# Nuoya Xiong

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## RESEARCH INTEREST

- **Research Interest**: Reinforcement Learning with Human Feedback, Reinforcement Learning Theory, Machine Learning Theory.

## EDUCATION

- **Carnegie Mellon University** — Pittsburgh, PA, United States
  *Machine Learning Department* — *Sep 2024-Present*

- **Tsinghua University** — Beijing, China
  *Institute for Interdisciplinary Information Sciences, Yao Class* — *Sep 2020 - Jun 2024*
- **Grades**: **GPA:** 3.93/4.00 (rank 13 in Yao Class),

## PUBLICATIONS (* stands for equal contribution)

- **Nuoya Xiong**, Zhaoran Wang, Zhuoran Yang. A General Framework for Sequential Decision-Making under Adaptivity Constraints, *ICML 2024*.

- **Nuoya Xiong**, Lijun Ding, Simon S. Du. How Over-Parameterization Slows Down Gradient Descent in Matrix Sensing: The Curses of Symmetry and Initialization, *ICLR 2024 Spotlight*.

- **Nuoya Xiong***, Zhihan Liu*, Zhaoran Wang, Zhuoran Yang. Sample-Efficient Multi-Agent RL: An Optimization Perspective *ICLR 2024*.

- **Nuoya Xiong**, Wei Chen. Combinatorial Pure Exploration of Causal Bandits, *ICLR 2023*.

- **Nuoya Xiong**, Yihan Du, Longbo Huang. Provably Safe Reinforcement Learning with Step-wise Violation Constraints, *NeurIPS 2023*.

- Feng Shi*, **Nuoya Xiong***, Wei Chen. Combinatorial Causal Bandits without Graph Skeleton, *ACML 2024*.

## RESEARCH/WORK EXPERIENCE

- **Ph.D.**
  *Carnegie Mellon University* — *Sep 2024-Present*
  - **Advisor**: Aarti Singh
  - **Research Contents**:
    * Study the preference aggregated in RLHF for Large Language Model.
    * Derive reward-free RLHF algorithm for the multi-group general aggregated feature problem.
    * Establish a feedback paradigm in which the aggregated weight can be learned from the feedback data.

- **Visiting Student**
  *University of Washington* — *Feb 2023 - Aug2023*
  - **Advisor**: Simon S. Du
  - **Research Contents**:
    * Construct the first rigorous polynomial convergence theoretically lower bound of gradient descent on symmetric matrix sensing.
    * Show the gradient descent of asymmetric matrix sensing with imbalance initialization converges linearly with an initialization-dependent rate.
    * Provide a simple and fast algorithm to accelerate the gradient descent.

- **Research Assistant** — Remote
  *Yale University & Northwestern University* — *Sep 2022 - Mar 2023*
  - **Advisor**: Zhuoran Yang, Zhaoran Wang
  - **Research Contents**:
    * Construct the first logarithm switching-cost RL algorithm under general function approximation in theory.
    * Prove the converge results for batch RL learning algorithm under general function approximation in theory.
    * Provide empirical results that show that our low-switching algorithm executes 10 times faster than the previous algorithm.

- **Research Assistant** — Remote

  *Yale University & Northwestern University* — *Mar 2022 - Aug 2023*
  - **Advisor**: Zhuoran Yang, Zhaoran Wang
  - **Research Contents**:
    * Provide a math framework that can learn NE/CCE/CE of general-sum Markov Games for both model-based and model-free RL problems under general function approximation.
    * Propose a math complexity measure that captures the learning hardness of a general-sum Markov Game.

- **Research Assistant**

  *Tsinghua University* — *Sep 2022 - Jan 2023*
  - **Advisor**: Longbo Huang
  - **Research Contents**:
    * Propose a theoretical framework for safe RL that ensures step-wise safety using dynamic programming.
    * Show the tradeoff between constraint violation and the performance guarantee (regret).

- **Intern**

  *Microsoft Asia* — *Feb 2022 - Aug 2022*
  - **Mentor**: Wei Chen
  - **Research Contents**:
    * Propose the first combinatorial pure exploration algorithm of causal bandit that achieves gap-dependent sample complexity.
    * Extend our algorithm to general graphs with hidden variables using the causal inference technique.

## AWARDS

- Tsinghua University Comprehensive Excellence Award (top 10% in Yao Class) - Nov, 2023
- Yao Award (Bronze Metal) (top 9 in Yao Class) - Sep, 2023
- Tsinghua University Academic Excellence Scholarship - May, 2022
- Tsinghua University Comprehensive Excellence Award (top 10 % in Yao Class) - May, 2021
- Tsinghua University Love Reading Scholarship - May, 2021
- China National Mathematical Olympiad gold medal (29th in China) - Nov, 2018
- China National Mathematical Olympiad gold medal (top 60 in China) - Nov, 2019

## SKILLS

- **Language**: Chinese (native language), English (fluent)
- **Programming Languages**: C++, Python, Assembly language
- **Other Skills**: Latex, Github, Pytorch