

Summary

Research Interests Machine Learning (Recommendation Systems, Learning to Rank, Algorithm Design, etc.), Differential Privacy, Computational Social Choice, and Quantum Computation

Experience 1+ years of industry experience in personalization, recommendation systems, LLM, theoretical computer science, differential privacy, and adversarial robustness

Academia Published 20+ papers and received 250+ citations to date.
 Reviewed 50+ papers for top AI conferences or journals.

Education

- 01/2018 – 05/2023 **Ph.D. in Computer Science**, Rensselaer Polytechnic Institute (RPI) Troy, NY
 Thesis: *Group Decision Makings from Partial Preferences* [\[Link\]](#)
- 08/2015 – 05/2018 **M.Eng. in Material Engineering**, Rensselaer Polytechnic Institute (RPI) Troy, NY
Focus on optics and polymer physics, received Presidential Graduate Research Fellowship
- 08/2010 – 05/2014 **B.S. in Mathematics and Physics**, Tsinghua University Beijing, China
Minor in Computer Technology, and in Academic Talent Program

Experience

- 07/2023 – Present **Research Software Engineer at Google Core ML** Mountain View, CA
 Design and Research More Efficient Transformers for Recommendation Systems
- 05/2022 – 08/2022 **Research Intern at Google Core ML** Mountain View, CA
 Project: A More Accurate Position Bias Estimator for Unbiased Learning to Rank
- Significant prediction accuracy improvement ($\sim 8\%$) *v.s.* state-of-the-art without any cost
 - Proposed a novel probabilistic model to more accurately estimate position bias and designed an unbiased recommendation system based on it.
 - Implemented the data pipeline and machine learning algorithm for the proposed unbiased recommendation system. Integrated all into Google codebase. (*Python, TensorFlow, C/C++*)
- 08/2018 – 12/2018 **Visiting Scholar at MIT-IBM Watson AI Lab** Cambridge, MA
 and Project: Certifiably Robust Interpretation via Rényi Differential Privacy
- 05/2019 – 08/2019 ○ Significant robustness improvement ($\sim 12\%$) plus accuracy improvement *v.s.* state-of-the-art
- Yes! We improved both robustness and accuracy, which usually are trade-offs in machine learning.
 - Designed the first algorithm in the world with theoretically guaranteed top- k robustness against ℓ_∞ -norm attacks, where the theoretical proofs relies on Rényi differential privacy.
 - Implemented the proposed algorithm and tested its robustness, accuracy, and computational efficiency on image classification and objective detection. (*PyTorch, TorchRay, TensorFlow*)
 - Delivered one academic paper (on top AI journal and conference) and two patents.

Skills

Implementation Programming languages: *Python, C/C++, MATLAB*
 Tools and platforms: *TensorFlow, PyTorch, TorchRay, L^AT_EX*

Design/ Theory *Algorithm design, Statistics, Time/Sample-complexity analysis, User-modeling, Markov chain Monte-Carlo, Privacy analysis, Robustness analysis, Model identifiability, Smoothed analysis*

Review Services

Journal Information Sciences, TMLR, ACM ToIS, Sankhya B

Conference NeurIPS (20,21,22&23), ICML (22,23&24), ICLR (23&24), AAI (21&22), IJCAI-22

Selected Publication

- TMLR* **Smoothed Differential Privacy** [\[PDF\]](#)
Ao Liu, Yu-Xiang Wang, and Lirong Xia
- UAI-23* **Accelerating Voting by Quantum Computation** [\[PDF\]](#)
Ao Liu, Qishen Han, Lirong Xia, and Nengkun Yu
- AIJ* and *AAAI-23* (oral) **Certifiably Robust Interpretation via Rényi Differential Privacy** [\[Link\]](#) [\[ArXiv\]](#)
Ao Liu, Xiaoyu Chen, Sijia Liu, Lirong Xia, and Chuang Gan
- AAAI-23* (oral) **Differentially Private Condorcet Voting** [\[PDF\]](#)
Zhechen Li, *Ao Liu*, Lirong Xia, Yongzhi Cao, and Hanpin Wang
- AAAI-22* **The Semi-Random Likelihood of Doctrinal Paradoxes** [\[PDF\]](#)
Ao Liu and Lirong Xia
- IJCAI-22* (oral) **Learning Mixtures of Random Utility Models with Features from Incomplete Preferences**
Zhibing Zhao, *Ao Liu*, and Lirong Xia [\[PDF\]](#)
- JAIR* and *IJCAI-23* (oral) **Learning to Design Fair and Private Voting Rules** [\[PDF\]](#)
Farhad Mohsin, *Ao Liu*, Pin-Yu Chen, Francesca Rossi, and Lirong Xia
- UAI-20* (oral) **How Private Are Commonly-Used Voting Rules?** [\[PDF\]](#)
Farhad Mohsin, *Ao Liu*, Pin-Yu Chen, Francesca Rossi, and Lirong Xia
- ETRA-20 Adjunct* **Let It Snow: Adding Pixel Noise to Protect the Users Identity** [\[Link\]](#)
Brendan John, *Ao Liu*, Lirong Xia, Sanjeev Koppal, and Eakta Jain
- AAAI-19* (oral) **Near-Neighbor Methods in Random Preference Completion** [\[PDF\]](#)
Ao Liu, Qiong Wu, Zhenming Liu, and Lirong Xia
- AAAI-19* (oral) **Learning Plackett-Luce Mixture from Partial Preferences** [\[PDF\]](#)
Ao Liu, Zhibing Zhao, Chao Liao, Pinyan Lu, and Lirong Xia
- ETRA-19* (oral) **Differential Privacy for Eye-Tracking Data** [\[PDF\]](#)
Ao Liu, Lirong Xia, Andrew Duchowski, Reynold Bailey, Kenneth Holmqvist, and Eakta Jain
- US Patent **Certifiably Robust Interpretation** [\[PDF\]](#)
Ao Liu, Sijia Liu, Bo Wu, Lirong Xia, Qi Cheng Li, and Chuang Gan
- US Patent **Interpretation Maps with Guaranteed Robustness** [\[PDF\]](#)
Ao Liu, Sijia Liu, Abhishek Bhandwaldar, Chuang Gan, Lirong Xia, and Qi Cheng Li
- J. Polym. Sci. B: Polymer Physics* **Simulation of Pulse Responses of Lithium Salt-Doped Poly-Ethyleneoxide** [\[Link\]](#)
Ao Liu, F. Zeng, Y. Hu, S. Lu, W. Dong, X. Li, C. Chang, and D. Guo
- Nano-Micro Letters* **Controlling Ion Conductance and Channels to Achieve Synaptic-like Frequency Selectivity**
Siheng Lu, Fei Zeng, Wenshuai Dong, *Ao Liu*, Xiaojun Li, and Jingting Luo [\[Link\]](#)

Awards and Teaching

- 09/2019 – 05/2022 **RPI-IBM AI Horizon Scholarship**
- 09/2016 – 05/2017 **RPI Presidential Graduate Research Fellowship** [\[Certificate\]](#)
- 01/2023 – 05/2023 **Teaching Assistant** of CSCI 4150: Introduction to AI
- 04/2021 **Guest Lecture** at CSCI 4967/6967: Economics and Computation
- 08/2017 – 12/2017 **Teaching Assistant** of MATH 1020: Calculus II