Dhruv Shah

Contact Information

Department of ECE, Princeton University
41 Olden Street
Princeton, NJ
USA 08544

Webpage: ece.princeton.edu/people/shahd
E-Mail: shahd@princeton.edu
Phone: +1 (510) 590 6348
Google Scholar

Education

University of California, Berkeley 2019 – 2024
M.S. & Ph.D. in Electrical Engineering & Computer Science
Advisor: Prof. Sergey Levine; GPA: 4.0/4.0

Indian Institute of Technology, Bombay 2015 – 2019
B.Tech. (with Honors) in Electrical Engineering; GPA: 9.54/10

Appointments

Princeton University
Visiting Research Scholar & Incoming Assistant Professor of ECE

Google DeepMind
Senior Research Scientist of Robotics

Honors and Awards

Microsoft Future Leader in Robotics & AI 2024
Best Conference Paper Award × 2, Intl. Conference on Robotics & Automation (ICRA) 2024
Best Student Paper Award (Finalist) × 2, –"– 2024
Best Paper Award in Cognitive Robotics (Finalist), –"– 2024
Best Paper Award in Robot Manipulation (Finalist), –"– 2024
Best Systems Paper Award (Finalist), Robotics: Science and Systems (RSS) 2022
Berkeley Fellowship, UC Berkeley (<0.2% of graduate applicants) 2019–24
National Academy of Engineering Award (INAE), India ×2 2019 & 2018

Refereed Publications

[1] **Extreme Cross-Embodiment Learning for Manipulation and Navigation**
Robotics: Science and Systems (RSS) 2024
Berkeley DeepDrive Workshop 2024 (Invited Talk)
J. Yang, C. Glossop, A. Bhorkar, ***Dhruv Shah***, Q. Vuong, C. Finn, D. Sadigh, S. Levine

[2] **GOAT: GO to Any Thing**
Robotics: Science and Systems (RSS) 2024
T. Gervet†, M. Chang†, M. Khanna†, S. Yenamandra†, ***Dhruv Shah***, T. Min, C. Paxton, D. Batra, R. Mottaghi, D. S. Chaplot, J. Malik

[3] **NoMaD: Goal Masked Diffusion Policies for Navigation and Exploration**
International Conference on Robotics and Automation (ICRA) 2024
Best Conference Paper Award (0.05%)
Best Student Paper Award (Finalist, 0.2%)
Best Paper Award in Cognitive Robotics (Finalist, 0.1%)
NeurIPS 2023 Workshop on Foundation Models for Decision-Making (Oral Presentation)

CoRL 2023 Workshop on Pre-Training for Robot Learning (Oral Presentation)
Ajay Sridhar, ***Dhruv Shah***, Catherine Glossop, Sergey Levine

[4] **Open X-Embodiment: Robotic Learning Datasets and RT-X Models**
International Conference on Robotics and Automation (ICRA) 2024
Best Conference Paper Award (0.05%)
Best Student Paper Award (Finalist, 0.2%)
Best Paper Award in Robot Manipulation (Finalist, 0.1%)
CoRL 2023 Workshop Towards Generalist Robots (Oral Presentation)
Open X-Embodiment Collaboration

[5] **Grounded Decoding: Guiding Text Generation with Grounded Models for Robot Control**
Advances in Neural Information Processing Systems (NeurIPS) 2023
W. Huang, F. Xia, ***Dhruv Shah***, D. Driess, A. Zeng, Y. Lu, P. Florence, I. Mordatch, S. Levine, K. Hausman, B. Ichter

[6] **SACSoN: Scalable Autonomous Data Collection for Social Navigation**
IEEE Robotics and Automation Letters (RA-L) 2023
Conference on Robot Learning (CoRL) 2023 (Live Demo)
IROS 2023 Workshop on Social Robot Navigation (Spotlight Presentation)
Noriaki Hirose, ***Dhruv Shah***, Ajay Sridhar, Sergey Levine

[7] **ViNT: A Foundation Model for Visual Navigation**
Conference on Robot Learning (CoRL) 2023 (Oral Presentation & Live Demo, 6.6%)
BayLearn Machine Learning Symposium 2023 (Oral Presentation, <8%)
Dhruv Shah†, A. Sridhar†, N. Dashora†, K. Stachowicz, K. Black, N. Hirose, S. Levine

[8] **Navigation with Large Language Models: Semantic Guesswork as a Heuristic for Planning**
Conference on Robot Learning (CoRL) 2023
Dhruv Shah†, Michael Equi†, Blazej Osinski, Fei Xia, Brian Ichter, Sergey Levine

[9] **FastRLAP: A System for Learning High-Speed Driving via Deep RL and Autonomous Practicing**
Conference on Robot Learning (CoRL) 2023
Kyle Stachowicz†, ***Dhruv Shah***†, Arjun Bhorkar†, Ilya Kostrikov, Sergey Levine

[10] **HomeRobot: An Open Source Software Stack for Mobile Manipulation Research**
AAAI Fall Symposium: Unifying Representations for Robot Application Dev. 2023
C. Paxton, A. Wang, B. Shah, B. Matulevich, ***Dhruv Shah***, K. Yadav, S. Ramakrishnan, S. Yenamandra, Y. Bisk

[11] **GNM: A General Navigation Model to Drive Any Robot**
International Conference on Robotics and Automation (ICRA) 2023
Dhruv Shah†, Ajay Sridhar†, Arjun Bhorkar, Noriaki Hirose, Sergey Levine

[12] **ExAug: Robot-Conditioned Navigation Policies via Geometric Experience Augmentation**
International Conference on Robotics and Automation (ICRA) 2023
Noriaki Hirose, ***Dhruv Shah***, Ajay Sridhar, Sergey Levine

[13] **Learning Robotic Navigation from Experience: Principles, Methods, and Recent Results**

Philosophical Transactions of the Royal Society of London: B 2022 (Invited Paper)
Sergey Levine, ***Dhruv Shah***

[14] **Offline Reinforcement Learning for Visual Navigation**
Conference on Robot Learning (CoRL) 2022 (Oral Presentation, 6.5%)
Dhruv Shah†, A. Bhorkar†, H. Leen, I. Kostrikov, N. Rhinehart, S. Levine

[15] **LM-Nav: Robotic Navigation with Large Pre-Trained Models of Language, Vision, and Action**
Conference on Robot Learning (CoRL) 2022
BayLearn Machine Learning Symposium 2022 (Oral Presentation, <8%)
Dhruv Shah†, Blazej Osinski†, Brian Ichter, Sergey Levine

[16] **ViKiNG: Vision-Based Kilometer-Scale Navigation with Geographic Hints**
Robotics: Science and Systems (RSS) 2022 (Oral Presentation)
Best Systems Paper Award (Finalist, <2%)
Dhruv Shah, Sergey Levine

[17] **Value Function Spaces: Skill-Centric State Abstractions for Long-Horizon Reasoning**
International Conference on Learning Representations (ICLR) 2022
Dhruv Shah, Peng Xu, Yao Lu, Ted Xiao, Alex Toshev, Sergey Levine, Brian Ichter

[18] **Hybrid Imitative Planning with Geometric and Predictive Costs for Off-road Environments**
International Conference on Robotics and Automation (ICRA) 2022
N. Dashora†, D. Shin†, ***Dhruv Shah***, H. Leopold, D. Fan, A. Agha, N. Rhinehart, S. Levine

[19] **Rapid Exploration for Open-World Navigation with Latent Goal Models**
Conference on Robot Learning (CoRL) 2021 (Oral Presentation, 6.5%)
ICLR 2021 Workshop on Never-Ending Reinforcement Learning (Oral Presentation)
Dhruv Shah, Benjamin Eysenbach, Nicholas Rhinehart, Sergey Levine

[20] **ViNG: Learning Open-World Navigation with Visual Goals**
International Conference on Robotics and Automation (ICRA) 2021
Dhruv Shah, Benjamin Eysenbach, Gregory Kahn, Nicholas Rhinehart, Sergey Levine

[21] **Aerial Manipulation Using Hybrid Force and Position NMPC Applied to Aerial Writing**
Robotics: Science and Systems (RSS) 2020
D. Tzoumanikas, F. Graule, Q. Yan, ***Dhruv Shah***, M. Popovic, S. Leutenegger

[22] **The Ingredients of Real World Robotic Reinforcement Learning**
International Conference on Learning Representations (ICLR) 2020 (Spotlight Presentation, 4.1%)
H. Zhu†, J. Yu†, A. Gupta†, ***Dhruv Shah***, K. Hartikainen, A. Singh, V. Kumar, S. Levine

[23] **Swarm Aggregation without Communication and Global Positioning**
IEEE Robotics and Automation Letters (RA-L) 2019
International Conference on Robotics and Automation (ICRA) 2019
Dhruv Shah, Leena Vachhani

[24] **Projection Design for Compressive Source Separation using Mean Errors and Cross-Validation**
International Conference on Image Processing (ICIP) 2019
Dhruv Shah, Ajit Rajwade

[25] **Designing Constrained Projections for Compressed Sensing: Mean Errors and Anomalies with Coherence**
Global Conference on Signal and Information Processing (GlobalSIP) 2018
Dhruv Shah†, Alankar Kotwal†, Ajit Rajwade

† *Equal Contribution*

Invited Talks

Guiding Robotic Planning with Large Pre-Trained Models

Invited Speaker, VLM3 Workshop @ ICRA 2024	May 2024

The Foundation Model Path to Open-World Robots

EECS 598 Guest Lecture, University of Michigan	April 2024
Microsoft Invited Speaker, University of Maryland	April 2024
Department Seminar, Columbia University	April 2024
–"–, Purdue University	April 2024
–"–, Massachusetts Institute of Technology	March 2024
–"–, Princeton University	March 2024
–"–, University of California, San Diego	March 2024
–"–, University of California, Los Angeles	February 2024
–"–, University of California, Berkeley	February 2024
–"–, University of Michigan	February 2024

Learning General-Purpose Robot Navigation

Invited Speaker, ML4AD Workshop @ NeurIPS 2023	December 2023
AirLab Seminar, Carnegie Mellon University	November 2023
Bay Area Robotics Symposium	October 2023
MILA Robot Learning Seminar, Universite de Montreal	September 2023
Bay Area Machine Learning Symposium	October 2023
Seminar Series, Vayu Robotics	July 2023
ARL DCIST PI Meeting, University of Pennsylvania	June 2023

Intuitive Interfaces for Learning from Offline Data

Bay Area Robotics Symposium	October 2022
Scientific Speaker Series, Wayve	September 2022

Kilometer-Scale Navigation with Geographic Hints

ML Seminar, Toyota Research Institute	March 2022
RACER Seminar, NASA Jet Propulsion Laboratory	March 2022
Berkeley Deep Drive Seminar, UC Berkeley	February 2022

Skill-Centric State Abstractions for Planning

Google Brain/DeepMind Open Research Talks	November 2021

Learning to Explore Open-World Environments

Google Brain/DeepMind Open Research Talks	November 2021

Press Coverage

GOAT: GO to Any Thing — November 2023
MarkTechPost, ITinAI (Singapore)

Open X-Embodiment: Robotic Learning Datasets and RT-X Models — October 2023
MIT Tech Review, IEEE Spectrum, VentureBeat, Tech Times,

Synced Review (Canada), TechForge (UK), Analytics India Magazine (India)

FastRLAP: A System for Learning High-Speed Driving May 2023
TechXplore, SyncedReview (Canada), MarkTechPost, TechEBlog

GNM: A General Navigation Model to Drive Any Robot December 2022
MarkTechPost

LM-Nav: Robotic Navigation with Large, Pre-Trained Models August 2022
Two Minute Papers, Utmel (Hong Kong)

ViKiNG: Kilometer-Scale Exploration in the Real World March 2022
IEEE Spectrum, ZDNet, Wevoler (Netherlands)

DARPA RACER (JPL/UC Berkeley/MIT/GeorgiaTech) January 2022
IEEE Spectrum, Caltech News, DARPA News, The Defense Post

RECON: Rapid Exploration with Latent Goal Models December 2021
RSIP Vision (Israel)

Blog Posts

Scaling up Learning Across Many Different Robot Types October 2023
Google DeepMind Blog

Extracting Skill-Centric State Abstractions from Value Functions April 2022
Google AI Blog

Learning to Explore the Real World with a Ground Robot November 2021
Berkeley AI Research (BAIR) Blog

The Ingredients of Real World Robotic Reinforcement Learning April 2020
Berkeley AI Research (BAIR) Blog

Research Mentoring

I have had the fortune of working with and mentoring some fantastic student collaborators.

Undergraduate & Masters Students

Ajay Sridhar (2022–, BS @ UC Berkeley; NSF GRFP, CRA Finalist) → *PhD @ Stanford CS*
Nitish Dashora (2020–23, BS @ UC Berkeley; NSF GRFP, Astronaut Sch.) → *PhD @ MIT EECS*
Michael Equi (2022–23, BS @ UC Berkeley) → *Research Eng. @ Physical Intelligence*
Hrish Leen (2022–, BS/MS @ UC Berkeley) → *PhD @ Georgia Tech Robotics*
Arjun Bhorkar (2021–, BS/MS @ UC Berkeley; Siebel Scholar) → *Research Eng. @ Bloomberg*
Chongyi Zheng (2023, MS @ CMU) → *PhD @ Princeton CS*

PhD Students

Jonathan Yang (Stanford University; Summer 2023–Present)
Hongbo Zhang (Chinese University of Hong Kong; Spring 2023–Present)
Catherine Glossop (UC Berkeley; Fall 2023–Present)
Kyle Stachowicz (UC Berkeley; Fall 2022–Present)
Blazej Osinski (University of Warsaw; Spring 2022–Spring 2023)

Service

Area Chair, International Conference on Robotics & Automation (ICRA) 2024 – Present

Workshop Organization

3rd Workshop on Language and Robot Learning @ CoRL 2024
Morphology-Aware Policy and Design Learning Workshop @ CoRL 2024
The Earth Rover Challenge @ IROS 2024
6th Workshop on Robot Learning @ NeurIPS 2023 (Lead Organizer)

2nd Workshop on Language and Robot Learning @ CoRL 2023 (Lead Organizer)
2nd Workshop on Learning from Diverse, Offline Data @ ICRA 2023
1st Workshop on Language and Robot Learning @ CoRL 2022 (Lead Organizer)
1st Workshop on Learning from Diverse, Offline Data @ RSS 2022

Peer Review

Robotics — CoRL, RSS, RA-L, ICRA, T-RO, AuRo, IROS, ISRR, Humanoids, IJRR
Machine Learning — ICLR, NeurIPS, ICML
Computer Vision — T-PAMI