Nicholas Rhinehart

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Current Position

University of Toronto, Institute for Aerospace Studies, affiliated with the Robotics Institute — Jul 2024 – Present
Assistant Professor

Education

Carnegie Mellon University, The Robotics Institute of the School of Computer Science — Aug 2014 – Sep 2019
Doctor of Philosophy in Robotics
Adviser: Kris Kitani

Carnegie Mellon University, The Robotics Institute of the School of Computer Science — Jan 2013 – Aug 2014
Master of Science in Robotics
Adviser: Drew Bagnell

Swarthmore College — Aug 2008 – May 2012
Bachelor of Arts in Computer Science, Bachelor of Science in Engineering

Professional Experience

University of Toronto, Institute for Aerospace Studies, affiliated with the Robotics Institute — Jul 2024 – Present
Assistant Professor

Waymo Research, Waymo, Alphabet — Nov 2022 – Jun 2024
Senior Research Scientist

University of California, Berkeley, EECS Department, Berkeley A.I. Research (BAIR) — Oct 2019 – Sep 2022
Postdoctoral Scholar with Sergey Levine

University of California, Berkeley, EECS Department, Berkeley A.I. Research (BAIR) — Jun 2018 – Nov 2018
Visiting Researcher with Sergey Levine

NEC Labs America, Media Analytics Department — May 2017 – Sep 2017
Research Assistant with Paul Vernaza

Uber Advanced Technologies Group — Jun 2016 – Sep 2016
Research Engineer with Drew Bagnell

University of Tokyo, Institute of Industrial Science — Jun 2015 – July 2015
Visiting Researcher with Kris Kitani

Carnegie Mellon University, The Robotics Institute of the School of Computer Science — Aug 2014 – Sep 2019
Doctoral Student Researcher with Kris Kitani

Carnegie Mellon University, The Robotics Institute of the School of Computer Science — Jan 2013 – Aug 2014
Master's Student Researcher with Drew Bagnell

Academic Awards

PAPER AWARDS

Best Paper Award, ICML 2019 Workshop on AI for Autonomous Driving 2019

For the paper: PRECOG (Rhinehart et al.)

Best Paper Award Honorable Mention, ICCV 2017 2017

For the paper: First-Person Activity Forecasting (Rhinehart et al.). Awarded to 3 of 2,143 submissions.

FELLOWSHIP AWARDS

PhD Fellowship, Center for Machine Learning and Health 2018

Awarded full tuition and funds for *Automatic Forecasting and Understanding of Behavior* research proposal

IBM PhD Fellowship Finalist 2017

Nominated as one of three CMU Robotics Institute candidates for the IBM PhD Fellowship

The Robert E., Elizabeth, and Walter Lamb Scholarship, Swarthmore College 2011, 2012

Awarded scholarships on the bases of academic merit and financial need.

PROFESSIONAL SERVICE AWARDS

Top Reviewer Award (x4) 2019, 2019, 2021, 2021

NeurIPS 2021 · ICML 2021 · NeurIPS 2019 · ICCV 2019

Recognized for contributions to the reviewing process.

Funding Awards

Toyota Research Institute, Co-Investigator. 2021–2024

$1,125,000 to study "Unified Predictive Representations for Multi-agent Modeling, Tracking, Forecasting, and Control".

Fellowship, CMU Center for Machine Learning and Health. 2019

$85,000 (tuition, stipend, and discretionary funds) to study "Automatic Forecasting and Understanding of Behavior".

Travel Grant (x5): NeurIPS (x2), CMU Provost (x2), ICRA {2018, 2015}, {2017, 2016}, 2017

Financial conference travel support.

Hardware Grant: NVIDIA 2014

Granted GPU.

Publications

CONFERENCE AND JOURNAL PUBLICATIONS

[1] CARFF: Conditional Auto-encoded Radiance Field for 3D Scene Forecasting

J. Yang, K. Desai, C. Packer, H. Bhatia, **N. Rhinehart**, R. McAllister, J. Gonzalez

European Conference on Computer Vision (**ECCV**), 2024.

[2] The Waymo Open Sim Agents Challenge

N. Montali, J. Lambert, P. Mougin, A. Kuefler, **N. Rhinehart**, M. Li, C. Gulino, T. Emrich, Z. Yang, S. Whiteson, B. White,
D. Anguelov

Neural Information Processing Systems (**NeurIPS**), 2023.

[3] Offline Reinforcement Learning for Customizable Visual Navigation

D. Shah, A. Bhorkar, H. Leen, I. Kostrikov, **N. Rhinehart**, S. Levine

Conference on Robot Learning (**CoRL**), 2022.

[4] Is Anyone There? Learning a Planner Contingent on Perceptual Uncertainty
C. Packer, **N. Rhinehart**, R. McAllister, M. A. Wright, X. Wang, J. He, S. Levine, J. E. Gonzalez
Conference on Robot Learning (**CoRL**), 2022.

[5] S2Net: Stochastic Sequential Pointcloud Forecasting
X. Weng, J. Nan, K. Lee, R. McAllister, A. Gaidon, **N. Rhinehart**, K. Kitani.
European Conference on Computer Vision (**ECCV**), 2022.

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

[7] Information is Power: Intrinsic Control via Information Capture
N. Rhinehart, J. Wang, G. Berseth, JD Co-Reyes, D. Hafner, C. Finn, S. Levine
Neural Information Processing Systems (**NeurIPS**), 2021.

[8] RECON: Rapid Exploration for Open-World Navigation with Latent Goal Models
D. Shah, B. Eysenbach, **N. Rhinehart**, S. Levine
Oral Presentation, Conference on Robot Learning (**CoRL**), 2021.

[9] Contingencies from Observations: Tractable Contingency Planning with Learned Behavior Models
N. Rhinehart*, J. He*, C. Packer, M. A. Wright, R. McAllister, J. E. Gonzalez, S. Levine
International Conference on Robotics and Automation (**ICRA**), 2021.

[10] ViNG: Learning Open-World Navigation with Visual Goals
D. Shah, B. Eysenbach, G. Kahn, **N. Rhinehart**, S. Levine
International Conference on Robotics and Automation (**ICRA**), 2021.

[11] Parrot: Data-Driven Behavioral Priors for Reinforcement Learning
A. Singh*, H. Liu*, G. Zhou, A. Yu, **N. Rhinehart**, S. Levine
Oral Presentation, International Conference on Learning Representations (**ICLR**), 2021.

[12] SMiRL: Surprise Minimizing RL in Dynamic Environments
G. Berseth, D. Geng, C. Devin, **N. Rhinehart**, C. Finn, D. Jayaraman, S. Levine
Oral Presentation, International Conference on Learning Representations (**ICLR**), 2021.

[13] Conservative Safety Critics for Exploration
H. Bharadhwaj, A. Kumar, **N. Rhinehart**, S. Levine, F. Shkurti, A. Garg
International Conference on Learning Representations (**ICLR**), 2021.

[14] Inverting the Forecasting Pipeline with SPF2: Sequential Pointcloud Forecasting for Sequential Pose Forecasting
X. Weng, J. Wang, S. Levine, K. Kitani, **N. Rhinehart**
Conference on Robot Learning (**CoRL**), 2020.

[15] Can Autonomous Vehicles Identify, Recover From, and Adapt to Distribution Shifts?
A. Filos*, P. Tigas*, R. McAllister, **N. Rhinehart**, S. Levine, Y. Gal
International Conference of Machine Learning (**ICML**), 2020.

[16] Generative Hybrid Representations for Activity Forecasting with No-Regret Learning
J. Guan, Y. Yuan, K. M. Kitani, **N. Rhinehart**
Oral Presentation, Computer Vision and Pattern Recognition (**CVPR**), 2020.

[17] Deep Imitative Models for Flexible Inference, Planning, and Control
N. Rhinehart, R. McAllister, S. Levine
International Conference on Learning Representations (**ICLR**), 2020.

[18] PRECOG: PREdiction Conditioned On Goals in Visual Multi-Agent Settings
N. Rhinehart, R. McAllister, K. M. Kitani, S. Levine
IEEE International Conference on Computer Vision (**ICCV**), 2019.

[19] Directed-Info GAIL: Learning Hierarchical Policies from Unsegmented Demonstrations using Directed Information
M. Sharma, A. Sharma, **N. Rhinehart**, K. M. Kitani
International Conference on Learning Representations (**ICLR**), 2019.

[20] First-Person Activity Forecasting from Video with Online Inverse Reinforcement Learning
N. Rhinehart, K. M. Kitani.
IEEE Transactions on Pattern Analysis and Machine Intelligence (**TPAMI**), 2018.

[21] R2P2: A ReparameteRized Pushforward Policy for Diverse, Precise Generative Path Forecasting
N. Rhinehart, K. M. Kitani, P. Vernaza
European Conference on Computer Vision (**ECCV**), 2018.

[22] Learning Neural Parsers with Deterministic Differentiable Imitation Learning
T. Shankar, **N. Rhinehart**, K. Muelling, K. M. Kitani
Conference on Robot Learning (**CoRL**), 2018.

[23] Human-Interactive Subgoal Supervision for Efficient Inverse Reinforcement Learning
X. Pan, E. Ohn-Bar, **N. Rhinehart**, Y. Xu, Y. Shen, K. M. Kitani
International Conference on Autonomous Agents and Multiagent Systems (**AAMAS**), 2018.

[24] N2N Learning: Network to Network Compression via Policy Gradient Reinforcement Learning
A. Ashok, **N. Rhinehart**, F. Beainy, K. M. Kitani
International Conference on Learning Representations (**ICLR**), 2018.

[25] Predictive-State Decoders: Encoding the Future into Recurrent Networks
A. Venkatraman*, **N. Rhinehart***, W. Sun, L. Pinto, M. Hebert, B. Boots, K. M. Kitani, J. A. Bagnell
Neural Information Processing Systems (**NeurIPS**), 2017.

[26] First-Person Activity Forecasting with Online Inverse Reinforcement Learning
N. Rhinehart, K. M. Kitani.
Oral Presentation, IEEE International Conference on Computer Vision (**ICCV**), 2017.
Best Paper Award Honorable Mention. Awarded to 3 of 2,143 submissions

[27] Learning Action Maps of Large Environments via First-Person Vision
N. Rhinehart, K. M. Kitani
Computer Vision and Pattern Recognition (**CVPR**), 2016.

[28] Visual Chunking: A List Prediction Framework for Region-Based Object Detection
N. Rhinehart, J. Zhou, M. Hebert, J. A. Bagnell
International Conference on Robotics and Automation (**ICRA**), 2015.

Pre-Prints

[29] Imitative Models for Passenger-Scale Autonomous Off-Road Driving
N. Dashora, S. Jung, V. Ibars, O. Lerner, C. Jung, D. Shah, **Nicholas Rhinehart**, R. Thakker, S. Levine, A. Agha-mohammadi
In Submission, 2022.

[30] Explore and Control with Adversarial Surprise
A. Fickinger*, N. Jaques*, S. Parajuli, M. Chang, **N. Rhinehart**, G. Berseth, S. Russell, S. Levine
arXiv, 2021.

Patents

[31] Generative Adversarial Inverse Trajectory Optimization for Probabilistic Vehicle Forecasting
P. Vernaza, W. Choi, **N. Rhinehart**
US10739773B2, 2017.

[32] Traffic prediction with reparameterized pushforward policy for autonomous vehicles
P. Vernaza, **N. Rhinehart**
US11189171B2, 2019.

[33] Balancing diversity and precision of generative models with complementary density estimators
P. Vernaza, **N. Rhinehart**, A. Liu, Kihyuk Sohn
US11049265B2, 2019.

Academic & Professional Presentations

Invited Conference and Workshop Talks

NeurIPS 2022, Machine Learning for Autonomous Driving, New Orleans, LA, USA, Dec 2022

IROS 2022, Behavior-driven Autonomous Driving in Unstructured Environments, Kyoto, Japan [Remote], October 2022

ICRA 2021, Long-term Human Motion Prediction, Xi'an, China [Remote], Jun 2021

CVPR 2020, Precognition: Seeing through the Future, Seattle, Washington [Remote], Jun 2020

ICCV 2019, Workshop on Autonomous Driving - Beyond Single Frame Prediction, Seoul, South Korea, Oct 2019

ACCV 2018, Attention/Intention Understanding Workshop, Perth, Australia, Dec 2018

CVPR 2018, Tutorial on Inverse RL for Computer Vision, Organizer and Speaker, Salt Lake City, Utah, Jun 2018

CVPR 2018, Tutorial on Human Activity Forecasting, Salt Lake City, Utah, Jun 2018

Contributed Conference and Workshop Talks

ICLR 2021, Oral Paper Presentation of SMiRL (non-speaking), Vienna, Austria [Remote]	May 2021
ICLR 2021, Oral Paper Presentation PARROT (non-speaking), Vienna, Austria [Remote]	May 2021
CVPR 2020, Oral Paper Presentation (Last author, non-speaking), Seattle, Washington [Remote]	Jun 2020
Baylearn 2019, Single-Track Oral Paper Presentation, San Francisco, California	Oct 2019
NeurIPS 2018, Infer2Control: Probabilistic RL and Structured Control Workshop, Montreal, Canada	Dec 2018
NeurIPS 2018, ML for Intelligent Transportation Systems Workshop, Montreal, Canada	Dec 2018
ICCV 2017, Single-Track Oral Paper Presentation, Venice, Italy	Oct 2017
MACV 2016, Mid-Atlantic Computer Vision Workshop, Baltimore, Maryland	May 2016

Invited University Talks

The University of Toronto Robotics Institute, Toronto, Canada	June 2022
McGill University, Department of Electrical Engineering, Digital	March 2022
Stanford University, Stanford Vision and Learning Lab, Digital	Jan 2022
U.C. Berkeley, Berkeley Artificial Intelligence Research Lab Seminar, Berkeley, California	Jan 2022
Applied RL Seminar, Digital	Dec 2020
U.C. Berkeley, Berkeley Deep Drive Group, Berkeley, California	Aug 2018
U.C. Berkeley, RAIL Lab, Berkeley, California	Jun 2018
The University of Tokyo IIS, Sato Laboratory, Tokyo, Japan	Jun 2015
CMU, Misc-Read Vision Group, Pittsburgh, PA	Nov 2015

Invited Industry Talks

Apple, Cupertino, California [Remote]	June 2022
Uber ATG, Toronto, Canada [Remote]	Oct 2020

Scale AI, San Francisco, California	Oct 2019
Tesla, Palo Alto, California	Oct 2019
Argo AI, Pittsburgh, Pennsylvania	Jul 2019
iSee, Pittsburgh, Pennsylvania	May 2019
Zoox, San Francisco, California	Jan 2019
Google Waymo, Mountain View, California	Nov 2018
NEC Labs America, Cupertino, California	Jun 2017

Panels

ICCV 2019, Workshop on Autonomous Driving - Beyond Single Frame Prediction, Seoul, South Korea	Oct 2019

Guest Lectures

CMU, Guest Lecture in Statistical Techniques of Robotics, Pittsburgh, Pennsylvania	May 2019
CMU, Guest Lecture in Deep RL and Control (10-703), Pittsburgh, Pennsylvania	Nov 2018
CMU, Introduction to Computer Vision, Guest Lecture, Pittsburgh, Pennsylvania	Apr 2018
CMU, Graduate Statistical Techniques in Robotics, Guest Lecture, Pittsburgh, Pennsylvania	Apr 2018
CMU, Graduate Statistical Techniques in Robotics, Guest Lecture, Pittsburgh, Pennsylvania	Sep 2017

Academic Activity & Service

Research Mentoring

Graduate students

Charles Packer (UC Berkeley PhD student). Co-authored ICRA '21 paper, CoRL '22 submission.	2020–2022
Dhruv Shah (UC Berkeley PhD student). Co-authored ICRA '21, '22; CoRL '21 paper, '22 submission.	2020–2022
Panos Tigas (Oxford PhD student). Co-authored ICML '20 paper.	2019–2022
Xinshuo Weng (CMU RI PhD → NVIDIA research). Co-authored CoRL '20, ECCV '22, and NeurIPS '22 submission	2019–2022
Angelos Filos (Oxford PhD student). Co-authored ICML '20 paper.	2019–2020
Tanmay Shankar (CMU MS RI → FAIR). Co-authored CORL '18 paper.	2018
Arjun Sharma (CMU MS RI → Vicarious). Co-authored ICLR '19 paper.	2018
Mohit Sharma (CMU MS RI → PhD at CMU). Co-authored ICLR '19 paper.	2018
Anubhav Ashok (CMU MS CV → Niantic). Co-authored ICLR '18 paper.	2017
Xinlei Pan (UC Berkeley PhD → Waymo). Co-authored AAMAS '18 paper.	2017

Undergraduate students

Hrish Leen (UC Berkeley). Co-authored CoRL '22 submission with Hrish.	2022–2022
Arjun Bhorkar (UC Berkeley). Co-authored CoRL '22 submission with Arjun.	2022–2022
Nitish Dashora (UC Berkeley). Co-authored ICRA '22 paper with Nitish.	2021–2022
Daniel Shin (UC Berkeley). Co-authored ICRA '22 paper with Daniel.	2021
Jenny Wang (UC Berkeley → CMU PhD). Co-authored NeurIPS '21 paper with Jenny.	2020–2022
Jeff He (UC Berkeley → MS at Stanford). Co-authored ICRA '21 paper with Jeff.	2020–2021
Huihan Liu (UC Berkeley → PhD at UT Austin). Co-authored ICLR '21 paper with Huihan.	2020 – 2021
Jiaqi Guan (Tsinghua University → PhD at UIUC). Last-authored CVPR '20 paper (Oral) with Jiaqi.	2018 – 2019

Teaching

Teaching Assistance

Geometry-based Methods in Vision (16-822), CMU.	Fall 2016
Data Structures and Algorithms (CPSC 035), Swarthmore College.	Fall 2011
Data Structures and Algorithms (CPSC 035), Swarthmore College.	Spring 2011
Introduction to Computer Science (CPSC 021), Swarthmore College.	Spring 2010

Tutoring

Fundamentals of Digital Systems (ENGR 015, CS 038), Swarthmore College	Fall 2011
Grade 6–12 Mathematics and Physics	Spring 2009 – Spring 2012

Professional Service

Organizer

ICRA '22 Workshop on Fresh Perspectives on the Future of Autonomous Driving	2022
NeurIPS '21 Workshop on Machine Learning for Autonomous Driving	2021
NeurIPS '20 Workshop on Machine Learning for Autonomous Driving	2020
NeurIPS '19 Workshop on Machine Learning for Autonomous Driving	2019
ICML '19 Workshop on Imitation, Intent, and Interaction (I3)	2019
CVPR '18 Tutorial on Inverse RL for Computer Vision [recording has >5,000 views]	2018

Area Chair

NeurIPS '24	2024
NeurIPS '23	2023

Conference and Journal Reviewing

CoRL '22, CVPR '22, ICML '22, NeurIPS '22, NeurIPS '22 workshop proposals, TMLR '22	2022
CoRL '21, CVPR '21, ICCV '21, ICLR '21, ICML '21, ICRA '21, NeurIPS '21, RA-L '21	2021
CoRL '20, ICLR '20, ICML '20, ICRA '20, ECCV '20, HRI '20, JAIR '20, NeurIPS '20, TPAMI '20	2020
BMVC '19, CVPR '19, ICML '19, ICCV '19, ICRA '19, NeurIPS '19, TPAMI '19, IJCV '19	2019
CVPR '18, ECCV '18, IJCV '18, IJRR '18, IROS '18	2018
CVPR '17, ICCV '17	2017
CVPR '16	2016

Workshop Reviewing

Omitted for concision. Available upon request.

University Service

BAIR Undergraduate Mentoring, UC Berkeley	2020
Mentored undergraduates from underrepresented groups to foster participation in AI research	
Ph.D. Admissions Committee, CMU Robotics Institute	2017
Evaluated Ph.D. applications as part of small committee	
M.S. Admissions Committee, CMU Robotics Institute	2015, 2016
Evaluated M.S. applications as part of small committee	
Robotics Institute Representative, CMU Graduate Student Association	2015 – 2017
Represented and liaised between Robotics graduate students and the Graduate Student Assembly	
Co-Chair, Swarthmore Philanthropy Council	2011 – 2012
Assist in coordinating alumni fundraising efforts	
Class Treasurer, Swarthmore College	2011 – Present
Manage the collective finances of the Class of 2012	

Thesis Committees

M.S. Robotics, CMU

Tanmay Shankar, Learning Neural Parsers with Deterministic Differentiable Imitation Learning	2018
Arjun Sharma, Integrating Structure with Deep Reinforcement and Imitation Learning	2018
Mohit Sharma, Inverse Reinforcement Learning with Conditional Choice Probabilities	2018