Ao LIU

Ph.D. in Computer Science

+1 (518) 233-4797
Personal Website
aoliu.cs@gmail.com
Google Scholar

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
Research Focus: *Optics* and *Polymer Physics*

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   **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 accuracy improvement ($\sim 8\%$) *v.s.* state-of-the-art without extra computational resources.
  - Proposed a more accurate model for position bias in recommendation systems. (*user-modeling*)
  - Designed a new machine learning framework based on the proposed position bias model and two-tower model. (*algorithm design, statistics*)
  - Implemented a data pipeline to extract the required features from data. (*C/C++*)
  - Implemented the machine learning framework, tested on Yahoo! dataset and integrated it into Google codebase. (*Python, TensorFlow, GoogleTest*)

08/2018 – 12/2018 and 05/2019 – 08/2019   **Visiting Scholar** at **MIT-IBM Watson AI Lab**   Cambridge, MA
Project: Certifiably Robust Interpretation via Rényi Differential Privacy
- Significant robustness improvement ($\sim 12\%$) plus accuracy improvement *v.s.* state-of-the-art.
  - Yes! We improved both robustness and accuracy at the same time! Note that accuracy and robustness are trade-offs in machine learning.
  - Theoretically connected Rényi differential privacy and interpretation robustness.
  - Designed a new robust algorithm to interpret neural networks for image classifications.
  - Implemented the proposed robust algorithm and tested it on VOC2007 dataset for various properties, including robustness, accuracy, and computational efficiency. (*Python, PyTorch, TorchRay, TensorFlow*)
- Delivered one academic paper (on top AI journal) and two patents.

Skills

Implementation	Programming languages: *Python, C/C++,* MATLAB Tools and platforms: *TensorFlow, PyTorch, TorchRay, LaTeX, GoogleTest*
Design/ Theory	*Algorithm design, Statistics, Time/Sample-complexity analysis, User-modeling, Markov chain Mount-Carlo (MCMC), Differential privacy analysis, Robustness analysis, Model identifiability.*

Review Services

Journal	Information Sciences, TMLR, ACM ToIS, Sankhya B
Conference	NeurIPS (20,21,22&23), ICML (22,23&24), ICLR (23&24), AAAI (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 **Certifiably Robust Interpretation via Rényi Differential Privacy** [**Link**] [**ArXiv**]
Ao Liu, Xiaoyu Chen, Sijia Liu, Lirong Xia, and Chuang Gan
Also in proceedings of **AAAI-23 Journal Track** (oral presentation)

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** [**PDF**]
Zhibing Zhao, _Ao Liu_, and Lirong Xia

JAIR **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

Awards and Teaching

09/2019 – 05/2022 **RPI-IBM AI Horizon Scholarship**
3-year scholarship supported by Rensselaer-IBM Artificial Intelligence Research Collaboration

09/2016 – 05/2017 **RPI Presidential Graduate Research Fellowship**
A One-Year Fellowship for Outstanding Graduate Students [**Certificate**]

Spring 2023 **Teaching Assistant** of **CSCI 4150: Introduction to AI**
Instructor: Lirong Xia

04/2021 **Guest Lecture** at **CSCI 4967/6967: Economics and Computation**
Topic: The Semi-Random Likelihood of Doctrinal Paradoxes

Spring 2023 **Teaching Assistant** of **MATH 1020: Calculus II**
Instructor: David A. Schmidt