Tongzhou Wang

✉ tongzhou@mit.edu | ⌂ tongzhouwang.info | Google Scholar | ssnl

EDUCATION

Massachusetts Institute of Technology

Ph.D. in Computer Science   *2019 - 2024*
- Advisors: Antonio Torralba, Phillip Isola
- Thesis: Intelligent Agents via Representation Learning

Massachusetts Institute of Technology

M.S. in Computer Science   *2019 - 2022*
- Advisors: Antonio Torralba, Phillip Isola
- Thesis: Geometric Properties of Learned Representations

University of California, Berkeley

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

EXPERIENCES

Simons Institute for the Theory of Computing

Long-Term Visitor   *2024*
- Summer Cluster: AI, Psychology, and Neuroscience.

Facebook AI Research (FAIR), Meta Platforms, Inc.

Part-Time Student Researcher   *2021*
- Mentor: Yuandong Tian. Minimal world model for reinforcement learning. Paper published in ICML 2022.

Facebook AI Research (FAIR), Meta Platforms, Inc.

Research Intern (FAIR)   *2021*
- Mentor: Yuandong Tian. Research on world model for reinforcement learning.

Facebook AI Research (FAIR), Meta Platforms, Inc.

Software Engineer   *2017 - 2019*
- Built `PyTorch`, a leading software framework for deep learning. Works on data pipelines, autograd, ML 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
Simons Institute   *June 2024*
UC Berkeley   *May 2024*

Structured Representations for Active Agents
Stanford Vision and Learning Lab (SVL), Stanford University   *November 2023*
Guest Lecture, USC   *November 2023*

Quasimetric Reinforcement Learning
Brown University   *November 2023*
AI Seminar, CMU   *October 2023*
Vector Institute   *September 2023*
Deep Learning: Classics and Trends (DLCT)   *June 2023*
Machine Learning Advances Symposium, MIT   *May 2023*
UT 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, *MIT*   *Fall 2022*
Teaching Assistant (Co-Designed Curriculum and Assignments for 1st Undergraduate Offering)

Professional Development Course on Deep Learning, *MIT*   *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 ——————— (106k stars on GitHub combined over projects that I made significant contributions to)

`PyTorch` *2017-2020*
Core dev on ata loading pipelines, CUDA/CPU kernels, ML ops, API design, autograd optimization, Python bindings, etc.

CycleGAN and pix2pix in PyTorch *2018-PRESENT*
Maintainer for image-to-image translation toolkit

`torchreparam` *2019-2020*
Built one of the first tools to reparametrize neural nets; now part of the large-scale SFDP training framework `fairscale`

`torchqmet` *2022-PRESENT*
Built the first toolkit for learning quasimetrics with neural nets

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*

OTHER ENGINEERING EXPERIENCES

Airbnb, Inc. *2016*
Intern on Machine Learning Infrastructure

Facebook, Inc. *2015*
Intern on Ads API Platform

Grue, Inc. *2015*
Co-Founder

Sellegit, Inc. *2014*
Intern on Mobile App Development

PUBLICATIONS (COMPLETE LIST) ——————————————— (* indicates equal contribution)

A Framework for Evaluating the Efficacy of Foundation Embedding Models in Healthcare
Sonnet Xu, Haiwen Gui, Veronica Rotemberg, <u>Tongzhou Wang</u>, Yiqun Chen, Roxana Daneshjou *2024*
- ⎘ <u>medRxiv</u>

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

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

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

Deep Augmentation: Enhancing Self-Supervised Learning through Transformations in Higher Activation Space

Rickard Brüel-Gabrielsson, <u>Tongzhou Wang</u>, Manel Baradad, Justin Solomon *2023*

- ⬏ <u>arXiv</u>

Steerable Equivariant Representation Learning

Sangnie Bhardwaj, Willie McClinton, <u>Tongzhou Wang</u>, Guillaume Lajoie, Chen Sun, Phillip Isola, Dilip Krishnan *2023*

- ⬏ <u>arXiv</u>

Improved Representation of Asymmetrical Distances with Interval Quasimetric Embeddings

<u>Tongzhou Wang</u>, Phillip Isola *2022*

- Workshop on Symmetry and Geometry in Neural Representations at NeurIPS 2022 [`NeurReps Workshop at NeurIPS 2022`].
- ⬏ <u>PyTorch Package for Quasimetric Learning</u> <u>Webpage</u> <u>OpenReview</u> <u>arXiv</u>

Procedural Image Programs for Representation Learning

Manel Baradad, Chun-Fu Chen, Jonas Wulff, <u>Tongzhou Wang</u>, Rogerio Feris, Antonio Torralba, Phillip Isola *2022*

- Advances in Neural Information Processing Systems 2022 [`NeurIPS 2022`].
- ⬏ <u>Code & Datasets</u> <u>Webpage</u> <u>OpenReview</u> <u>arXiv</u>

Denoised MDPs: Learning World Models Better Than the World Itself

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

- International Conference on Machine Learning 2022 [`ICML 2022`].
- ⬏ <u>Code</u> <u>Webpage</u> <u>arXiv</u>

On the Learning and Learnability of Quasimetrics

<u>Tongzhou Wang</u>, Phillip Isola *2022*

- International Conference on Learning Representations 2022 [`ICLR 2022`].
- ⬏ <u>Code</u> <u>Webpage</u> <u>OpenReview</u> <u>arXiv</u>

Dataset Distillation by Matching Training Trajectories

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

- Conference on Computer Vision and Pattern Recognition 2022 [`CVPR 2022`].
- ⬏ <u>Code</u> <u>Webpage</u> <u>arXiv</u>

Wearable ImageNet: Synthesizing Tileable Textures via Dataset Distillation

George Cazenavette, <u>Tongzhou Wang</u>, 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`].
- ⬏ <u>Code</u> <u>Webpage</u> <u>Paper</u>

Totems: Physical Objects for Verifying Visual Integrity

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

- European Conference on Computer Vision 2022 [`ECCV 2022`].
- ⬏ <u>Code</u> <u>Webpage</u> <u>arXiv</u>

Learning to See by Looking at Noise

Manel Baradad*, Jonas Wulff*, <u>Tongzhou Wang</u>, Phillip Isola, Antonio Torralba *2021*

- Advances in Neural Information Processing Systems 2021 [`NeurIPS 2021`].
- ⬏ <u>Code & Datasets</u> <u>Webpage</u> <u>arXiv</u>

Understanding Contrastive Representation Learning through Alignment and Uniformity on the Hypersphere

<u>Tongzhou Wang</u>, Phillip Isola *2020*

- International Conference on Machine Learning 2020 [`ICML 2020`].
- ⬏ <u>Code</u> <u>Webpage</u> <u>arXiv</u>

Rewriting a Deep Generative Model

David Bau, Steven Liu, <u>Tongzhou Wang</u>, Jun-Yan Zhu, Antonio Torralba *2020*

- European Conference on Computer Vision 2020 [`ECCV 2020`].
- ⬏ <u>Code</u> <u>Webpage</u> <u>arXiv</u>

Diverse Image Generation via Self-Conditioned GANs

Steven Liu, <u>Tongzhou Wang</u>, David Bau, Jun-Yan Zhu, Antonio Torralba *2020*

- Conference on Computer Vision and Pattern Recognition 2020 [`CVPR 2020`].
- ⬏ <u>Code</u> <u>Webpage</u> <u>arXiv</u>

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