

Shangtong Zhang

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School of Engineering and Applied Science
University of Virginia
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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 Huawei Noah's Ark Lab Edmonton	Jun 2021 - Sep 2021 Feb 2021 - Jun 2021 Jun 2020 - Aug 2020 May 2018 - Aug 2018

EDUCATION

Doctor of Philosophy , Computer Science University of Oxford, Oxford, United Kingdom Advisor: Prof. Shimon Whiteson	Oct 2018 - Jul 2022
Master of Science , Computer Science University of Alberta, Edmonton, Canada Advisor: Prof. Richard S. Sutton	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) *The ODE Method for Stochastic Approximation and Reinforcement Learning with Markovian Noise.*
Shuze Liu, Shuhang Chen, **Shangtong Zhang**.

arXiv:2401.07844, 2024.
Under review of Journal of Machine Learning Research.

- (P2) *Direct Gradient Temporal Difference Learning*.
Xiaochi Qian, **Shangdong Zhang**.
arXiv:2308.01170, 2023.
Under review of Journal of Machine Learning Research.
- (P3) *StarCraft II 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:2308.03526, 2023
- (P4) *Improving Monte Carlo Evaluation with Offline Data*.
Shuze Liu, **Shangdong Zhang**.
arXiv:2301.13734, 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) *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.
- (J2) *Truncated Emphatic Temporal Difference Methods for Prediction and Control*
Shangdong Zhang, Shimon Whiteson.
Journal of Machine Learning Research (**JMLR**), 2022.
- (J3) *MLPack 3: A Fast, Flexible Machine Learning Library*.
Ryan Curtin, Marcus Edel, Mikhail Lozhnikov, Yannis Mentekidis, Sumedh Ghaisas, **Shangdong
Zhang**
Journal of Open Source Software (**JOSS**), 2018.

Refereed Conference Papers

- (C1) *On the Convergence of SARSA with Linear Function Approximation*.
Shangdong Zhang, Remi Tachet des Combes, Romain Laroche.
International Conference on Machine Learning (**ICML**), 2023.
Acceptance rate: 28%
- (C2) *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%
- (C3) *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%.

- (C4) *Breaking the Deadly Triad with a Target Network*.
Shangtong Zhang, Hengshuai Yao, Shimon Whiteson.
 International Conference on Machine Learning (**ICML**), 2021.
 Acceptance rate: 21.5%.
- (C5) *Average-Reward Off-Policy Policy Evaluation with Function Approximation*.
Shangtong Zhang*, Yi Wan*, Richard S. Sutton, Shimon Whiteson.
 International Conference on Machine Learning (**ICML**), 2021.
 Acceptance rate: 21.5%.
- (C6) *Mean-Variance Policy Iteration for Risk-Averse Reinforcement Learning*.
Shangtong Zhang, Bo Liu, Shimon Whiteson.
 AAAI Conference on Artificial Intelligence (**AAAI**), 2021.
 Acceptance rate: 21.4%.
- (C7) *Learning Retrospective Knowledge with Reverse Reinforcement Learning*.
Shangtong Zhang, Vivek Veeriah, Shimon Whiteson.
 Conference on Neural Information Processing Systems (**NeurIPS**), 2020.
 Acceptance rate: 20.1%.
- (C8) *GradientDICE: Rethinking Generalized Offline Estimation of Stationary Values*.
Shangtong Zhang, Bo Liu, Shimon Whiteson.
 International Conference on Machine Learning (**ICML**), 2020.
 Acceptance rate: 21.8%.
- (C9) *Provably Convergent Two-Timescale Off-Policy Actor-Critic with Function Approximation*.
Shangtong Zhang, Bo Liu, Hengshuai Yao, Shimon Whiteson.
 International Conference on Machine Learning (**ICML**), 2020.
 Acceptance rate: 21.8%.
- (C10) *Deep Residual Reinforcement Learning*.
Shangtong Zhang, Wendelin Boehmer, Shimon Whiteson.
 International Conference on Autonomous Agents and Multiagent Systems (**AAMAS**), 2020.
 Acceptance rate: 23%. **Best Paper Award**.
- (C11) *Mega-Reward: Achieving Human-Level Play without Extrinsic Rewards*.
 Yuhang Song, Jianyi Wang, Thomas Lukasiewicz, Zhenghua Xu, **Shangtong Zhang**, Andrzej Wojcicki, Mai Xu.
 AAAI Conference on Artificial Intelligence (**AAAI**), 2020.
 Acceptance rate: 20.6%.
- (C12) *DAC: The Double Actor-Critic Architecture for Learning Options*.
Shangtong Zhang, Shimon Whiteson.
 Conference on Neural Information Processing Systems (**NeurIPS**), 2019.
 Acceptance rate: 21.2%.
- (C13) *Generalized Off-Policy Actor-Critic*.
Shangtong Zhang, Wendelin Boehmer, Shimon Whiteson.
 Conference on Neural Information Processing Systems (**NeurIPS**), 2019.
 Acceptance rate: 21.2%.
- (C14) *Distributional Reinforcement Learning for Efficient Exploration*.
 Borislav Mavrin, **Shangtong Zhang**, Hengshuai Yao, Linglong Kong, Kaiwen Wu, Yaoliang Yu
 International Conference on Machine Learning (**ICML**), 2019.
 Acceptance rate: 22.6%.
- (C15) *ACE: An Actor Ensemble Algorithm for Continuous Control with Tree Search*.
Shangtong Zhang, Hao Chen, Hengshuai Yao.
 AAAI Conference on Artificial Intelligence (**AAAI**), 2019.
 Acceptance rate: 16.2%.

- (C16) *QUOTA: The Quantile Option Architecture for Reinforcement Learning*.
Shangtong Zhang, Borislav Mavrin, Linglong Kong, Bo Liu, Hengshuai Yao.
 AAAI Conference on Artificial Intelligence (**AAAI**), 2019.
 Acceptance rate: 16.2%.
- (C17) *Crossprop: Learning Representations by Stochastic Meta-Gradient Descent in Neural Networks*.
 Vivek Veeriah*, **Shangtong 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%.
- (C18) *A Deep Neural Network for Modeling Music*.
 Pengjing Zhang, Xiaoqing Zheng, Wenqiang Zhang, Siyan Li, Sheng Qian,
 Wenqi He, **Shangtong Zhang**, Ziyuan Wang
 International Conference on Multimedia Retrieval (**ICMR**), 2015.
 Acceptance rate: 31%.

Refereed Workshop Papers (Non-Archival)

- (W1) *A Deeper Look at Experience Replay*.
Shangtong Zhang, Richard S. Sutton.
 Deep RL Symposium at NIPS, 2017.
- (W2) *Comparing Deep Reinforcement Learning and Evolutionary Methods in Continuous Control*.
Shangtong Zhang, Osmar R. Zaiane
 Deep RL Symposium at NIPS, 2017
- (W3) *A Demon Control Architecture with Off-Policy Learning and Flexible Behavior Policy*.
Shangtong Zhang, Richard S. Sutton.
 Hierarchical RL Workshop at NIPS, 2017.

FUNDING

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 - 2024

HONORS

Rising Stars in AI, 2024¹
 AAAI New Faculty Highlights, 2023
 IFAAMAS Victor Lesser Dissertation Award (Runner-Up), 2022
 Alf Weaver Junior Faculty Fellowship, UVA, 2022
 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

¹by KAUST AI Initiative led by Juergen Schmidhuber

EPSRC Studentship, University of Oxford, 2018
EMC Scholarship, Fudan University, 2014

SERVICES

Organizers

CPS Rising Star Workshop 2024, Co-Chair

Meta Reviewer & Area Chair

RL Conference 2024

ICLR 2024

AISTATS 2024

ACML 2022, 2023, 2024

Reviewer & Program Committee

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 GRFP

2023 - Now

Jiuqi Wang

2023 - Now

Shuze Liu

2022 - Now

Master of Science Students

Kefan Song

2023 - Now

Licheng Luo

2023 - Now

Zhengkun Xiao. Then PhD student at University of Florida

2022 - 2023

Undergraduate Researchers

Xi (Cici) Wang

2023 - Now

Steve Zhou, BA CS Distinguished Major Program	2023 - Now
Pawan Jayakumar	2023 - Now
Ja-Zhua Cheng	2022 - Now

Research Interns

Jiuqi Wang, University of Alberta. Then PhD student at UVA	2022 - 2023
Xiaochi (Joe) Qian, University of Oxford	2022 - Now

PhD Committees

Sudhir Shenoy
 Chuanhao Li
 Kun Yang (Proposal)
 Zeyu Mu (Proposal)
 Ingy ElSayed-Aly (Proposal)
 Matthew Landers (Qualification)
 Amar Kulkarni (Qualification)

INVITED TALKS

Offline Reinforcement Learning: Current and Future

AAAI New Faculty Highlight Program	Feb 2023
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Breaking the Deadly Triad in Off-Policy Reinforcement Learning

Department of Computer Science, University of Virginia	Mar 2022
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School of Computing Science, Simon Fraser University	Feb 2022
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Department of Electrical & Computer Engineering, University of Waterloo	Feb 2022
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School of Informatics, University of Edinburgh	Oct 2021
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Breaking the Deadly Triad with a Target Network

Microsoft Research Summit	Oct 2021
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Breaking the Deadly Triad in Reinforcement Learning

RL team, DeepMind, hosted by Hado van Hasselt	Sep 2021
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Off-Policy Evaluation

Data Fest 2020, Open Data Science	Oct 2020
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Off-Policy Evaluation and Control

ByteDance AI Lab, Shanghai	Oct 2020
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Coding Deep RL Papers

NIPS MLTrain Workshop, Long Beach	Dec 2019
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Off-Policy Actor-Critic Algorithms

Latent Logic LTD, Oxford	Apr 2019
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TEACHING

University of Virginia

CS 6316: Machine Learning	Spring 2024
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CS 4501: Optimization	Fall 2023
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CS 6501: Topics in Reinforcement Learning	Fall 2022
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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 *Reinforcement Learning: An Introduction* with **13.8k stars**.

Google Summer of Code (GSoC)

MLPack

2017

The Xapian Project

2014