

## Lily Xu

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lily-x.github.io

EDUCATION	<b>Harvard University.</b> Cambridge, MA PhD Candidate, School of Engineering and Applied Sciences Advised by Prof. Milind Tambe	2019 – present
	<b>Dartmouth College.</b> Hanover, NH A.B. with Honors in Computer Science, minor in Spanish <i>Magna cum laude</i>	2014 – 2018
HONORS AND AWARDS	Google PhD Fellowship INFORMS Doing Good with Good OR Competition Winner AAAI Best Paper Award Runner Up 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.”</i> Computational Photography (Wojciech Jarosz, CS 89.15) Latin American Film (Silvia Spitta, Spanish 63.01) Computer Graphics (Emily Whiting, CS 77) Object-Oriented Programming (Travis Peters, CS 10) Introduction to Programming and Computation (Hany Farid, CS 1) Adobe Women-In-Technology Scholarship – Honorable Mention Rick Angulo World Experience Award <i>For “intellectual openness, enthusiasm, and impressive academic performance” following a study abroad program in Cusco, Peru. Award in \$1,500.</i> James O. Freedman Presidential Scholar Willis S. Fitch ’17 Metropolitan Washington Scholarship Bank of America’s Joe Martin Scholarship	2022 2021 2021 2021 2018 2014 – 2018                    
NON-PROFIT SERVICE	<b>SMART Conservation Partnership.</b> <i>AI Lead</i> <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
PUBLICATIONS (JOURNALS)	* indicates equal contribution † indicates undergraduate I advised ( $\alpha\text{--}\beta$ ) indicates alphabetical ordering  <b>Towards more effective use of ranger-based monitoring for protected area management</b> <i>in preparation</i> with Timothy Kuiper, Anthony Dancer, Colin Beale, Arash Ghoddousi, Harriet Ibbett, Laure Joanny, Blessing Kavhu, Aidan Keane, Daniel Makaza, Jennifer F. Moore, E.J. Milner-Gulland	

**Ranger patrols deter poachers: causal insights for protected area management**

*in preparation; preliminary at EAAMO 2022*

Rachel Guo<sup>†\*</sup>, **Lily Xu\***, Andrew Perrault, Luke W. Miratrix, Andrew J. Plumptre, Joshua Mabonga, Herbert Kitimbo, Fred Wanyama, Milind Tambe, Andrew B. Davies

**Bridging adaptive management and reinforcement learning for more robust decisions**

*Philosophical Transactions of the Royal Society B*

Melissa Chapman, **Lily Xu**, Marcus Lapeyrolerie, Carl Boettiger

PUBLICATIONS  
(BOOK CHAPTERS)

**Environment, Society, and Machine Learning**

*under review*

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)

**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

**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 (top 0.08% of submissions)*

**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

**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

**Best Lightning Paper**

**A High-Performance Graph Model for Near-Optimal Payments for Ecosystem Services**

*Working paper*

*Appeared at Mechanism Design for Social Good (MD4SG) Workshop 2020*

Florian Berlinger\*, **Lily Xu\***, Yiling Chen

RESEARCH  
EXPERIENCE

**University of Southern California.** Los Angeles, CA

*Doctoral Research Assistant*

2018 – 2019

Advised by Prof. Bistra Dilkina and Prof. Milind Tambe

**Dartmouth College.** Hanover, NH

*Undergraduate Senior Thesis Researcher*

2017 – 2018

Advised by Prof. Amro Farid

*Presidential Scholar Research Assistant*

2016 – 2017

Advised by Prof. Emily Whiting and Prof. David Kotz

WORK  
EXPERIENCE

**Google Research.** India, AI for Social Good lab

*Student Researcher*

Spring 2022

**Google.** Seattle, WA

	Software Engineering Intern	Summer 2017
	<b>Dyn, Inc.</b> Hanover, NH Data Analytics Research Intern	Spring 2016
TEACHING EXPERIENCE	→ <i>Guest Lecturer</i> Cornell University. INFO 6960. Data Science for Global Development Harvard University. CS 96. Machine Learning for Social Impact Wellesley University. CS 115. Computing for the Socio-Techno Web Ohio State University. CSE 3521. Survey of Artificial Intelligence I University of Southern California. ISE 599. Analytics for Social Impact University of Pennsylvania. OIDD 941. Recent Advances in Data-Driven Decision-Making Harvard University. CS 96. Machine Learning for Social Impact Cornell Tech. ORIE 5355/INFO 5370. People, Data, Systems Wellesley University. CS 115. Computing for the Socio-Techno Web Australian National University. CECS8001. Building Cyber-Physical Systems University of Pittsburgh. CS 1699. AI for Good: Ethics and Implications University of Michigan. SI 431. Algorithms and Society Harvard University. CS 182. Artificial Intelligence Dartmouth College. CS 11. Foundations of Applied Computer Science	Spring 2023 Spring 2023 Fall 2022 Fall 2022 Spring 2022 Spring 2022 Spring 2022 Fall 2021 Fall 2021 Fall 2021 Fall 2021 Spring 2021 Spring 2021 Fall 2020 Spring 2018
	<b>Harvard University</b> → <i>Head Teaching Fellow</i> CS 182: Artificial Intelligence	Fall 2020
	<b>Dartmouth College</b> → <i>Teaching Assistant, Department of Computer Science</i> CS 31: Algorithms CS 11: Foundations of Applied Computer Science, <i>head TA</i> CS 10: Object-Oriented Programming CS 10: Object-Oriented Programming CS 1: Intro to Programming and Computation CS 1: Intro to Programming and Computation CS 1: Intro to Programming and Computation CS 1: Intro to Programming and Computation CS 1: Intro to Programming and Computation	Winter 2017 Spring 2018 Spring 2016 Spring 2015 Spring 2018 Fall 2017 Spring 2017 Winter 2016 Fall 2015
	→ <i>Teaching Assistant, Tuck School of Business</i> Tuck FWP: Fundamentals of Web Programming Tuck DSA: Data Structures and Analytics	Spring 2017 Spring 2017
STUDENTS ADVISED	→ <i>At Harvard College</i> Vincent Börsch-Supan '25 Alejandra Perea Rojas '24 Christopher Ong '23 April Chen '22 <i>Adobe Research Women-In-Technology Scholarship Winner</i> Ezenia Diaz-Lembert '23 Emilia Cabrera '21 <i>Thesis: Protecting the Lion's Share: Mitigating Illegal Wildlife Poaching</i>	Sept 2022 – June 2022 – Dec 2022 Spring 2022 Summer 2021  Spring 2021 Sept 2020 – Dec 2021

*with Multi-Agent Reinforcement Learning*

Rachel Guo '22 June 2020 –  
*NCWIT Collegiate Award Winner*  
*CRA Outstanding Undergraduate Researcher Award — Honorable Mention*  
*Harvard Hoopes Prize for Outstanding Thesis*  
*Thesis: On the Effect of Ranger Patrols on Deterring Poaching: A Bayesian Approach for Causal Inference Using Field Tests as an Instrument*

PROFESSIONAL  
SERVICE

**Initiative Organization**

Co-organizer, Mechanism Design for Social Good (MD4SG) March 2021 –  
 Co-lead, MD4SG Community Engagement Oct 2020 – Apr 2021  
 Co-founder and co-organizer, MD4SG Working Group on Environment Jan 2020 – Apr 2021

**Tutorial Organization**

Lead organizer, AI for Social Impact tutorial @ IJCAI'23 August 2023

**Workshop Organization**

Co-organizer, Mechanism Design for Social Good workshop @ IJCAI'23 August 2023  
 Co-organizer, AI-Assisted Decision Making for Conservation Workshop at Harvard CRCS October 2022  
 Organizer, SMART/PAWS Workshop. Rio Bravo, Belize August 2022  
 Lead organizer, Harvard CRCS Rising Stars Workshop March 2020  
 Co-organizer, Computational Sustainability Doctoral Consortium October 2019

**Conference Event Organization**

Social chair, ACM EAAMO'22 October 2022  
 Social co-chair, ACM EAAMO'21 October 2021  
 Social co-chair, Fourth Workshop on MD4SG August 2020

**Seminar Organization**

Co-organizer, Harvard CRCS Panel on the Future of AI for Social Impact April 2022  
 Co-organizer, Harvard CRCS Social Impact Seminar Series Spring 2022  
 Co-organizer, Harvard CRCS Rising Stars Speaker Series April 2021  
 Co-organizer, CompSust Open Graduate Seminar (COGS) Spring 2020

**Program Committee (Reviewing)**

→ *Conferences*

*AIES.* Artificial Intelligence, Ethics, and Society 2022  
*AAAI.* AAAI Conference on Artificial Intelligence 2023  
*AAAI AISI track.* AAAI Conference on Artificial Intelligence 2020, 2021, 2022  
*COMPASS.* ACM SIGCAS Conference on Computing and Sustainable Societies 2021  
*EAAMO.* Equity and Access in Algorithms, Mechanisms, and Optimization 2021, 2022  
*FaccT.* ACM Conference on Fairness, Accountability, and Transparency 2022, 2023  
*IAAI.* AAAI Innovative Applications of Artificial Intelligence 2023  
*UAI.* Uncertainty in Artificial Intelligence 2023

→ *Workshops*

Autonomous Agents for Social Good (AASG) Workshop @ AAMAS 2021, 2023  
 RL Ready for Production Workshop @ AAAI 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
	Fourth Workshop on Mechanism Design for Social Good (MD4SG)	2020
	AI for Social Good Workshop @ Harvard CRCS	2020
	<b>Competition Selection Committee</b>	
	AI2, EarthRanger Conservation Tech Award	2022
	<b>Reviewer</b>	
	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
INVITED PANELS	<i>Hertz Foundation Workshop. AI Science and Policy, moderator</i>	July 2022
	Jacob Steinhardt, Julie Owono, Jessica Fjeld	
	<i>Harvard CRCS. The Future of AI for Social Impact, co-moderator</i>	April 2022
	Fei Fang, Lynn Kaack, Danaë Metaxa, Bryan Wilder	
	<i>South by Southwest (SXSW). AI for Wildlife, panelist</i>	March 2021
	<i>Harvard CRCS. AI for Social Impact, moderator</i>	March 2020
	Susan Murphy, Erez Yoeli, Desmond Patton	
INVITED TALKS	<i>Does not include contributed conference and workshop talks</i>	
	<b>Robust Restless Bandits for Maternal Health</b>	
	<i>INFORMS Healthcare. Behavioral Health session</i>	July 2023
	<b>Causal AI and Conservation</b>	
	WWF. Fuller Seminar Series on Conservation AI	April 2023
	Penn State. CSRAI Young Achiever Symposium	March 2023
	Harvard University. Davies Lab seminar	January 2023
	<b>Learning and Planning Under Uncertainty for Wildlife Conservation</b>	
	<i>Operations Research Society of South Africa.</i>	2023
	<i>Centro de Analítica para Políticas Públicas (CAPP). (in Spanish)</i>	December 2022
	<i>Georgia Tech. ISyE DEI seminar</i>	November 2022
	<i>Analytics for a Better World.</i>	September 2022
	<i>Harvard University. Kempner Institute celebration</i>	September 2022
	<i>Universität Tübingen. Decision Making Group</i>	August 2022
	<i>Harvard Kennedy School. “Leading in AI” Executive Education</i>	July 2022
	<i>Harvard SEAS. Summertime Seminar Series</i>	June 2022
	<i>UC Berkeley. Ethics and Practices of Algorithmic Conservation</i>	April 2022
	<i>MD4SG. Environment Working Group</i>	April 2022
	<i>UCL. Climate Hack AI Competition, keynote</i>	March 2022
	<i>Harvard University. AI-Assisted Decision-Making Colloquium</i>	February 2022
	<i>Pasteur’s Quadrant. Seminar Series</i>	February 2022

<i>Harvard Business School.</i> From Data to Decisions	October 2021
<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”	October 2022

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

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

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

<i>CompSust.</i> Computational Sustainability Doctoral Consortium	March 2022
<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. Kigali, Rwanda	December 2021
<i>IUCN WCC.</i> World Conservation Congress. Marseille, France	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

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

<i>Beijing Academy of Artificial Intelligence.</i>	March 2021
<i>University College London.</i> AI Society	February 2021
<i>Harvard University.</i> EconCS Seminar	March 2020

#### **Poaching Prediction and Patrol Planning Under Uncertainty**

<i>AI LA.</i> Earth Summit	April 2021
<i>Harvard CRCS.</i> Rising Stars Workshop	March 2020
<i>Harvard University.</i> PhD on Tap	February 2020

### **OUTREACH**

#### **Speaking**

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

#### **Mentoring**

<i>Harvard University.</i> InTouch Peer Mentor	2020 –
<i>Harvard University.</i> Women in STEM Mentor	2019 – 2020
<i>Dartmouth College.</i> Women in Computer Science	2017 – 2018

### Volunteering

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

### PRESS

#### Case Studies

<i>Harvard Business School.</i> SMART: AI and ML for Wildlife Conservation	October 2022
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#### Podcasts

<i>Ecochat.</i>	2023
<i>Harvard Business School - Cold Call.</i>	2023
<i>INFORMS Resoundingly Human Podcast.</i>	May 2022
<i>Rethinking Economics NL.</i> Disruptive Technologies podcast series.	May 2021

#### Video

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

#### Text

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

### NON-ACADEMIC LEADERSHIP

<b>Ledyard Canoe Club at Dartmouth.</b> <i>Secretary, Canoeing Leader</i>	2014 – 2018
<ul style="list-style-type: none"> <li>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.</li> <li>Co-organized an Explorers Symposium featuring ten notable speakers, including Olympic racers and members of National Geographic-sponsored expeditions.</li> <li>Led a group of twenty-eight students on a nine-day, 220-mile canoe expedition.</li> </ul>	



- 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