

# 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

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

## EDUCATION

<b>Doctor of Philosophy</b> , Computer Science University of Oxford, Oxford, United Kingdom Advisor: Prof. Shimon Whiteson	Oct 2018 - Jul 2022
<b>Master of Science</b> , Computer Science University of Alberta, Edmonton, Canada Advisor: Prof. Richard S. Sutton	Sep 2016 - Jul 2018
<b>Bachelor of Science</b> , 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<sup>†</sup>, Romain Laroche<sup>‡</sup>.  
 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*.  
**Shangdong 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.*  
**Shangdong 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.*  
**Shangdong Zhang**, Bo Liu, Shimon Whiteson.  
AAAI Conference on Artificial Intelligence (**AAAI**), 2021.  
Acceptance rate: 21.4%.
- (C7) *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%.
- (C8) *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%.
- (C9) *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%.
- (C10) *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.**
- (C11) *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%.
- (C12) *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%.
- (C13) *Generalized Off-Policy Actor-Critic.*  
**Shangdong 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, **Shangdong 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.*  
**Shangdong 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.*  
**Shangdong 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\*, **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%.

(C18) *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) *A Deeper Look at Experience Replay.*

**Shangdong Zhang**, Richard S. Sutton.

Deep RL Symposium at NIPS, 2017.

(W2) *Comparing Deep Reinforcement Learning and Evolutionary Methods in Continuous Control.*

**Shangdong Zhang**, Osmar R. Zaiane

Deep RL Symposium at NIPS, 2017

(W3) *A Demon Control Architecture with Off-Policy Learning and Flexible Behavior Policy.*

**Shangdong 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, 2024<sup>1</sup>

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

EPSRC Studentship, University of Oxford, 2018

EMC Scholarship, Fudan University, 2014

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<sup>1</sup>by KAUST AI Initiative led by Juergen Schmidhuber

## 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  
Xiaochi (Joe) Qian, University of Oxford

2022 - 2023  
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

**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 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  
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 *Reinforcement Learning: An Introduction* with **13.8k stars**.

**Google Summer of Code (GSoC)**  
MLPack  
The Xapian Project

2017  
2014