorithms to million-point datasets via dimensionality reduction/coreset techniques (99% size reduction). Executed privacy-preserving federated optimization solutions for various optimization algorithms.

QUALIFICATION

- **Worldquant Brain Gold User.** Earned 'Gold Level' certification in WorldQuant Brain, demonstrating expertise in alpha research. Got top 1% rank in the competition.
- **J.P. Morgan Quantitative Job Simulation Certification.** Completed the J.P. Morgan Quantitative Job Simulation Certification, showcasing expertise in data analysis, machine learning model training, and quantitative finance applications.
- **Teaching and Learning in Higher Degree.** Obtained the "Teaching and Learning in Higher Degree" certification at HKU.
- **Lead of Student Union of Tongji University.** Served as the lead of the We-media and current affairs commentary group at the student union of Tongji University from 2019 to 2020.
- **Piano Performer.** Obtained the Level 10 Amateur Piano Certification from the Shanghai Conservatory of Music.