

# Roy Fox

Assistant Professor, UC Irvine

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## Appointment

2019–current **Assistant Professor**, *Intelligent Dynamics Lab (indylab)*, Department of Computer Science, University of California, Irvine.

## Research Interests

Reinforcement learning ▪ Dynamical systems ▪ Information theory ▪ Robotics

## Education

- 2016 **PhD**, *School of Computer Science and Engineering*, Hebrew University.  
Advisor: Prof. Naftali Tishby  
Thesis: Information-Theoretic Methods for Planning and Learning in Partially Observable Markov Decision Processes [↗](#)
- 2008 **MSc**, *Computer Science Department*, Technion IIT.  
Advisor: Prof. Moshe Tennenholtz  
Thesis: Reinforcement Learning in Partially Observable Decision Processes [↗](#)
- 2001 **BSc (cum laude)**, *School of Computer Science*, Hebrew University.
- 2000 **BSc**, *Medical Sciences*, Hebrew University Hadassah Medical School.

## Research Experience

- 2016–2019 **Postdoctoral Scholar**, *RISELab, AUTOLAB, and BAIR*, Department of Electrical Engineering and Computer Sciences, University of California, Berkeley.  
Advisors: Profs. Ion Stoica and Ken Goldberg
- 2012–2013 **Exchange PhD Student**, *Center for Theoretical Neuroscience*, Columbia University.  
Hosts: Profs. Larry Abbott and Liam Paninski
- 2011 **Research Intern**, Microsoft Research, Israel.  
Investigated and implemented data mining for auction pricing
- 2009–2011 **Head of Research**, Sentrigo.  
Led a team of security researchers to discover database vulnerabilities and detect attacks
- 2008 **Researcher**, Safend.  
Advised on using machine learning for securing end-point devices
- 2001–2007 **Researcher and Team Leader**, IDF.  
Performed algorithmic research and development; led a team of Math and CS teachers

## Teaching Experience

- 2014–2015 **Reinforcement learning**, *teacher*, Center for Brain Sciences, Hebrew University.  
Created and taught a new graduate class
- 2011 **Computability and Complexity**, *teaching assistant*, School of Computer Science and Engineering, Hebrew University.
- 2007 **Digital Systems**, *teaching assistant*, Department of Electrical Engineering, Technion IIT.

## Entrepreneurial Experience

- 2013–2015 **Founder & CTO**, *AudLog*.  
Developed a mobile app for recording meetings and summarizing topics and action items
- 2008–2009 **Founder & CTO**, *Serendipity*.  
Developed a web widget for recommended content discovery by collaborative filtering
- 2007–2008 **Founder & CTO**, *QuiXilver*.  
Developed middleware for seamlessly utilizing configurable hardware to accelerate software

## Honors and Awards

- 2012–2013 **Research scholarship**, *The Gatsby Charitable Foundation*, Columbia University.
- 2011 **First place**, *HUJICode*, Hebrew University's algorithmic programming competition.
- 1998 **Rector award for excellence**, Hebrew University.
- 1997 **First place**, *The International Mathematics Tournament of the Towns*.

## Publications

### Conferences

- CASE 2019 Multi-Task Hierarchical Imitation Learning for Home Automation [↗](#)  
**Roy Fox\***, Ron Berenstein\*, Ion Stoica, and Ken Goldberg  
15th IEEE Conference on Automation Science and Engineering
- WAFR 2018 Generalizing Robot Imitation Learning with Invariant Hidden Semi-Markov Models [↗](#)  
Ajay Kumar Tanwani, Jonathan Lee, Brijen Thananjeyan, Michael Laskey, Sanjay Krishnan, **Roy Fox**, Ken Goldberg, and Sylvain Calinon  
13th International Workshop on the Algorithmic Foundations of Robotics
- CASE 2018 Constraint Estimation and Derivative-Free Recovery for Robot Learning from Demonstrations [↗](#)  
Jonathan Lee, Michael Laskey, **Roy Fox**, and Ken Goldberg  
14th IEEE Conference on Automation Science and Engineering
- ICML 2018 RLlib: Abstractions for Distributed Reinforcement Learning [↗](#)  
Eric Liang\*, Richard Liaw\*, Robert Nishihara, Philipp Moritz, **Roy Fox**, Ken Goldberg, Joseph Gonzalez, Michael Jordan, and Ion Stoica  
35th International Conference on Machine Learning
- ICRA 2018 Fast and Reliable Autonomous Surgical Debridement with Cable-Driven Robots Using a Two-Phase Calibration Procedure [↗](#)  
Daniel Seita, Sanjay Krishnan, **Roy Fox**, Stephen McKinley, John Canny, and Ken Goldberg  
35th IEEE International Conference on Robotics and Automation
- ICRA 2018 Robustly Adjusting Indoor Drip Irrigation Emitters with the Toyota HSR Robot [↗](#)  
Ron Berenstein, **Roy Fox**, Stephen McKinley, Stefano Carpin, and Ken Goldberg  
35th IEEE International Conference on Robotics and Automation
- ICLR 2018 Parametrized Hierarchical Procedures for Neural Programming [↗](#)  
**Roy Fox**, Richard Shin, Sanjay Krishnan, Ken Goldberg, Dawn Song, and Ion Stoica  
6th International Conference on Learning Representations
- CoRL 2017 DDCO: Discovery of Deep Continuous Options for Robot Learning from Demonstrations [↗](#)  
Sanjay Krishnan\*, **Roy Fox\***, Ion Stoica, and Ken Goldberg  
1st Conference on Robot Learning
- CoRL 2017 DART: Noise Injection for Robust Imitation Learning [↗](#)  
Michael Laskey, Jonathan Lee, **Roy Fox**, Anca Dragan, and Ken Goldberg  
1st Conference on Robot Learning

- CASE 2017 An Algorithm and User Study for Teaching Bilateral Manipulation via Iterated Best Response Demonstrations [↗](#)  
Carolyn Chen, Sanjay Krishnan, Michael Laskey, **Roy Fox**, and Ken Goldberg  
13th IEEE Conference on Automation Science and Engineering
- CASE 2017 Statistical Data Cleaning for Deep Learning of Automation Tasks from Demonstrations [↗](#)  
Caleb Chuck, Michael Laskey, Sanjay Krishnan, Ruta Joshi, **Roy Fox**, and Ken Goldberg  
13th IEEE Conference on Automation Science and Engineering
- CDC 2016 Minimum-Information LQG Control — Part I: Memoryless Controllers [↗](#)  
**Roy Fox** and Naftali Tishby  
55th IEEE Conference on Decision and Control
- CDC 2016 Minimum-Information LQG Control — Part II: Retentive Controllers [↗](#)  
**Roy Fox** and Naftali Tishby  
55th IEEE Conference on Decision and Control
- EWRL 2016 Principled Option Learning in Markov Decision Processes [↗](#)  
**Roy Fox\***, Michal Moshkovitz\*, and Naftali Tishby  
13th European Workshop on Reinforcement Learning
- UAI 2016 Taming the Noise in Reinforcement Learning via Soft Updates [↗](#)  
**Roy Fox\***, Ari Pakman\*, and Naftali Tishby  
32nd Conference on Uncertainty in Artificial Intelligence
- NeurIPS 2013 A Multi-Agent Control Framework for Co-Adaptation in Brain-Computer Interfaces [↗](#)  
Josh Merel\*, **Roy Fox\***, Tony Jebara, and Liam Paninski  
27th Annual Conference on Neural Information Processing Systems
- ICML 2012 Bounded Planning in Passive POMDPs [↗](#)  
**Roy Fox** and Naftali Tishby  
29th International Conference on Machine Learning
- AAAI 2007 A Reinforcement Learning Algorithm with Polynomial Interaction Complexity for Only-Costly-Observable MDPs [↗](#)  
**Roy Fox** and Moshe Tennenholtz  
22nd Conference on Artificial Intelligence
- [Symposia and Workshops](#)
- Infer2Control Hierarchical Imitation Learning via Variational Inference of Control Programs [↗](#)  
@ NeurIPS 2018 **Roy Fox**, Richard Shin, William Paul, Yitian Zou, Dawn Song, Ken Goldberg, Pieter Abbeel, and Ion Stoica  
Infer to Control: Probabilistic Reinforcement Learning and Structured Control workshop
- DLT An Empirical Exploration of Gradient Correlations in Deep Learning [↗](#)  
@ NeurIPS 2018 Daniel Rothchild, **Roy Fox**, Noah Golmant, Joseph Gonzalez, Michael Mahoney, Kai Rothauge, Ion Stoica, and Zhewei Yao  
Integration of Deep Learning Theories workshop
- ML for Sys Neural Inference of API Functions from Input–Output Examples [↗](#)  
@ NeurIPS 2018 Rohan Bavishi, Caroline Lemieux, Neel Kant, **Roy Fox**, Koushik Sen, and Ion Stoica  
Machine Learning for Systems workshop
- NAMPI Imitation Learning of Hierarchical Programs via Variational Inference [↗](#)  
@ ICML 2018 **Roy Fox\***, Richard Shin\*, Pieter Abbeel, Ken Goldberg, Dawn Song, and Ion Stoica  
Neural Abstract Machines & Program Induction workshop
- PGMRL Task-Relevant Embeddings for Robust Perception in Reinforcement Learning [↗](#)  
@ ICML 2018 Eric Liang, **Roy Fox**, Joseph Gonzalez, and Ion Stoica  
Prediction and Generative Modeling in Reinforcement Learning workshop

- Causal Imit. Robot Learning with Invariant Hidden Semi-Markov Models [↗](#)
- @ RSS 2018 Ajay Kumar Tanwani, Jonathon Lee, Michael Laskey, Sanjay Krishnan, **Roy Fox**, and Ken Goldberg  
Perspectives on Robot Learning: Imitation and Causality workshop
- DeepRL Ray RLLib: A Composable and Scalable Reinforcement Learning Library [↗](#)
- @ NeurIPS 2017 Eric Liang\*, Richard Liaw\*, Robert Nishihara, Philipp Moritz, **Roy Fox**, Joseph Gonzalez, Ken Goldberg, and Ion Stoica  
Deep Reinforcement Learning symposium
- [Preprints](#)
- 2017 Multi-Level Discovery of Deep Options [↗](#)  
**Roy Fox\***, Sanjay Krishnan\*, Ion Stoica, and Ken Goldberg  
arXiv:1703.08294
- 2015 Optimal Selective Attention in Reactive Agents [↗](#)  
**Roy Fox** and Naftali Tishby  
arXiv:1609.05524

## Advising and Mentoring

### Undergraduate Students

- Andy Yan (2018–2019 — Master's student at UC Berkeley)
- Matthew Trepte (2018–2019)
- William Paul (2018–2019)
- Yitian Zou (2018–2019)
- David Tseng (2017–2018 — Master's at UC Berkeley)
- Erez Peterfreund (2014–2015 — PhD student at Hebrew University)
- Itay Fried (2014–2015)

## Service

### Workshop Organizer

- 2018 Infer to Control: Probabilistic Reinforcement Learning and Structured Control Workshop (Infer2Control @ NeurIPS) [↗](#)  
Lead organizer; co-organizers: Leslie Kaelbling, Martin Riedmiller, Marc Toussaint, Igor Mordatch, Tuomas Haarnoja; estimated attendance: 650+
- 2017 Hierarchical Reinforcement Learning Workshop (HRL @ NeurIPS) [↗](#)  
Lead organizer; co-organizers: Andrew Barto, Doina Precup, Shie Mannor, Tom Schaul, Carlos Florensa; estimated attendance: 950+

### Senior Program Committee Member / Meta-Reviewer

UAI (2019)

### Program Committee Member / Reviewer

NeurIPS (2016–2019) ■ JAAMAS journal (2018–2019) ■ HILL workshop @ ICML (2019) ■ CASE (2019) ■ IJRR journal (2018–2019) ■ IJCAI (2019) ■ RLDM (2019) ■ SPiRL workshop @ ICLR (2019) ■ ICML (2018–2019) ■ ICRA (2019) ■ Infer2Control workshop @ NeurIPS (2018) ■ RSS (2017–2018) ■ ICLR (2017–2018) ■ Adaptive Behavior journal (2018) ■ HRL workshop @ NeurIPS (2017)

### Volunteer

- 2019 IBM Watson AI XPRIZE competition [↗](#)  
Technical judge and mentor to a competing team
- 2016 International Workshop on the Algorithmic Foundations of Robotics (WAFR)
- 2007 Conference of the Association for the Advancement of Artificial Intelligence (AAAI)

## Talks and Presentations

### Contributed Presentations

- 2019 Multi-Task Hierarchical Imitation Learning for Home Automation  
*CASE*, talk, Vancouver, Canada, August 25
- 2018 Panel on Inference for Control  
*Infer2Control Workshop @ NeurIPS*, panel moderator, Montréal, Canada, December 8
- 2018 Hierarchical Imitation Learning via Variational Inference of Control Programs  
*Infer2Control Workshop @ NeurIPS*, poster, Montréal, Canada, December 8
- 2018 Imitation Learning of Hierarchical Programs via Variational Inference  
*NAMPI Workshop @ ICML*, poster, Stockholm, Sweden, July 15
- 2018 Task-Relevant Embeddings for Robust Perception in Reinforcement Learning  
*PGMRL Workshop @ ICML*, poster, Stockholm, Sweden, July 15
- 2018 Parametrized Hierarchical Procedures for Neural Programming  
*ICLR*, poster, Vancouver, Canada, April 30
- 2017 Panel on Hierarchical Reinforcement Learning  
*HRL Workshop @ NeurIPS*, panel moderator, Long Beach, California, December 9
- 2017 Ray RLLib: A Composable and Scalable Reinforcement Learning Library  
*DeepRL Symposium @ NeurIPS*, poster, Long Beach, California, December 7
- 2016 Minimum-Information LQG Control  
*CDC*, double talk, Las Vegas, Nevada, December 14
- 2016 Taming the Noise in Reinforcement Learning via Soft Updates  
*UAI*, talk and poster, Jersey City, New Jersey, June 26
- 2013 A Multi-Agent Control Framework for Co-Adaptation in Brain-Computer Interfaces  
*NeurIPS*, poster, Lake Tahoe, Nevada, December 8
- 2012 Bounded Planning in Passive POMDPs  
*ICML*, spotlight and poster, Edinburgh, UK, June 27
- 2007 A Reinforcement Learning Algorithm with Polynomial Interaction Complexity for Only-Costly-Observable MDPs  
*AAAI*, talk, Vancouver, Canada, July 24
- 2007 A Reinforcement Learning Algorithm with Polynomial Interaction Complexity for Only-Costly-Observable MDPs  
*BISFAI*, talk, Ramat Gan, Israel, June 21

### Invited Talks

- 2019 Learning Hierarchical Control Programs
  - Université de Montréal, Canada, February 22
  - University of California, Irvine, March 19
  - University of Michigan, Ann Arbor, April 11
- 2018 Hierarchical Imitation Learning of Robot Skills and Control Programs
  - Google Research, Tel Aviv, Israel, November 15
  - Department of Electrical Engineering, Technion IIT, Haifa, Israel, November 14
- 2017 Deep Hierarchical Reinforcement Learning Made Fast and Easy with Ray  
Data Science Summit Europe, Jerusalem, Israel, May 29
- 2016 An Information-Theoretic Bag of Tools for Optimal Control and Reinforcement Learning  
Google DeepMind, London, UK, June 1
- 2016 Minimum-Information Planning in Partially-Observable Decision Problems

- Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany, May 10
  - Marc Toussaint's group, University of Stuttgart, Germany, May 9
- 2015 Soft-Optimal Decisions under Uncertainty  
Information and Decision Making workshop, University of Hertfordshire, UK, September 3
- 2014 Optimal Selective Attention and Action in Reactive Agents
- Pieter Abbeel's group, University of California, Berkeley, October 8
  - Richard Murray's group, California Institute of Technology, Los Angeles, October 2
  - Stefano Soatto's group, University of California, Los Angeles, October 1
  - Artificial Intelligence group, University of California, San Diego, September 29
  - Liam Paninski's group, Columbia University, New York, September 24
  - Microsoft Research, New York, September 16
  - GRASP lab, University of Pennsylvania, Philadelphia, September 15
- 2012 Information Theoretic Methods for POMDP Planning  
DARPA MSEE program review meeting, University of California, Los Angeles, May 2
- [Departmental Talks](#)
- 2019 Hierarchical Imitation Learning of Robot Skills and Control Programs  
RISE Retreat, University of California, Berkeley, January 17
- 2018 Multi-Task Hierarchical Imitation Learning of Robot Skills
- BAIR/CPAR/BDD Seminar, University of California, Berkeley, October 12
  - RISE Seminar, University of California, Berkeley, October 8
- 2018 SkillHub: Shared Hierarchical Imitation Learning of Robot Control  
RISE Retreat, University of California, Berkeley, May 23
- 2018 Parametrized Hierarchical Procedures for Neural Programming  
RISE Retreat, University of California, Berkeley, January 10
- 2017 Discovery of Hierarchical Structure for Robot Learning and Neural Programming  
BAIR/CPAR/BDD Seminar, University of California, Berkeley, November 3
- 2017 Reinforcement Learning Concepts  
RISE Camp, University of California, Berkeley, September 7
- 2017 Multi-Level Discovery of Deep Options
- RISE-BDD Joint Mini-Retreat, University of California, Berkeley, May 2
  - BAIR/CPAR/BDD Seminar, University of California, Berkeley, March 17
- 2017 Learning Control Hierarchies  
RISE Retreat, University of California, Berkeley, January 11
- 2015 Soft-Optimal Decisions under Uncertainty  
Machine Learning Club, Hebrew University, October 22
- 2013 Separating Inference and Control  
The Center for Theoretical Neuroscience, Columbia University, May 13
- 2013 What to Notice and What to Remember: Finding Good Inference Policies  
The Interdisciplinary Center for Neural Computation Retreat, Hebrew University, January 29
- 2012 Information Theory in Reinforcement Learning
- The Center for Theoretical Neuroscience, Columbia University, August 20
  - Liam Paninski's group, Columbia University, May 22
- 2012 Bounded Planning in Passive POMDPs  
Machine Learning Club, Hebrew University, March 15
- 2007 Reinforcement Learning in Partially Observable Decision Processes  
Graduate Seminar, Technion IIT, November 4