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Ruiquan Huang

Research Interests

The ultimate goal is to advance machine learning (ML) and develop provable yet practically **efficient and trustworthy** machine learning algorithms and artificial intelligence (AI) agents. Topics include

Reinforcement Learning (RL)	Sample complexity, safe RL, robust RL
Bandits	federated bandits, differential privacy
Optimization	Large-scale Optimization for Machine Learning
Deep Learning	transformer theory, convergence rate, robustness, large language models

Education

Ph.D., Electrical Engineering, The Pennsylvania State University (PSU) **Aug 2020 — Jun 2025 (Expected)**
Master of Science, Applied Mathematics, Columbia University **Aug 2018 — Dec 2019**
Bachelor of Science, Applied Mathematics, University of Science and Technology of China **Aug 2014 — Jun 2018**

Publications (Google Scholar Profile)

[1] Non-asymptotic Convergence of Training Transformers for Next-token Prediction
R. Huang, Y. Liang, J. Yang, accepted by the Conference on Neural Information Processing Systems (NeurIPS), 2024.

[2] Federated Online Prediction from Experts with Differential Privacy: Separations and Regret Speed-ups
F. Gao, **R. Huang**, J. Yang, accepted by the Conference on Neural Information Processing Systems (NeurIPS), 2024.

[3] Provably Efficient UCB-type Algorithms For Learning Predictive State Representations
R. Huang, Y. Liang, J. Yang, accepted by International Conference on Learning Representations(ICLR), 2024. https://arxiv.org/abs/2307.00405

[4] Provable Benefits of Multi-task RL under Non-Markovian Decision Making Processes
R. Huang, Y. Cheng, J. Yang, V. Tan, Y. Liang, accepted by International Conference on Learning Representations(ICLR), 2024. https://arxiv.org/abs/2310.13550

[5] Temporal-Distributed Backdoor Attack Against Video Based Action Recognition
X. Li, S. Wang, **R. Huang**, M. Gowda, G. Kesidis, accepted by 38th AAAI Conference on Artificial Intelligence (AAAI), 2024. https://arxiv.org/abs/2308.11070

[6] Federated Linear Contextual Bandits with User-level Differential Privacy
R. Huang, H. Zhang, M. Hejazinia, L. Melis, M. Shen, J. Yang, accepted by International Conference on Machine Learning (ICML), 2023.

[7] Near-optimal Conservative Exploration in Reinforcement Learning under Episode-wise Constraints
D. Li*, **R. Huang***, C. Shen, J. Yang, accepted by International Conference on Machine Learning (ICML), 2023. (* Equal contribution)

[8] Non-stationary Reinforcement Learning under General Function Approximation
S. Feng, M.Yin, **R. Huang**, Y. Wang, J. Yang, Y. Liang, accepted by International Conference on Machine Learning (ICML), 2023.

[9] FLORAS: Differentially Private Wireless Federated Learning Using Orthogonal Sequences
X. Wei, T. Wang, **R. Huang**, C. Shen, J. Yang, and H. V. Poor, IEEE International Conference on Communications (ICC), May 2023.

[10] Safe Exploration Incurs Nearly No Additional Sample Complexity for Reward-free RL
R. Huang, J. Yang, Y. Liang, The Eleventh International Conference on Learning Representations (ICLR), 2023.

[11] Improved Sample Complexity for Reward-free Reinforcement Learning under Low-rank MDPs
Y. Cheng*, **R. Huang***, J. Yang, Y. Liang, The Eleventh International Conference on Learning Representations (ICLR), 2023. (* Equal contribution)

[12] Federated Linear Contextual Bandits
R. Huang, W. Wu, J. Yang, C. Shen, The 35th Conference on Neural Information Processing Systems (NeurIPS), December 2021.

[13] Cascading Bandits With Two-Level Feedback
D. Cheng*, **R. Huang***, C. Shen and J. Yang, IEEE International Symposium on Information Theory (ISIT), June 2022. (* Equal contribution)

Preprint

[1] Robust Offline Reinforcement Learning for Non-Markovian Decision Processes
R. Huang, Y. Liang, J. Yang, under review, submitted to IEEE Transactions on Information Theory.

[2] How Transformers Learn Regular Language Recognition: A Theoretical Study on Training Dynamics and Implicit Bias
R. Huang, Y. Liang, J. Yang, under review, submitted to the International Conference on Machine Learning (ICML), 2025.

Teaching

Instructor **2023 — 2024**
EDSGN 100: Cornerstone Engineering Design PSU

Teaching Assistant **2017 — 2018**
Calculus USTC

Employment

Machine Learning Research Scientist Intern **Jun 2018 — Jul 2018**
Riemann Information Technology Hefei, China

Awards & Honors

2023 — 2024 Future Faculty Immersive Teaching (FIT) Fellow, PSU;
2024 Melvin P. Bloom Memorial Graduate Fellowship in Electrical Engineering, PSU;
2024 — 2025 Joab and Marly Thomas Graduate Fellowship, PSU.
(The **only** recipient in College of Engineering in the past 3 years.)

SERVICES

Conference Reivewer
NeurIPS (2021-present)
ICML (2022-present)
ICLR (2022-present)
AAAI (2024-present)
AISTATS (2024-present)