Tongzhou Wang

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Education

Massachusetts Institute of Technology
Ph.D. in Computer Science — *2019 - 2024 (expected)*
- Advisors: Antonio Torralba, Phillip Isola

University of California, Berkeley
B.A. in Computer Science and Statistics — *2013 - 2017*
- Advisors: Stuart J. Russell, Ren Ng, Alexei A. Efros

Employments

Simons Institute for the Theory of Computing
Long-Term Visitor — *2024*
- Summer Cluster: AI, Psychology, and Neuroscience.

Facebook AI Research (FAIR)
Research Intern — *2021*
- Mentor: Yuandong Tian. Minimal world model for reinforcement learning. Paper published in ICML 2022.

Facebook AI Research (FAIR)
Full-time Engineer — *2017 - 2019*
- Built `PyTorch`, a leading software framework for deep learning. Data pipelines, autograd, machine learning operators, *etc*.

Research Interests

Learning world representations for generalist agents.

I am interested in learning structured representations that aggregate and select information about the world from various data sources, improve multi-task training, and enable autonomous adaptation to new tasks.

Featured Publications

(* indicates equal contribution)

The Platonic Representation Hypothesis
Minyoung Huh*, Brian Cheung*, **Tongzhou Wang***, Phillip Isola* — *2024*
International Conference on Machine Learning 2024 [ICML 2024 (Position Paper)]

Optimal Goal-Reaching Reinforcement Learning via Quasimetric Learning
Tongzhou Wang, Antonio Torralba, Phillip Isola, Amy Zhang — *2023*
International Conference on Machine Learning 2023 [ICML 2023]

Denoised MDPs: Learning World Models Better Than the World Itself
Tongzhou Wang, Simon S. Du, Antonio Torralba, Phillip Isola, Amy Zhang, Yuandong Tian — *2022*
International Conference on Machine Learning 2022 [ICML 2022]

Understanding Contrastive Representation Learning through Alignment and Uniformity on the Hypersphere
Tongzhou Wang, Phillip Isola — *2020*
International Conference on Machine Learning 2020 [ICML 2020].

Dataset Distillation
Tongzhou Wang, Jun-Yan Zhu, Antonio Torralba, Alexei A. Efros — *2018*

Learning to See by Looking at Noise
Manel Baradad*, Jonas Wulff*, **Tongzhou Wang**, Phillip Isola, Antonio Torralba — *2021*
Advances in Neural Information Processing Systems 2021 [NeurIPS 2021]

Invited Talks

Reinforcement Learning as Representation Learning
UC Berkeley — *May 2024*

Structured Representations for Active Agents
Stanford Vision and Learning Lab, Stanford University — *November 2023*
Guest Lecture, University of Sounthern California — *November 2023*

Quasimetric Reinforcement Learning

Brown University	*November 2023*
AI Seminar, Carnegie Mellon University	*October 2023*
Vector Institute for Artificial Intelligence	*September 2023*
Deep Learning: Classics and Trends (DLCT)	*June 2023*
Machine Learning Advances Symposium, Massachusetts Institute of Technology	*May 2023*
University of Texas, Austin	*April 2023*
Northeastern University	*April 2023*

Technical Talks on PyTorch Internals

PyTorch Developer Conference, San Francisco, CA, USA	*October 2019*
Global Mobile Internet Conference, Beijing, China	*April 2018*

Mentoring

Massachusetts Institute of Technology

Adrian Rodriguez Munoz (Ph.D. student)	*Spring 2024 - PRESENT*
Hyojin Bahng (Ph.D. student)	*Summer 2023 - PRESENT*
David X. Wu (B.S. & M.S. '22; now Ph.D. student at UC Berkeley)	*Summer & Fall 2021*
Jingwei Ma (B.S. & M.S. '21; now Ph.D. student at University of Washington)	*2019 - 2022*
Steven Liu (B.S. & M.S. '21; now at TwoSigma)	*2019 - 2020*

Carnegie Mellon University

George Cazenavette (M.S. '22; now Ph.D. student at MIT)	*2021 - 2023*

Summer Geometry Initiative (SGI)

Daniel Perazzo (master student at IMPA, Brazil)	*Summer 2023 - PRESENT*
Biruk Abere (B.S. student at University of Gondar, Ethiopia)	*Summer 2023*
Gabriele Dominici (master student at University of Cambridge, UK)	*Summer 2023*
Sana Arastehfar (master student at Queen's University, Canada)	*Summer 2023*
Sanowar Raihan (research assistant at Center for Computational & Data Sciences, Bangladesh)	*Summer 2023*

Teaching

6.S898: Deep Learning, *Massachusetts Institute of Technology* — *Fall 2022*
Teaching Assistant (Co-Designed Curriculum and Assignments for 1st Undergraduate Offering)

Professional Development Course on Deep Learning, *Massachusetts Institute of Technology* — *Summer 2019*
Lab Session Instructor

Deep Learning Tutoring — *Spring & Summer 2023*
Volunteer Tutoring for a Data Science Professional in Boston, MA, USA

Deep Learning with PyTorch — *Spring 2018*
Tutorial and Lab Session Instructor (200-300 participants) at Global Mobile Internet Conference, Beijing, China

Middle-School Mathematics and English — *Summer 2011*
Volunteer Teaching for Low-Income Students in Northwestern China

Services

Reviewer ICML 2020-2024, NeurIPS 2020-2023, ICLR 2022, RLC 2024, CVPR 2021, TMLR, TPAMI, GCRL Workshop 2023.

Workshop Organizer Goal-Conditioned Reinforcement Learning (GCRL) Workshop at NeurIPS 2023.
The First Dataset Distillation Challenge at ECCV 2024.

Open-Source Projects

(104k stars on GitHub combined over projects that I made significant contributions to)

`PyTorch` Framework for Hardware-Accelerated Machine Learning and Scientific Computing — *2017-2020*
Data loading pipelines, CUDA/CPU kernels, ML ops, API design, autograd optimization, Python bindings, etc.

CycleGAN and pix2pix in PyTorch — *2018-PRESENT*
Popular repository for image-to-image translation

torchreparam *2019-2020*
One of the first toolkits to reparametrize neural nets; now a core part of the large-scale training framework **fairscale**

torchqmet *2022-PRESENT*
The first toolkit for parametrizing quasimetric functions in deep learning

Honors and Awards

Meta Ph.D. Fellowship Finalist *2023*

Outstanding Reviewer for ICML 2022 *2022*

Top Reviewer for ICML 2020 *2020*

Merrill Lynch Graduate Fellowship *2019*

UC Berkeley High Distinction in General Scholarship *2017*

Best Summer Social Practice of Shanghai for my volunteer teaching in northwestern China *2011*

Software Engineering Experiences

Airbnb, Inc. *2016*
Machine Learning Infrastructure

Facebook, Inc. *2015*
Ads API Platform

Grue, Inc. *2015*
Co-Founder

Publications (Complete List)

(* indicates equal contribution)

The Platonic Representation Hypothesis
Minyoung Huh*, Brian Cheung*, **Tongzhou Wang***, Phillip Isola* *2024*
- International Conference on Machine Learning 2024 [ICML 2024 (Position Paper)]
- Code Webpage arXiv

Optimal Goal-Reaching Reinforcement Learning via Quasimetric Learning
Tongzhou Wang, Antonio Torralba, Phillip Isola, Amy Zhang *2023*
- International Conference on Machine Learning 2023 [ICML 2023].
- Code Webpage arXiv

Generalizing Dataset Distillation via Deep Generative Prior
George Cazenavette, **Tongzhou Wang**, Antonio Torralba, Alexei A. Efros, Jun-Yan Zhu *2023*
- Conference on Computer Vision and Pattern Recognition 2023 [CVPR 2023].
- Code Webpage arXiv

Deep Augmentation: Enhancing Self-Supervised Learning through Transformations in Higher Activation Space
Rickard Brüel-Gabrielsson, **Tongzhou Wang**, Manel Baradad, Justin Solomon *2023*
- arXiv

Steerable Equivariant Representation Learning
Sangnie Bhardwaj, Willie McClinton, **Tongzhou Wang**, Guillaume Lajoie, Chen Sun, Phillip Isola, Dilip Krishnan *2023*
- arXiv

Improved Representation of Asymmetrical Distances with Interval Quasimetric Embeddings
Tongzhou Wang, Phillip Isola *2022*
- Workshop on Symmetry and Geometry in Neural Representations at NeurIPS 2022 [NeurReps Workshop at NeurIPS 2022].
- PyTorch Package for Quasimetric Learning Webpage OpenReview arXiv

Procedural Image Programs for Representation Learning
Manel Baradad, Chun-Fu Chen, Jonas Wulff, **Tongzhou Wang**, Rogerio Feris, Antonio Torralba, Phillip Isola *2022*
- Advances in Neural Information Processing Systems 2022 [NeurIPS 2022].
- Code & Datasets Webpage OpenReview arXiv

Denoised MDPs: Learning World Models Better Than the World Itself

Tongzhou Wang, Simon S. Du, Antonio Torralba, Phillip Isola, Amy Zhang, Yuandong Tian *2022*

- International Conference on Machine Learning 2022 [ICML 2022].
- Code Webpage arXiv

On the Learning and Learnability of Quasimetrics

Tongzhou Wang, Phillip Isola *2022*

- International Conference on Learning Representations 2022 [ICLR 2022].
- Code Webpage OpenReview arXiv

Dataset Distillation by Matching Training Trajectories

George Cazenavette, **Tongzhou Wang**, Antonio Torralba, Alexei A. Efros, Jun-Yan Zhu *2022*

- Conference on Computer Vision and Pattern Recognition 2022 [CVPR 2022].
- Code Webpage arXiv

Wearable ImageNet: Synthesizing Tileable Textures via Dataset Distillation

George Cazenavette, **Tongzhou Wang**, Antonio Torralba, Alexei A. Efros, Jun-Yan Zhu *2022*

- 5th Workshop on Computer Vision for Fashion, Art, and Design at CVPR 2022 [CVFAD Workshop at CVPR 2022].
- Code Webpage Paper

Totems: Physical Objects for Verifying Visual Integrity

Jingwei Ma, Lucy Chai, Minyoung Huh, **Tongzhou Wang**, Ser-Nam Lim, Phillip Isola, Antonio Torralba *2022*

- European Conference on Computer Vision 2022 [ECCV 2022].
- Code Webpage arXiv

Learning to See by Looking at Noise

Manel Baradad*, Jonas Wulff*, **Tongzhou Wang**, Phillip Isola, Antonio Torralba *2021*

- Advances in Neural Information Processing Systems 2021 [NeurIPS 2021].
- Code & Datasets Webpage arXiv

Understanding Contrastive Representation Learning through Alignment and Uniformity on the Hypersphere

Tongzhou Wang, Phillip Isola *2020*

- International Conference on Machine Learning 2020 [ICML 2020].
- Code Webpage arXiv

Rewriting a Deep Generative Model

David Bau, Steven Liu, **Tongzhou Wang**, Jun-Yan Zhu, Antonio Torralba *2020*

- European Conference on Computer Vision 2020 [ECCV 2020].
- Code Webpage arXiv

Diverse Image Generation via Self-Conditioned GANs

Steven Liu, **Tongzhou Wang**, David Bau, Jun-Yan Zhu, Antonio Torralba *2020*

- Conference on Computer Vision and Pattern Recognition 2020 [CVPR 2020].
- Code Webpage arXiv

Dataset Distillation

Tongzhou Wang, Jun-Yan Zhu, Antonio Torralba, Alexei A. Efros *2018*

- Code Webpage arXiv

Meta-Learning MCMC Proposals

Tongzhou Wang, Yi Wu, David A. Moore, Stuart J. Russell *2017*

- Advances in Neural Information Processing Systems 2018 [NeurIPS 2018].
- Automatic Machine Learning Workshop at ICML 2017 (Oral) [AutoML Workshop at ICML 2017 (Oral)].
- arXiv

Learning to Synthesize a 4D RGBD Light Field from a Single Image

Pratul Srinivasan, **Tongzhou Wang**, Ashwin Sreelal, Ravi Ramamoorthi, Ren Ng *2017*

- International Conference on Computer Vision 2017 [ICCV 2017].
- Code arXiv