MENGFAN XU

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EDUCATION

Northwestern University, United States *Aug. 2018 - Jun. 2024*
Ph.D. in Industrial Engineering and Management Sciences
Dissertation title: "Multi-agent and Multi-objective Multi-armed Bandit"
Advisor: Professor Diego Klabjan

University of Science and Technology of China, China *Jun. 2018*
B.S. in Statistics

Yale University, United States *Sep. 2017*
Summer Research in Biostatistics

RESEARCH INTERESTS

Multi-armed bandits, Statistical learning, Sequential decision making under uncertainty, Reinforcement learning, e-Commerce, Federated learning

RESEARCH EXPERIENCE

Research Assistant, Northwestern University *Apr. 2022 - Present*
Multi-objective Multi-armed Bandit, Paper accepted at ICML 2023
• Established a theoretical lower bound on Pareto regret for multi-objective bandit;
• Proposed a new algorithm and showed its Pareto regret upper bound is optimal
Multi-agent Multi-armed Bandit, Paper accepted at NeurIPS 2023 (spotlight)
• Extended multi-armed bandit algorithms to the framework of federated learning on decentralized multi-agent networks;
• Provided theoretical guarantee for the algorithm and worst-case scenario analyses for the problem
Blockchain-based Multi-armed Bandit, In progress
• Extend multi-armed bandits to the framework of Block chain for secure and efficient communications with privacy preserving on multi-agent networks

Research Assistant, Northwestern University *Jul. 2019 - Nov. 2020*
Multi-armed Bandit & Reinforcement learning, Paper under review
• Established theoretical lower and upper bounds on the regret of unbounded bandits;
• Extended Multi-armed Bandit algorithm to Reinforcement Learning and implemented the new algorithm with parallel computations and distributed GPU on OpenAI and achieve 50% AUC improvement.

Independent Study, Northwestern University *Mar. 2019 - Jun. 2019*
• literature related to rare event simulation and large-deviation theory. Implemented the experiment of rare event simulation with the fixed level algorithm;
• Established the relative error and variance of the algorithm that can explode.

PROFESSIONAL EXPERIENCE

Machine Learning Engineer Intern at LinkedIn *Jun. 2023 - Sep. 2023*
• Developed natural language understanding models and large language models (LLMs) for keywords extraction based on user queries in search AI team;
• Prompt engineering and data mining;
• Developed a workflow and pipeline to ultimately improve users' search experience

Algorithm Engineer at Didi Chuxing *2021*

• Developed two-staged algorithms that achieve over 25% improvement on baselines for pricing of multiple ride options at Didi;
• Developed the very first algorithm with causal forest for model-based route-based pricing of Didi Discount Express and iterated multiple versions with superior performance;
• Built data pipelines with Spark for processing billions of data and advancing feature engineering to support large-scale model training and distributional computations;
• Built a model pipeline for online recommender systems with causal neural networks;
• Conducted research on treatment effect estimation: proving the convergence of GCF for non-parametric DRF, delivering multiple presentations, and completing a paper accepted for oral presentation at KDD 2022

TEACHING EXPERIENCE

Teaching Assistant at Northwestern University
• MLDS-400: Everything starts with data (Fall 2023)
• IEMS-404/MLDS-401: Predictive analytics (Fall 2023)

Teaching Assistant at University of Science and Technology of China
• Real analysis (Spring 2017)
• Functions of complex variables (Fall 2016)

AWARDS AND SCHOLARSHIPS

Walter P. Murphy Graduate Fellowship, Northwestern University *2018 - 2019*

Runner up, Guo Moruo Scholarship, USTC (the highest honor) *2018*

National Scholarship, Chinese Ministry of Education (top 1%) *2017*

National Scholarship, Chinese Ministry of Education (top 1%) *2016*

Mobile Commerce Competition, USTC (top 1) *2016*

Scholarship of Minglong Huang, USTC (top 10%) *2015*

National High School Mathematics Olympiad, Chinese Mathematics Society
The Second Prize in Henan Province *2013*

PUBLICATIONS

M. Xu and D. Klabjan, *Decentralized Randomly Distributed Multi-agent Multi-armed Bandit with Heterogeneous Rewards*. Advances in Neural Information Processing Systems (NeurIPS), New Orleans 2023. [.pdf] [Spotlight; top 3% out of ∼13000 submissions]

M. Xu and D. Klabjan, *Pareto Regret Analyses in Multi-objective Multi-armed Bandit*. International Conference on Machine Learning (ICML), Honolulu, HI 2023. [.pdf]

S. Wan, C. Zheng, Z. Sun, **M. Xu**, X. Yang, H. Zhu, and J. Guo, *GCF: Generalized Causal Forest for Heterogeneous Treatment Effect Estimation in Online Marketplace*. ACM SIGKDD Conference on Knowledge Discovery and Data Mining Workshop (KDD workshop), Washington DC, 2022. [.pdf]

PREPRINTS

M. Xu and D. Klabjan, *Decentralized Blockchain-based Robust Multi-agent Multi-armed Bandit*. 2024. [.pdf]

M. Xu and D. Klabjan, *Regret Bounds and Reinforcement Learning Exploration of EXP-based Algorithms*. 2024. [.pdf]

M. Xu and D. Klabjan, *Regret Lower Bounds in Multi-agent Multi-armed Bandit*. 2023. [.pdf]

PRESENTATIONS

Spotlight Presentation at **NeurIPS 2023**, New Orleans, LA *Dec. 2023*
Decentralized Randomly Distributed Multi-agent Multi-armed Bandit with Heterogeneous Rewards

Oral Presentation at **Informs 2023**, Phoenix, AZ *Oct. 2023*
Multi-agent and Multi-objective Multi-armed Bandit

Oral Presentation at **LinkedIn**, Sunnyvale, California *Sep. 2023*
On natural language understanding and large language models for LinkedIn search recommendation

Poster Presentation at **ICML 2023**, Honolulu, Hawaii *Jul. 2023*
Pareto Regret Analyses in Multi-objective Multi-armed Bandits

Oral Presentation at **LinkedIn**, Virtual *Oct. 2022*
GCF: Generalized Causal Forest for Heterogeneous Treatment Effect Estimation in Online Marketplace

Oral Presentation at **KDD 2022**, Washington DC *Aug. 2022*
GCF: Generalized Causal Forest for Heterogeneous Treatment Effect Estimation in Online Marketplace

Oral Presentation at **Northwestern**, Evanston, IL *Jun. 2019*
Fully Sequential Ranking And Selection Procedures With PAC Guarantee, by Y. Zhong, L.J. Hong

SKILLS

Programming: Python, R, SQL, Scala, C; Linux, Spark, Hadoop, Kubernetes, Pytorch, GCC
Selected taken courses: Statistical learning, Probability theory, Algorithms, Convex optimization, Dynamic optimization, Stochastic analysis, Mathematical statistics, Real analysis, Functional analysis, Complex analysis, Algebra, Bayesian statistics

REFERENCES

Diego Klabjan
Professor of Industrial Engineering and Management Sciences
Director of Master of Science in Machine Learning and Data Science Program
Director of Center for Deep Learning
Department of Industrial Engineering and Management Sciences
McCormick School of Engineering
Northwestern University

Barry Nelson
Walter P. Murphy Professor Emeritus of Industrial Engineering and Management Sciences
Department of Industrial Engineering and Management Sciences
McCormick School of Engineering
Northwestern University

Achal Bassamboo
Charles E. Morrison Professor of Decision Sciences
Professor of Operations, Chair of Operations Department
Co-Director of MMM Program
Kellogg School of Management
Northwestern University

Zhaoran Wang
Assistant Professor of Industrial Engineering and Management Sciences
Assistant Professor of Computer Science (by courtesy)
Department of Industrial Engineering and Management Sciences
McCormick School of Engineering
Northwestern University