

# Lily Xu

lily\_xu@g.harvard.edu  
lily-x.github.io

EDUCATION	<b>Harvard University.</b> Cambridge, MA PhD Candidate in Computer Science Advised by Prof. Milind Tambe  <b>Dartmouth College.</b> Hanover, NH A.B. with Honors in Computer Science, minor in Spanish <i>Magna cum laude</i>	(expected) 2024    2018
HONORS AND AWARDS	Stanford Rising Star in Management Science and Engineering (MS&E) Google PhD Fellowship <i>One of 13 awardees in machine learning globally, with two years of funding support.</i> INFORMS Doing Good with Good OR Competition Winner <i>Recognizes the “most exciting work performed by students in partnership with public and private organizations that yields tangible and beneficial outcomes for individuals, communities, and organizations”.</i> AAAI Best Paper Award Runner Up <i>3 best papers and 3 runner-ups were selected out of 9,034 submissions and 1,692 accepted papers.</i> Harvard University Certificate of Distinction in Teaching Certificate of Appreciation from the SMART Consortium Five Citations for Academic Excellence at Dartmouth College <i>Special distinction rarely awarded by faculty members “for meritorious characteristics not indicated adequately by academic grades”, received across five computer science and Spanish courses.</i> Adobe Women-In-Technology Scholarship – Honorable Mention	2023 2022  2021  2021  2021 2018 2014 – 2018  2017
NON-PROFIT SERVICE	<b>SMART Conservation Partnership.</b> AI Lead <i>I work with SMART to effectively integrate AI, computation, and research into their conservation management activities. The SMART Partnership is the global leader in protected area solutions, consisting of 9 leading conservation NGOs: WWF, WCS, Peace Parks Foundation, Wildlife Protection Solutions, Frankfurt Zoological Society, ZSL, NC Zoo, Panthera, and Re:wild.</i>	2022 – present
WORK EXPERIENCE	<b>Google Research.</b> India, AI for Social Good lab Student Researcher  <b>Google.</b> Seattle, WA Software Engineering Intern  <b>Dyn, Inc.</b> Hanover, NH Data Analytics Research Intern	Spring 2022   Summer 2017  Spring 2016

- PUBLICATIONS  
(JOURNALS)      **Bridging adaptive management and reinforcement learning for more robust decisions**  
*Philosophical Transactions of the Royal Society B* (2023)  
 Melissa Chapman, **Lily Xu**, Marcus Lapeyrolerie, Carl Boettiger
- PUBLICATIONS  
(BOOK CHAPTERS)      **Environment, Society, and Machine Learning**  
*Oxford Handbook of the Sociology of Machine Learning* (2023)  
 Caleb Scoville, Hilary Faxon, Melissa Chapman, Samantha Jo Fried, **Lily Xu**, Carl Boettiger, J. Michael Reed, Marcus Lapeyrolerie, Amy Van Scoyoc, Razvan Amironesei
- PUBLICATIONS  
(CONFERENCES)      \* *indicates equal contribution*  
 † *indicates undergraduate I advised*  
 ( $\alpha$ - $\beta$ ) *indicates alphabetical ordering*
- Optimistic Whittle Index Policy: Online Learning for Restless Bandits**  
*AAAI 2023*. Thirty-Seventh AAAI Conference on Artificial Intelligence  
 Kai Wang\*, **Lily Xu**\*, Aparna Taneja, Milind Tambe
- Flexible Budgets in Restless Bandits: A Proximal Primal-Dual Algorithm for Efficient Budget Allocation**  
*AAAI 2023*. Thirty-Seventh AAAI Conference on Artificial Intelligence  
 Paula Rodriguez Diaz, Jackson A. Killian, **Lily Xu**, Aparna Taneja, Arun Sai Suggala, Milind Tambe
- Robust Planning over Restless Groups: Engagement Interventions for a Large-Scale Maternal Telehealth Program**  
*AAAI 2023*. Thirty-Seventh AAAI Conference on Artificial Intelligence  
 Jackson A. Killian\*, Arpita Biswas\*, **Lily Xu**\*, Shresth Verma\*, Vineet Nair, Aparna Taneja, Aparna Hegde, Neha Madhiwalla, Paula Rodriguez Diaz, Sonja Johnson-Yu, Milind Tambe
- Restless and Uncertain: Robust Policies for Restless Bandits via Deep Multi-Agent Reinforcement Learning**  
*UAI 2022*. Proc. 38th Conference on Uncertainty in Artificial Intelligence  
 Jackson A. Killian, **Lily Xu**, Arpita Biswas, Milind Tambe
- Ranked Prioritization of Groups in Combinatorial Bandit Allocation**  
*IJCAI 2022*. Proc. 31st International Joint Conference on Artificial Intelligence  
**Lily Xu**, Arpita Biswas, Fei Fang, Milind Tambe
- Coordinating Followers to Reach Better Equilibria: End-to-End Gradient Descent for Stackelberg Games**  
*AAAI 2022*. Proc. 36th AAAI Conference on Artificial Intelligence  
 Kai Wang, **Lily Xu**, Andrew Perrault, Michael K. Reiter, Milind Tambe
- Robust Reinforcement Learning Under Minimax Regret for Green Security**  
*UAI 2021*. Proc. 37th Conference on Uncertainty in Artificial Intelligence  
**Lily Xu**, Andrew Perrault, Fei Fang, Haipeng Chen, Milind Tambe  
**Oral Presentation**  
*Top 6.17% of submissions*

**Envisioning Communities: A Participatory Approach Towards AI for Social Good**

*AIES 2021.* Proc. 4th AAI/ACM Conference on AI, Ethics, and Society  
Elizabeth Bondi\*, **Lily Xu\***, Diana Acosta-Navas, Jackson A. Killian

**Dual-Mandate Patrols: Multi-Armed Bandits for Green Security**

*AAAI 2021.* Proc. 35th AAAI Conference on Artificial Intelligence  
**Lily Xu**, Elizabeth Bondi, Fei Fang, Andrew Perrault, Kai Wang, and Milind Tambe  
**Best Paper Award Runner Up**  
*Top 6 of 1692 accepted papers*

**Stay Ahead of Poachers: Illegal Wildlife Poaching Prediction and Patrol Planning Under Uncertainty with Field Test Evaluations**

*ICDE 2020.* Proc. 36th IEEE International Conference on Data Engineering  
**Lily Xu\***, Shahrzad Gholami\*, Sara Mc Carthy, Bistra Dilkina, Andrew Plumptre, Milind Tambe, Rohit Singh, Mustapha Nsubuga, Joshua Mabonga, Margaret Driciru, Fred Wanyama, Aggrey Rwetsiba, Tom Okello, Eric Enyel

WORKSHOP PAPERS  
/ PREPRINTS

**Ranger patrols deter poaching: first causal insights for improving protected area management**

*under review; preliminary at EAAMO 2022*  
Rachel Guo<sup>†</sup>\*, **Lily Xu\***, Andrew Perrault, Luke W. Miratrix, Andrew J. Plumptre, Joshua Mabonga, Herbert Kitimbo, Fredrick Wanyama, Milind Tambe, Andrew B. Davies

**Human histories shape the biodiversity data that decides our future**

*under review; preliminary abstract accepted at EGU 2023*  
Melissa Chapman, Benjamin Goldstein, Christopher Schell, Justin Brashares, Neil Carter, Diego Ellis-Soto, Hilary Faxon, Jenny Goldstein, Joycelyn Longdon, Kari Norman, Dara O'Rourke, Caleb Scoville, **Lily Xu**, Carl Boettiger

**Artificial Replay: A Meta-Algorithm for Harnessing Historical Data in Bandits**

*under review*  
( $\alpha$ - $\beta$ ) Siddhartha Banerjee, Sean R. Sinclair, Milind Tambe, **Lily Xu**, Christina Lee Yu

**Enhancing Poaching Predictions for Under-Resourced Wildlife Conservation Parks Using Remote Sensing Imagery**

*NeurIPS MD4D.* Workshop on Machine Learning for Development 2020  
Rachel Guo<sup>†</sup>, **Lily Xu**, Andrew Plumptre, Drew Cronin, Francis Okeke, and Milind Tambe

## INVITED TALKS

*Does not include contributed conference and workshop talks*

### Causal AI and Conservation

<i>INFORMS Annual Meeting.</i> ML for Social Good session	October 2023
<i>ICCB.</i> SMART Symposium	July 2023
<i>Microsoft Research New England.</i> Machine Learning Ideas seminar	June 2023
<i>United Nations ITU.</i> AI for Good Summit	June 2023
<i>WWF.</i> Fuller Seminar Series on Conservation AI	April 2023

### Minimax Regret Optimization: Robust Planning for Conservation and Maternal Health

<i>UC Berkeley.</i> Multi-Agent Learning Seminar (Berkeley MARL)	March 2023
<i>Brown University.</i> Algorithmic Game Theory group	March 2023

### Learning and Planning Under Uncertainty for Wildlife Conservation

<i>Harvard Kennedy School.</i> “Leading in AI” Executive Education	July 2023
<i>Penn State.</i> CSRAI Young Achievers Symposium	March 2023
<i>UC Berkeley.</i> Global Policy Lab	February 2023
<i>Centro de Analítica para Políticas Públicas (CAPP).</i> (in Spanish)	December 2022
<i>Georgia Tech.</i> ISyE seminar	November 2022
<i>Analytics for a Better World.</i>	September 2022
<i>Harvard Kennedy School.</i> “Leading in AI” Executive Education	July 2022
<i>UC Berkeley.</i> Ethics and Practices of Algorithmic Conservation	April 2022
<i>UCL.</i> Climate Hack AI Competition, <i>keynote</i>	March 2022
<i>Harvard University.</i> AI-Assisted Decision-Making Colloquium	February 2022
<i>Pasteur’s Quadrant.</i> Seminar Series	February 2022
<i>INFORMS.</i> Doing Good with Good OR Finalists	October 2021

### Ranked Prioritization of Groups in Combinatorial Bandit Allocation

<i>Sony.</i> Computer Science Laboratories (CSL) Paris	October 2022
<i>Stanford.</i> Computing & Society group	October 2022
<i>INFORMS Annual Meeting.</i> Fairness in Sequential Decision Making session	October 2022

### Envisioning Communities: A Participatory Approach to AI for Social Good

<i>MIT.</i> AI Ethics group	September 2022
<i>Women’s Forum.</i> Women4AI Daring Circle workshop	June 2022

### Robust Reinforcement Learning Under Minimax Regret for Green Security

<i>Google Research India.</i> AI for Social Good research group	January 2022
---	--------------

### PAWS: AI to Predict and Plan Against Poaching

<i>ICCB.</i> International Congress for Conservation Biology	December 2021
<i>IUCN WCC.</i> World Conservation Congress	September 2021
<i>WILDLABS.</i> Tech Tutors: Season Three	September 2021
<i>AI for Climate.</i> Mexico Talk Series powered by Huawei	July 2021
<i>SMART Partnership.</i> International Women’s Day Webinar	March 2021
<i>WWF.</i> Webinar on SMART	April 2020
<i>AI LA.</i> Earth Summit	April 2021

### Dual-Mandate Patrols: Multi-Armed Bandits for Green Security

<i>Beijing Academy of Artificial Intelligence.</i>	March 2021
--	------------

	<i>University College London. AI Society</i>	February 2021
INVITED PANELS	<i>Hertz Foundation Workshop. AI Science and Policy, moderator</i> panelists: Jacob Steinhardt, Julie Owono, Jessica Fjeld	July 2022
	<i>South by Southwest (SXSW). AI for Wildlife, panelist</i>	March 2021
	<i>Harvard CRCS. AI for Social Impact, moderator</i> panelists: Susan Murphy, Erez Yoeli, Desmond Patton	March 2020
PROFESSIONAL SERVICE	<b>Initiative Organization</b> Co-organizer, Mechanism Design for Social Good (MD4SG) Co-lead, MD4SG Community Engagement Co-founder and co-organizer, MD4SG Working Group on Environment Apr 2021	March 2021 – Oct 2020 – Apr 2021 Jan 2020 –
	<b>Workshop Organization</b> Co-organizer, AI-Assisted Decision Making for Conservation Workshop Organizer, SMART/PAWS Workshop. Rio Bravo, Belize Lead organizer, Harvard CRCS Rising Stars Workshop Co-organizer, Computational Sustainability Doctoral Consortium	October 2022 August 2022 March 2020 October 2019
	<b>Tutorials</b> Lead organizer, AI for Social Impact tutorial <i>with Emily Aiken, Priya Donti, Nikhil Garg, and Paul Gözl</i>	August 2023
	<b>Panels</b> Co-organizer and co-moderator. The Future of AI for Social Impact <i>panelists: Fei Fang, Lynn Kaack, Danaë Metaxa, Bryan Wilder</i>	April 2022
	<b>Conference Event Organization</b> Social co-chair, ACM EAAMO'23 Social co-chair, ACM EAAMO'22 Social co-chair, ACM EAAMO'21 Social co-chair, Fourth Workshop on MD4SG	October 2023 October 2022 October 2021 August 2020
	<b>Seminar Organization</b> Co-organizer, Harvard CRCS Panel on the Future of AI for Social Impact Co-organizer, Harvard CRCS Social Impact Seminar Series Co-organizer, Harvard CRCS Rising Stars Speaker Series Co-organizer, CompSust Open Graduate Seminar (COGS)	April 2022 Spring 2022 April 2021 Spring 2020
	<b>Program Committee (Reviewing)</b> → <i>Conferences</i> <i>AIES. Artificial Intelligence, Ethics, and Society</i> <i>AAAI. AAAI Conference on Artificial Intelligence</i> <i>AAAI AISI track. AAAI Conference on Artificial Intelligence</i> <i>COMPASS. ACM SIGCAS Conference on Computing and Sustainable Societies</i> 2021 <i>EAAMO. Equity and Access in Algorithms, Mechanisms, and Optimization</i> 2022, 2023 <i>FAccT. ACM Conference on Fairness, Accountability, and Transparency</i> <i>IAAI. AAAI Innovative Applications of Artificial Intelligence</i> <i>NeurIPS. Neural Information Processing Systems</i> <i>UAI. Uncertainty in Artificial Intelligence</i>	2022, 2023 2023 2020, 2021, 2022 2021 2021, 2022, 2023 2022, 2023 2023 2023 2023

→ *Workshops*

AI for Wildlife Conservation Workshop @ SIGSPATIAL	2023
Regulating Machine Learning @ NeurIPS	2023
Autonomous Agents for Social Good (AASG) Workshop @ AAMAS	2021, 2023
AI for Social Good Workshop @ AAAI	2023
Cooperative AI Workshop @ NeurIPS	2022
Data-Driven Humanitarian Mapping @ KDD	2020, 2021, 2022
Black in AI Workshop @ NeurIPS	2020, 2021, 2022
Machine Learning for the Developing World (ML4D) @ NeurIPS	2020, 2021
Machine Learning for Public Health (ML4PH) @ NeurIPS	2021
AI for Social Good Workshop @ IJCAI	2020
Resistance AI @ NeurIPS	2020
Mechanism Design for Social Good (MD4SG)	2020
AI for Social Good Workshop @ Harvard CRCS	2020

**Competition Selection Committee**

AI2, EarthRanger Conservation Tech Award	2022, 2023
--	------------

**Reviewer**

Deep Learning Indaba	2022
Caltech Computer Vision for Ecology (CV4Ecology) Summer School	2022
ICML, <i>subreviewer</i>	2021
NeurIPS, <i>subreviewer</i>	2020
IJCAI Special Track on CompSust and Human Well-being, <i>subreviewer</i>	2020
COMPASS, <i>subreviewer</i>	2019
Bloomberg Data for Good Exchange (D4GX), <i>subreviewer</i>	2019

STUDENTS ADVISED → *At Harvard College*

Vincent Börsch-Supan '25	Sept 2022 –
Alejandra Perea Rojas '24	June 2022 – Dec 2022
Christopher Ong '23	Spring 2022
April Chen '22	Summer 2021
<i>Adobe Research Women-In-Technology Scholarship Winner</i>	
Ezenia Diaz-Lembert '23	Spring 2021
Emilia Cabrera '21	Sept 2020 – Dec 2021
<i>Thesis: Protecting the Lion's Share: Mitigating Illegal Wildlife Poaching with Multi-Agent Reinforcement Learning</i>	
Rachel Guo '22	June 2020 – May 2023
<i>NCWIT Collegiate Award Winner</i>	
<i>CRA Outstanding Undergraduate Researcher Award — Honorable Mention</i>	
<i>Harvard Hoopes Prize for Outstanding Thesis</i>	
<i>NSF Graduate Research Fellowship</i>	
<i>Thesis: On the Effect of Ranger Patrols on Deterring Poaching: A Bayesian Approach for Causal Inference Using Field Tests as an Instrument</i>	
<i>Next step: Stanford ICME PhD student</i>	

TEACHING → *Guest Lecturer*

EXPERIENCE	<i>Cornell University.</i> INFO 6960. Data Science for Global Development	Spring 2023
	<i>MIT.</i> 15 076. Analytics for a Better World	Spring 2023
	<i>Harvard University.</i> CS 96. Machine Learning for Social Impact	Spring 2023
	<i>Wellesley University.</i> CS 115. Computing for the Socio-Techno Web	Fall 2022
	<i>Ohio State University.</i> CSE 3521. Survey of Artificial Intelligence I	Fall 2022
	<i>Harvard University.</i> CS 288. AI for Social Impact class	Fall 2022

*University of Southern California.* ISE 599. Analytics for Social Impact Spring 2022  
*University of Pennsylvania.* OIDD 941. Recent Advances in Data-Driven Decision-Making Spring 2022  
*Harvard University.* CS 96. Machine Learning for Social Impact Spring 2022  
*Cornell Tech.* ORIE 5355/INFO 5370. People, Data, Systems Fall 2021  
*Harvard Business School.* HBSMBA 2231. From Data to Decisions Fall 2021  
*Wellesley University.* CS 115. Computing for the Socio-Techno Web Fall 2021  
*Australian National University.* CECS8001. Building Cyber-Physical Systems Fall 2021  
*University of Pittsburgh.* CS 1699. AI for Good: Ethics and Implications Spring 2021  
*University of Michigan.* SI 431. Algorithms and Society Spring 2021  
*Harvard University.* CS 182. Artificial Intelligence Fall 2020  
*Dartmouth College.* CS 11. Foundations of Applied Computer Science Spring 2018

### Harvard University

→ *Head Teaching Fellow*

CS 182: Artificial Intelligence Fall 2020

### Dartmouth College

→ *Teaching Assistant, Department of Computer Science*

CS 31: Algorithms Winter 2017  
 CS 11: Foundations of Applied Computer Science, *head TA* Spring 2018  
 CS 10: Object-Oriented Programming Spring 2016  
 CS 10: Object-Oriented Programming Spring 2015  
 CS 1: Intro to Programming and Computation Spring 2018  
 CS 1: Intro to Programming and Computation Fall 2017  
 CS 1: Intro to Programming and Computation Spring 2017  
 CS 1: Intro to Programming and Computation Winter 2016  
 CS 1: Intro to Programming and Computation Fall 2015

→ *Teaching Assistant, Tuck School of Business*

Tuck FWP: Fundamentals of Web Programming Spring 2017  
 Tuck DSA: Data Structures and Analytics Spring 2017

## OUTREACH

### Speaking

*Harvard.* Tech for Social Good and Harvard Computer Society March 2023  
*Harvard SEAS.* PhD Admitted Students Open House, *panelist* March 2021  
*Harvard SEAS.* Research Labs Open House November 2020  
*GirlsComputingLeague.* AIInnovation Business Summit September 2020  
*IEEE Computer Society.* Women in Computing, Kerala Chapter September 2020  
*Data Science Africa.* Tutorial on MD4SG and the Environment July 2020  
*Ledyard Canoe Club.* Inclusivity in the Outdoors July 2020  
*Dartmouth.* Women in Computer Science, *panelist* May 2020  
*Harvard SEAS.* Diversity, Inclusivity, and Belonging, *panelist* May 2020  
*Center for Initiatives in Jewish Education.* High school student visit March 2020  
*World Science Festival.* Science and Storytime June 2019  
*L.A. Unified School District (LAUSD).* African American Family Day May 2019  
*Zoo Magnet High School.* College and Career Day November 2018

### Mentoring

*Harvard University.* InTouch Peer Mentor 2020 –  
*Harvard University.* Women in STEM Mentor 2019 – 2020

*Dartmouth College.* Women in Computer Science 2017 – 2018

### Volunteering

*Harvard SEAS.* A Guide to Your PhD October 2020  
*Harvard University.* Project Teach April 2020  
*Cambridge Public Schools.* STEAM It Up! October 2019  
*Hustle N' Code.* Hackathon, *technical lead* December 2018  
*Hustle N' Code* is a Los Angeles hackathon for youth in public housing.  
 My team won first place, and the four students each received a laptop.

### PRESS

### Case Studies

*Harvard Business School.* SMART: AI and ML for Wildlife Conservation October 2022

### Podcasts

*Ecochat.* AI for Conservation - Using Machine Learning to Stop Poaching 2023  
*Cold Call (Harvard Business School podcast).* Can AI and Machine Learning Help Park Rangers Prevent Poaching? 2023  
*INFORMS Resoundingly Human Podcast.* May 2022  
*Rethinking Economics NL.* Disruptive Technologies podcast series. May 2021

### Video

*AIhub.* New Voices in AI: environmental conservation with Lily Xu. October 2022  
*Voice of America (VOA) News.* Wildlife Rangers Use AI to Predict Poachers' Next Moves. January 2022

### Articles

*Business Insider.* Conservationists are using artificial intelligence to map out the best ways for saving threatened wildlife and resources October 2022  
*Oxford Science.* AI in conservation: a modern-day solution to the biodiversity crisis? March 2022  
*The Hill.* These new technologies could transform wildlife conservation. February 2022  
*Harvard SEAS.* Computer Conservation. November 2021  
*AIhub.* Interview with Lily Xu. October 2021  
*Engadget.* PAWS anti-poaching AI predicts where illegal hunters will show up next. March 2021  
*Mongabay.* Where to patrol next: 'Netflix' of ranger AI serves up poaching predictions. November 2020  
*Harvard SEAS.* Preventing poaching. June 2020  
*BBC Sounds.* How tech is tackling wildlife trafficking. June 2020  
*BBC World Service.* Using technology to take on poachers. August 2019  
*USC Viterbi Magazine.* AI is for Animals. April 2019

### NON-ACADEMIC LEADERSHIP

**Ledyard Canoe Club at Dartmouth.** *Secretary, Canoeing Leader* 2014 – 2018

- Co-governed club functions for over 100 undergraduates. Managed club assets that include \$1M in endowments, a student-run rental business with annual revenues of \$50K, and boats and equipment valued at \$150K.
- Co-organized an Explorers Symposium featuring ten notable speakers, including Olympic racers and members of National Geographic-sponsored expeditions.
- Led a group of twenty-eight students on a nine-day, 220-mile canoe expedition.
- Voted by my peers to receive the Jay Evans '49 Award for service and commitment to the club.



**Fusion Dance Ensemble.** *Director* 2014 – 2018

- Led a group of fourteen dancers. Choreographed, taught, and performed contemporary and hip-hop dances, with over 20 performances each year.

**Dartmouth Sophomore Trips.** *Co-director* 2015 – 2016

- Planned the Sophomore Trips program for 130 undergraduates across 14 three-day outdoor trips throughout New Hampshire and Vermont.

**Dartmouth First-Year Trips.** *Grant Crew Volunteer* Summer 2015

- Served on a nine-person crew for a 21-day, round-the-clock commitment to assist with five-day outdoor orientation trips for 1,000 incoming students.

PERSONAL

Residential member, Los Angeles Eco Village

2018 – 2019