

Shangtong Zhang

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RESEARCH INTEREST

The goal of my research is to solve sequential decision making problems in a scalable and reliable way. Currently, I focus on Reinforcement Learning (RL) as a solution method. In particular, I work on stochastic approximations for RL, theories and algorithms of RL, and applications by RL.

ACADEMIC EMPLOYMENTS

Assistant Professor Department of Computer Science University of Virginia, VA, United States	Aug 2022 - Present
Research Scientist Interns Microsoft Research Montreal DeepMind London Microsoft Research Montreal	Jun 2021 - Sep 2021 Feb 2021 - Jun 2021 Jun 2020 - Aug 2020

EDUCATION

Doctor of Philosophy , Computer Science University of Oxford, Oxford, United Kingdom Advisor: Prof. Shimon Whiteson Thesis: Breaking the Deadly Triad in Reinforcement Learning	Oct 2018 - Jul 2022
Master of Science , Computer Science University of Alberta, Edmonton, Canada Advisor: Prof. Richard S. Sutton Thesis: Learning with Artificial Neural Networks	Sep 2016 - Jul 2018
Bachelor of Science , Computing Science Fudan University, Shanghai, China	Sep 2012 - Jul 2016

PUBLICATIONS

Advisees of SZ are underlined; * indicates equal contribution; [†] indicates equal supervision.

Preprints

- (P1) *[Reward Is Enough: LLMs Are In-Context Reinforcement Learners.](#)*
Kefan Song, Amir Moeini, Peng Wang, Lei Gong, Rohan Chandra, Yanjun Qi, **Shangtong Zhang**.

ArXiv Preprint 2025.

- (P2) *Finite Sample Analysis of Linear Temporal Difference Learning with Arbitrary Features.*
Zixuan Xie^{*}, Xinyu Liu^{*}, Rohan Chandra, **Shangdong Zhang**.
ArXiv Preprint 2025.
- (P3) *Experience Replay Addresses Loss of Plasticity in Continual Learning.*
Jiuqi Wang, Rohan Chandra, **Shangdong Zhang**.
ArXiv Preprint, 2025.
- (P4) *GameChat: Multi-LLM Dialogue for Safe, Agile, and Socially Optimal Multi-Agent Navigation in Constrained Environments.*
Vagul Mahadevan, **Shangdong Zhang**, Rohan Chandra.
ArXiv Preprint, 2025.
- (P5) *A Survey of In-Context Reinforcement Learning.*
Amir Moeini, Jiuqi Wang, Jakob Beck, Ethan Blaser, Shimon Whiteson, Rohan Chandra, **Shangdong Zhang**.
ArXiv Preprint, 2025.
- (P6) *Almost Sure Convergence Rates and Concentration of Stochastic Approximation and Reinforcement Learning with Markovian Noise.*
Xiaochi Qian^{*}, Xinyu Liu^{*}, Zixuan Xie^{*}, **Shangdong Zhang**.
ArXiv Preprint, 2024.
- (P7) *Asymptotic and Finite Sample Analysis of Nonexpansive Stochastic Approximations with Markovian Noise.*
Ethan Blaser, **Shangdong Zhang**.
ArXiv Preprint, 2024.
- (P8) *Almost Sure Convergence of Linear Temporal Difference Learning with Arbitrary Features.*
Jiuqi Wang, **Shangdong Zhang**.
ArXiv Preprint, 2024.
- (P9) *AlphaStar Unplugged: Large Scale Offline Reinforcement Learning.*
Michael Mathieu^{*}, Sherjil Ozair^{*}, Srivatsan Srinivasan^{*}, Caglar Gulcehre^{*}, **Shangdong Zhang**^{*}, Ray Jiang^{*}, Tom Le Paine^{*}, Richard Powell, Konrad Zolna, Julian Schrittwieser, David Choi, Petko Georgiev, Daniel Kenji Toyama, Aja Huang, Roman Ring, Igor Babuschkin, Timo Ewalds, Mahyar Bordbar, Sarah Henderson, Sergio Gomez Colmenarejo, Aaron van den Oord, Wojciech M. Czarnecki, Nando de Freitas, Oriol Vinyals.
ArXiv Preprint, 2023

Invited Articles

- (I1) *A New Challenge in Policy Evaluation.*
Shangdong Zhang.
AAAI Conference on Artificial Intelligence (AAAI), 2023
New Faculty Highlights Program.

Refereed Journals

- (J1) *The ODE Method for Stochastic Approximation and Reinforcement Learning with Markovian Noise.*
Shuze Liu, Shuhang Chen, **Shangdong Zhang**.
Journal of Machine Learning Research (JMLR), 2025.
- (J2) *Global Optimality and Finite Sample Analysis of Softmax Off-Policy Actor Critic under State Distribution Mismatch.*
Shangdong Zhang, Remi Tachet des Combes[†], Romain Laroche[‡].
Journal of Machine Learning Research (JMLR), 2022.

- (J3) [*Truncated Emphatic Temporal Difference Methods for Prediction and Control.*](#)
Shangtong Zhang, Shimon Whiteson.
 Journal of Machine Learning Research (**JMLR**), 2022.
- (J4) [*MLPack 3: A Fast, Flexible Machine Learning Library.*](#)
 Ryan Curtin, Marcus Edel, Mikhail Lozhnikov, Yannis Mentekidis, Sumedh Ghaisas, **Shangtong Zhang**
 Journal of Open Source Software (**JOSS**), 2018.

Refereed Conference Papers

- (C1) [*Counterfactual Explanations for Continuous Action Reinforcement Learning.*](#)
 Shuyang Dong, **Shangtong Zhang**, Lu Feng.
 International Joint Conference on Artificial Intelligence (**IJCAI**), 2025
 Acceptance rate: 19.3%
- (C2) [*Towards Large Language Models that Benefit for All: Benchmarking Group Fairness in Reward Models.*](#)
 Kefan Song, Jin Yao, Runnan Jiang, Rohan Chandra, **Shangtong Zhang**.
 Reinforcement Learning Conference (**RLC**), 2025
 Acceptance rate: 39%
- (C3) [*Linear Q-Learning Does Not Diverge in \$L^2\$: Convergence Rates to a Bounded Set.*](#)
 Xinyu Liu*, Zixuan Xie*, **Shangtong Zhang**.
 International Conference on Machine Learning (**ICML**), 2025.
 Acceptance rate: 26.9%
- (C4) [*Transformers Can Learn Temporal Difference Methods for In-Context Reinforcement Learning.*](#)
 Jiuqi Wang*, Ethan Blaser*, Hadi Daneshmand, **Shangtong Zhang**.
 International Conference on Learning Representations (**ICLR**), 2025.
 Acceptance rate: 32.08%.
QuantCo Spotlight Award at the ICML Workshop on In-Context Learning, 2024.
- (C5) [*Revisiting a Design Choice in Gradient Temporal Difference Learning.*](#)
 Xiaochi Qian, **Shangtong Zhang**.
 International Conference on Learning Representations (**ICLR**), 2025.
 Acceptance rate: 32.08%.
- (C6) [*Efficient Policy Evaluation with Safety Constraint for Reinforcement Learning.*](#)
Claire Chen*, Shuze Liu*, **Shangtong Zhang**.
 International Conference on Learning Representations (**ICLR**), 2025.
 Acceptance rate: 32.08%.
- (C7) [*Doubly Optimal Policy Evaluation for Reinforcement Learning.*](#)
Shuze Liu, Claire Chen, **Shangtong Zhang**.
 International Conference on Learning Representations (**ICLR**), 2025.
 Acceptance rate: 32.08%.
- (C8) [*Efficient Multi-Policy Evaluation for Reinforcement Learning.*](#)
Shuze Liu, Claire Chen, **Shangtong Zhang**.
 AAAI Conference on Artificial Intelligence (**AAAI**), 2025.
 Acceptance rate: 23.4%. **Oral presentation (4.6%)**.
- (C9) [*Efficient Policy Evaluation with Offline Data Informed Behavior Policy Design.*](#)
Shuze Liu, **Shangtong Zhang**.
 International Conference on Machine Learning (**ICML**), 2024.
 Acceptance rate: 27.5%
- (C10) [*On the Convergence of SARSA with Linear Function Approximation.*](#)
Shangtong Zhang, Remi Tachet des Combes, Romain Laroche.
 International Conference on Machine Learning (**ICML**), 2023.
 Acceptance rate: 28%

- (C11) *A Deeper Look at Discounting Mismatch in Actor-Critic Algorithms.*
Shangdong Zhang, Romain Laroche, Harm van Seijen, Shimon Whiteson, Remi Tachet des Combes.
 International Conference on Autonomous Agents and Multiagent Systems (**AAMAS**), 2022.
 Acceptance rate: 26%. **Oral presentation.**
- (C12) *Learning Expected Emphatic Traces for Deep RL.*
 Ray Jiang, **Shangdong Zhang**, Veronica Chelu, Adam White, Hado van Hasselt.
 AAAI Conference on Artificial Intelligence (**AAAI**), 2022.
 Acceptance rate: 15%.
- (C13) *Breaking the Deadly Triad with a Target Network.*
Shangdong Zhang, Hengshuai Yao, Shimon Whiteson.
 International Conference on Machine Learning (**ICML**), 2021.
 Acceptance rate: 21.5%.
- (C14) *Average-Reward Off-Policy Policy Evaluation with Function Approximation.*
Shangdong Zhang*, Yi Wan*, Richard S. Sutton, Shimon Whiteson.
 International Conference on Machine Learning (**ICML**), 2021.
 Acceptance rate: 21.5%.
- (C15) *Mean-Variance Policy Iteration for Risk-Averse Reinforcement Learning.*
Shangdong Zhang, Bo Liu, Shimon Whiteson.
 AAAI Conference on Artificial Intelligence (**AAAI**), 2021.
 Acceptance rate: 21.4%.
- (C16) *Learning Retrospective Knowledge with Reverse Reinforcement Learning.*
Shangdong Zhang, Vivek Veeriah, Shimon Whiteson.
 Conference on Neural Information Processing Systems (**NeurIPS**), 2020.
 Acceptance rate: 20.1%.
- (C17) *GradientDICE: Rethinking Generalized Offline Estimation of Stationary Values.*
Shangdong Zhang, Bo Liu, Shimon Whiteson.
 International Conference on Machine Learning (**ICML**), 2020.
 Acceptance rate: 21.8%.
- (C18) *Provably Convergent Two-Timescale Off-Policy Actor-Critic with Function Approximation.*
Shangdong Zhang, Bo Liu, Hengshuai Yao, Shimon Whiteson.
 International Conference on Machine Learning (**ICML**), 2020.
 Acceptance rate: 21.8%.
- (C19) *Deep Residual Reinforcement Learning.*
Shangdong Zhang, Wendelin Boehmer, Shimon Whiteson.
 International Conference on Autonomous Agents and Multiagent Systems (**AAMAS**), 2020.
 Acceptance rate: 23%. **Best Paper Award.**
- (C20) *Mega-Reward: Achieving Human-Level Play without Extrinsic Rewards.*
 Yuhang Song, Jianyi Wang, Thomas Lukasiewicz, Zhenghua Xu, **Shangdong Zhang**, Andrzej Wojcicki, Mai Xu.
 AAAI Conference on Artificial Intelligence (**AAAI**), 2020.
 Acceptance rate: 20.6%.
- (C21) *DAC: The Double Actor-Critic Architecture for Learning Options.*
Shangdong Zhang, Shimon Whiteson.
 Conference on Neural Information Processing Systems (**NeurIPS**), 2019.
 Acceptance rate: 21.2%.
- (C22) *Generalized Off-Policy Actor-Critic.*
Shangdong Zhang, Wendelin Boehmer, Shimon Whiteson.
 Conference on Neural Information Processing Systems (**NeurIPS**), 2019.
 Acceptance rate: 21.2%.

- (C23) [*Distributional Reinforcement Learning for Efficient Exploration.*](#)
Borislav Mavrin, **Shangdong Zhang**, Hengshuai Yao, Linglong Kong, Kaiwen Wu, Yaoliang Yu
International Conference on Machine Learning (**ICML**), 2019.
Acceptance rate: 22.6%.
- (C24) [*ACE: An Actor Ensemble Algorithm for Continuous Control with Tree Search.*](#)
Shangdong Zhang, Hao Chen, Hengshuai Yao.
AAAI Conference on Artificial Intelligence (**AAAI**), 2019.
Acceptance rate: 16.2%. **Spotlight presentation.**
- (C25) [*QUOTA: The Quantile Option Architecture for Reinforcement Learning.*](#)
Shangdong Zhang, Borislav Mavrin, Linglong Kong, Bo Liu, Hengshuai Yao.
AAAI Conference on Artificial Intelligence (**AAAI**), 2019.
Acceptance rate: 16.2%. **Oral presentation.**
- (C26) [*Crossprop: Learning Representations by Stochastic Meta-Gradient Descent in Neural Networks.*](#)
Vivek Veeriah*, **Shangdong Zhang***, Richard S. Sutton.
European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in
Databases (**ECML-PKDD**), 2017.
Acceptance rate: 27.1%.
- (C27) [*A Deep Neural Network for Modeling Music.*](#)
Pengjing Zhang, Xiaoqing Zheng, Wenqiang Zhang, Siyan Li, Sheng Qian,
Wenqi He, **Shangdong Zhang**, Ziyuan Wang
International Conference on Multimedia Retrieval (**ICMR**), 2015.
Acceptance rate: 31%.

Refereed Workshop Papers (Non-Archival)

- (W1) [*CRASH: Challenging Reinforcement-Learning Based Adversarial Scenarios For Safety Hardening.*](#)
Amar Kulkarni, **Shangdong Zhang**, Madhur Behl.
ML for Autonomous Driving Workshop at AAAI, 2025.
- (W2) [*A Deeper Look at Experience Replay.*](#)
Shangdong Zhang, Richard S. Sutton.
Deep RL Symposium at NIPS, 2017.
- (W3) [*Comparing Deep Reinforcement Learning and Evolutionary Methods in Continuous Control.*](#)
Shangdong Zhang, Osmar R. Zaiane
Deep RL Symposium at NIPS, 2017
- (W4) [*A Demon Control Architecture with Off-Policy Learning and Flexible Behavior Policy.*](#)
Shangdong Zhang, Richard S. Sutton.
Hierarchical RL Workshop at NIPS, 2017.

Technical Reports

- (T1) [*Group Fairness in Multi-Task Reinforcement Learning.*](#)
Kefan Song, Runnan Jiang, Rohan Chandra, **Shangdong Zhang**.
ArXiv Preprint, 2025.

GRANTS

[*Enhancing the Security of Large Language Models Against Persuasion-Based Jailbreak Attacks in Multi-Turn Dialogues*](#)

CCI Coastal Virginia Node, **Co-PI**, Total \$60,000, My Share \$20,000

2025 - 2026

[*RAMPART: Reinforcement Against Malicious Penetration by Adversaries in Realistic Topologies.*](#)

DARPA HR001123S0002, Co-PI , Total \$2,150,000, My Share \$77,000.	2023 - 2027
SLES: CRASH: Challenging Reinforcement-Learning Based Adversarial Scenarios for Safety Hardening.	
NSF 2331904, Co-PI , Total \$800,000, My Share \$400,000.	2023 - 2026
III: Small: Moving Offline Learning to Rank Online, from Theory to Practice.	
NSF 2128019, PI , Total \$500,000, My Share \$500,000.	2021 - 2025

HONORS

QuantCo Spotlight Award at the ICML In-Context Learning Workshop, 2024
 Rising Stars in AI by KAUST AI Initiative, 2024
 AAAI New Faculty Highlights, 2023
 IFAAMAS Victor Lesser Dissertation Award (Runner-Up), 2022
 Alf Weaver Junior Faculty Fellowship, UVA, 2022 - 2025
 ICLR Outstanding Reviewer, 2021
 NeurIPS Reviewer Award, 2020
 ICML Reviewer Award, 2020
 AAMAS Best Paper Award, 2020
 Light Senior Scholarship, St Catherine's College, University of Oxford, 2020
 EPSRC Studentship, University of Oxford, 2018 - 2022
 EMC Scholarship, Fudan University, 2014

SERVICES

Organizers

CPS Rising Star Workshop 2024, Co-Chair

Panelists

National Science Foundation (NSF), 2024
 Virginia's Commonwealth Cyber Initiative (CCI), 2024

Meta Meta Reviewer

RL Conference 2025 (Senior Area Chair)

Meta Reviewer

NeurIPS 2025 (Area Chair)
 ICML 2025 (Area Chair)
 ICLR 2024, 2025 (Area Chair)
 L4DC 2025 (Program Committee)
 AAMAS 2025 (Senior Program Committee)
 RL Conference 2024 (Area Chair)
 AISTATS 2024, 2025 (Area Chair)
 ACML 2022, 2023, 2024 (Area Chair)

Reviewer

Transactions on Pattern Analysis and Machine Intelligence (1)
 Transaction of Machine Learning Research (2)
 Journal of Machine Learning Research (3)
 Artificial Intelligence Journal (2)
 Transactions on Intelligent Systems and Technology (2)

IJCAI 2023
 AISTATS 2022
 NeurIPS 2020, 2021, 2022, 2023
 ICML 2020, 2021, 2022, 2023
 AAAI 2020, 2021, 2022, 2023
 ICLR 2021, 2022, 2023
 SIGCOMM 2022
 Offline Reinforcement Learning Workshop at NeurIPS 2020, 2021, 2022
 Deep Reinforcement Learning Workshop at NeurIPS 2019, 2020, 2021, 2022
 Adaptive and Learning Agents Workshop at AAMAS 2019, 2020
 Optimization Foundations for Reinforcement Learning Workshop at NeurIPS 2019
 Reinforcement Learning for Real Life Workshop at ICML 2019, 2021
 Reinforcement Learning for Real Life Workshop at NeurIPS 2022

Conference Session Chair

AAAI 2023, “Reinforcement Learning Theory & Algorithms”

SUPERVISION

Doctral Students

Ethan Blaser, NSF Graduate Research Fellowship	2023 - Now
Jiuqi Wang	2023 - Now
Xinyu Liu	2024 - Now
Zixuan Xie, UVA Provost’s Fellowship, UVA Engineering Distinguished Fellowship	2024 - Now
Amir Moeini	2024 - Now

Alumni with Theses or Publications

Shuze Liu, PhD → Research Scientist at Meta	2022 - 2025
Kefan Song, Master → PhD at UVA	2023 - 2025
Licheng Luo, Master → PhD at UC Riverside	2023 - 2024
Claire Chen, Undergraduate → Undergraduate at Caltech	2023 - 2025
Vikram Ostrander, Undergraduate (DMP thesis) → Software Engineer at Palantir	2024 - 2025
Vagul Mahadevan, Undergraduate (DMP thesis) → Software Engineer at Metron	2023 - 2025
Steve Zhou, Undergraduate (DMP thesis) → Master at MIT	2023 - 2024
Xiaochi Qian, Undergraduate (Oxford) → Quantitative Researcher at Marshall Wace	2022 - 2024

PhD Committees

Fengdi Che (U of Alberta, by Prof. Rupam Mahmood and Prof. Dale Schuurmans)
 Tao Jin (by Prof. Farzad Farnoud)
 Fan Yao (by Prof. Hongning Wang and Prof. Haifeng Xu)
 Ingy ElSayed-Aly (by Prof. Lu Feng)
 Sudhir Shenoy (by Prof. Afsaneh Doryab)
 Chuanhao Li (by Prof. Hongning Wang)

INVITED TALKS

Convergence of Value-Based Reinforcement Learning: Advances and Open Problems

Workshop on Advances in ML Theory, Canada, by Prof. Csaba Szepesvari May 2025

Understanding the Training and Inference of Reinforcement Learning

Tsinghua University, hosted by Prof. Hongning Wang June 2024

On the Cheating of Offline Reinforcement Learning

KAUST Rising Stars in AI Symposium Feb 2024

Offline Reinforcement Learning: Current and Future AAAI New Faculty Highlight Program	Feb 2023
Breaking the Deadly Triad in Off-Policy Reinforcement Learning Department of Computer Science, University of Virginia	Mar 2022
School of Computing Science, Simon Fraser University	Feb 2022
Department of Electrical & Computer Engineering, University of Waterloo	Feb 2022
School of Informatics, University of Edinburgh	Oct 2021
Breaking the Deadly Triad with a Target Network Microsoft Research Summit	Oct 2021
Breaking the Deadly Triad in Reinforcement Learning RL team, DeepMind, hosted by Dr. Hado van Hasselt	Sep 2021
Off-Policy Evaluation Data Fest 2020, Open Data Science	Oct 2020
Off-Policy Evaluation and Control ByteDance AI Lab, Shanghai	Oct 2020
Coding Deep RL Papers NIPS MLTrain Workshop, Long Beach	Dec 2019
Off-Policy Actor-Critic Algorithms Latent Logic LTD, Oxford	Apr 2019

TEACHING

University of Virginia	
CS 6316: Machine Learning	Spring 2024, Spring 2025
CS 4501: Reinforcement Learning	Fall 2024
CS 4501: Optimization	Fall 2023
CS 6501: Topics in Reinforcement Learning	Fall 2022

OPEN SOURCE CODE

GitHub Repo: PyTorch Deep RL A zoo of popular deep RL algorithms in PyTorch with 3k stars .	
GitHub Repo: Reinforcement Learning: An Introduction Python implementation of the book <i>Reinforcement Learning: An Introduction</i> with 13.8k stars .	
Google Summer of Code (GSoC)	
MLPack	2017
The Xapian Project	2014