Yan DAI

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Education

Institute for Interdisciplinary Information Sciences, Tsinghua University 2020 — Present

Special Pilot Class in CS (*a.k.a.* **Yao Class**). GPA: **3.99/4.00** (*selected course grades listed below*).
Bachelor of Engineering in Computer Science and Technology (*expected diploma*).

Research Experiences

Paul G. Allen School of CSE, University of Washington (Seattle, WA, USA) Jun. 2023 — Present

Visiting student hosted by **Prof. Simon S. Du**. **Project Description:** Designing Multi-Agent Reinforcement Learning (MARL) algorithms can be exceedingly challenging when considering prohibitively large state spaces. In this project, we model the vast space via the deployment of linear function approximation and develop the first algorithm that achieves an optimal convergence rate and a logarithmic dependence on the number of actions simutaneously. The manuscript is in preparation.

LIDS, Massachusetts Institute of Technology (Cambridge, MA, USA) Feb. 2023 — May 2023

Visiting student hosted by **Prof. Suvrit Sra**. **Project Description:** In Deep Learning community, the optimizer Sharpness-Aware Minimization (SAM) has recently demonstrated impressive empirical performance, though its theoretical foundations remain incomplete. In this project, we conduct rigorous theoretical analyses and well-designed practical experiments, revealing that the "normalization" plays a pivotal role towards SAM's success. The resulting paper [1] was accepted to **NeurIPS 2023**.

Department of CS, University of Southern California (Remote) Jun. 2022 — Jan. 2023

Remote visitor advised by **Prof. Haipeng Luo**. **Project Description:** Regret minimization in Reinforcement Learning (RL) with Linear Function Approximation has been a challenging problem, especially in the presence of adversarial losses. Previous algorithms only achieved $\tilde{\mathcal{O}}(K^{2/3})$ regret if no more assumptions were made. In contrast, our project develops the first $\tilde{\mathcal{O}}(K^{1/2})$-regret algorithm for Adversarial RL with Linear Function Approximation. The resulting paper [2] was published at **ICML 2023**.

Department of CS, University of Southern California (Remote) Feb. 2022 — May 2022

Remote visitor advised by **Prof. Haipeng Luo**. **Project Description:** Follow-the-Perturbed-Leader (FTPL) is a classic framework in Reinforcement Learning (RL). However, early theoretical attempts of utilizing FTPL in adversarial scenarios led to suboptimal regret. This project revisits this classical framework and surprisingly demonstrates that it can actually achieve near-optimal performance in a wide range of adversarial RL problems. The resulting paper [3] was published at **NeurIPS 2022**.

Paul G. Allen School of CSE, University of Washington (Remote) Nov. 2021 — Mar. 2022

Remote visitor advised by **Prof. Simon S. Du**. **Project Description:** Classical bandit algorithms typically optimize worst-case (i.e., minimax) regret, neglecting the potential for improved performance in benign environments. This study considers sparse linear bandits and introduces a pioneering algorithm that seamlessly bridges the gap between the $\tilde{\mathcal{O}}(\sqrt{dT})$ worst-case regret and $\tilde{\mathcal{O}}(1)$ best-case guarantee, thus adapting to various conditions. The resulting paper [4] was published at **ICLR 2023**.

Inst. for Interdisciplinary Info. Sci., Tsinghua University (Beijing, China) Jun. 2021 — Jan. 2022

Research assistant of **Prof. Longbo Huang**. **Project Description:** In Multi-Armed Bandits (MAB), non-stochasticity is a challenging issue that frequently arises in real-world demands but often eludes classical theoretical frameworks. This project tackles two sophisticated non-stochastic bandits: one facing adversarial losses and unpredictable feedback delays, and the other featuring non-stationary and heavy-tailed reward distributions. The resulting papers [5,6] were published at **ICML 2022 & 2023**.

Publications

(* stands for equal contribution; listed in the order of appearance in Research Experiences)

[1] **(NeurIPS 2023)** Yan Dai*, Kwangjun Ahn*, and Suvrit Sra. "The Crucial Role of Normalization in Sharpness-Aware Minimization." In *Advances in Neural Information Processing Systems 36*. [PDF]

[2] **(ICML 2023)** Yan Dai, Haipeng Luo, Chen-Yu Wei, and Julian Zimmert. "Refined Regret for Adversarial MDPs with Linear Function Approximation." In *Proceedings of the 40th International Conference on Machine Learning*, PMLR 202:6726-6759. [PDF] [Proceeding]

[3] **(NeurIPS 2022)** Yan Dai, Haipeng Luo, and Liyu Chen. "Follow-the-Perturbed-Leader for Adversarial Markov Decision Processes with Bandit Feedback." In *Advances in Neural Information Processing Systems 35*. [PDF] [OpenReview] [Proceeding]

[4] **(ICLR 2023)** Yan Dai, Ruosong Wang, and Simon S. Du. "Variance-Aware Sparse Linear Bandits." In *the Eleventh International Conference on Learning Representations*. [PDF] [OpenReview]

[5] **(ICML 2023)** Jiatai Huang*, Yan Dai*, and Longbo Huang. "Banker Online Mirror Descent: A Universal Approach for Delayed Online Bandit Learning." In *Proceedings of the 40th International Conference on Machine Learning*, PMLR 202:13814-13844. [PDF] [Proceeding]

[6] **(ICML 2022)** Jiatai Huang*, Yan Dai*, and Longbo Huang. "Adaptive Best-of-Both-Worlds Algorithm for Heavy-Tailed Multi-Armed Bandits." In *Proceedings of the 39th International Conference on Machine Learning*, PMLR 162:9173-9200. [PDF] [Proceeding]

Selected Awards and Scholarships

Scholarships

- **Presidential Scholarship** *(top scholarship for Tsinghua undergrads; 10/12000+)*, Tsinghua. Nov. 2023
- Andrew C. Yao Award, Gold Medal *(top scholarship in Yao Class; 1 student)*, IIIS, Tsinghua. Sep. 2023
- National Scholarship *(top scholarship in China; 0.2% domestically)*, Ministry of Education. Dec. 2022
- SenseTime AI Scholarship *(awarded to 30 students in AI research domestically)*, SenseTime. Dec. 2022
- "12·9" Scholarship *(top scholarship for Tsinghua sophomores; 1 student per major)*, Tsinghua. Dec. 2021

Competitive Programming in High School

- Gold Medal *(1st place with perfect score)*, Asia-Pacific Informatics Olympiad (APIO). May 2019
- Gold Medal *(5th place)*, Chinese National Olympiad in Informatics (NOI). Jul. 2018

Miscellaneous

- 2nd Place, National Collegiate Water Polo Championships. Jun. 2021
- 1st Place, Tsinghua Swimming Competition on Men's 100m Butterfly. Nov. 2021
- 1st Place, MIT Intramurals League on Water Polo. Apr. 2023

Invited Academic Talks

"The Crucial Role of Normalization in Sharpness-Aware Minimization."
@ *Conference on Neural Information Processing Systems* **(NeurIPS 2023)**, New Orleans, LA, USA. Dec. 2023

"Refined Regret for Adversarial MDPs with Linear Function Approximation."
@ *National Key Laboratory for Novel Software Technology*, Nanjing University, Jiangsu, China. Sep. 2023
@ *International Conference on Machine Learning* **(ICML 2023)**, Honolulu, HI, USA. Jul. 2023

"Banker Online Mirror Descent: A Universal Approach for Delayed Online Bandit Learning."
@ *International Conference on Machine Learning* **(ICML 2023)**, Honolulu, HI, USA. Jul. 2023

"Variance-Aware Sparse Linear Bandits."
@ *International Conference on Learning Representations* **(ICLR 2023)**, Kigali, Rwanda. May 2023
@ *International Seminar on Foundational Artificial Intelligence* (FAI-Seminar), Online. Apr. 2023
@ *Yao Class Seminar* (for undergrads in Yao Class), Tsinghua University, Beijing, China. Mar. 2023

"Follow-the-Perturbed-Leader for Adversarial Markov Decision Processes with Bandit Feedback."
@ *Conference on Neural Information Processing Systems* **(NeurIPS 2022)**, Online. Dec. 2022

"Adaptive Best-of-Both-Worlds Algorithm for Heavy-Tailed Multi-Armed Bandits."
@ *SparkDay* (for undergrads in Tsinghua University), Tsinghua University, Beijing, China. May 2022

Selected Course Grades

- Game Theory **A+**
- Theory of Computation **A+**
- AI+X Computing Acceleration **A+**
- Computer Architecture **A+**
- Causal and Statistical Learning **A+**
- Linear Algebra **A+**
- Introduction to Computer Science **A+**
- Advanced Computer Graphics **A+**

Professional Services

Conference Reviewing: **ICLR** 2024, **NeurIPS** 2023 & 2022, **ICML** 2023, **ALT** 2023, **AISTATS** 2023 & 2022.