THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

Department of Computing
電子計算學系

RESEARCH SEMINAR

Efficient and Adaptive Reinforcement Learning in Dynamic and Multi-Agent Environments: Theory and Applications

Prof. Shuai LI
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Date : 14 August 2025 (Thu)
Time : 10:30 am - 11:30 am
Venue : PQ703 / Online via Zoom

Abstract

Reinforcement Learning (RL) in dynamic and multi-agent environments poses critical theoretical and practical challenges. These include (i) the difficulty of decomposing complex structured actions, (ii) robust convergence across diverse and non-stationary scenarios, and (iii) balancing individual learning dynamics with multi-agent game-theoretic interactions.

This talk presents a unified framework addressing these challenges through (a) integrating decomposable action structures into agent learning, (b) leveraging statistical optimization techniques for automatic adaptation to environmental variations, and (c) designing equilibrium-aware algorithms for balancing multi-agent learning and strategic interactions.

I will highlight key theoretical contributions from my group, including optimal regret bounds and robust convergence guarantees under complex function approximations. These results, published in top venues such as SODA, COLT, and ICML, have established several state-of-the-art benchmarks. I will also share successful real-world applications: achieving a bronze medal in the International SAT Competition with Huawei's EDA parallel solver, reducing A/B testing durations by 10% in Tencent's WeChat experimentation platform, and lowering privilege restriction rates by 69% (from 6.36 to 1.96 per 1,000) with the same level of risk control capability in Ant Group's Risk Management Platform.

Looking forward, I will outline new directions for developing scalable RL theories and algorithms under dynamic environments with complex function approximation and multi-agent Markov games.

About the Speaker

Prof. Shuai Li is an Associate Professor at the AI School of Shanghai Jiao Tong University, and Deputy Director of the John Hopcroft Center for Computer Science. Her research focuses on reinforcement learning theory and algorithms for autonomous decision-making in dynamic environments, as well as the analysis of diffusion and large language models.

Prof. Li has authored over 90 publications, including papers in SODA, COLT (the first COLT paper from SJTU), ICML, and NeurIPS. Her theoretical contributions include more than 10 results that remain state-of-the-art. She serves as Area Chair or Senior PC member for leading conferences such as ICML, NeurIPS, ACL, IJCAI, AAMAS, and UAI. She was invited to deliver tutorials on multi-agent online learning (AAMAS 2024, IJCAI 2025) and Markov game theory (AAMAS 2025).

Her work has received the AAAI-IAAI Deployed Application Award, Google PhD Fellowship, Huawei Spark Award, Tencent Outstanding Mentor Award, and international recognition in the SAT Competition. Prof. Li's algorithms have been successfully deployed in large-scale industrial systems, significantly improving performance and efficiency. She has mentored students who have won prestigious awards such as the CCF Outstanding PhD Dissertation in Multi-agent Systems, Baidu Scholarship (global top 10), and faculty positions at leading universities.