

# 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         2017 2016  2016 2015 2014
PUBLICATIONS	<i>* indicates equal contribution</i> <i>(<math>\alpha</math>-<math>\beta</math>) indicates alphabetical ordering</i>  <b>Ranger Patrols Deter Poachers: Causal Inference with Bayesian Modeling and Field Tests as an Instrument</b> <i>Under review</i> Rachel Guo, <b>Lily Xu</b> , Andrew Perrault  <b>Flexible Budgets in Restless Bandits: A Proximal Primal-Dual Algorithm for Efficient Budget Allocation</b> <i>Under review</i> Paula Rodriguez Diaz, Jackson A. Killian, <b>Lily Xu</b> , Aparna Taneja, Arun Sai Suggala, Milind Tambe  <b>Robust Planning over Restless Groups: Engagement Interventions for a Large-Scale Maternal Telehealth Program</b> <i>Under review</i> Jackson Killian*, Arpita Biswas*, <b>Lily Xu*</b> , Shresth Verma, Vineet Nair, Aparna Taneja, Aparna Hegde, Neha Madhiwalla, Paula Rodriguez Diaz, Sonja Johnson-Yu, Milind Tambe  <b>Optimistic Whittle Index Policy: Online Learning for Restless Bandits</b> <i>Under review</i>	

Kai Wang\*, **Lily Xu\***, Aparna Taneja, Milind Tambe

**Restless and Uncertain: Robust Policies for Restless Bandits via Deep Multi-Agent Reinforcement Learning**

*UAI-22.* 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-22.* 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-22.* 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-21.* 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-21.* 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-21.* 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-20.* 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

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

*NeurIPS MD4D.* Workshop on Machine Learning for Development 2020  
Rachel Guo, **Lily Xu**, Andrew Plumptre, Drew Cronin, Francis Okeke, and Milind Tambe  
[Best Lightning Paper](#)

**Game Theory on the Ground: The Effect of Increased Patrols on Deterring Poachers**

*Working paper*  
*Appeared at Harvard CRCS Workshop on AI for Social Good 2020*  
**Lily Xu**, Andrew Perrault, Andrew Plumptre, Margaret Driciru, Fred Wanyama, Aggrey Rwetsiba, and Milind Tambe

**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

*\*Equal contribution*

RESEARCH EXPERIENCE	<b>Harvard University.</b> Cambridge, MA <i>Doctoral Research Assistant</i> Advised by Prof. Milind Tambe	2019 – present
	<b>University of Southern California.</b> Los Angeles, CA <i>Doctoral Research Assistant</i> Advised by Prof. Bistra Dilkina and Prof. Milind Tambe	2018 – 2019
	<b>Dartmouth College.</b> Hanover, NH <i>Undergraduate Senior Thesis Researcher</i> Advised by Prof. Amro Farid	2017 – 2018
	<i>Presidential Scholar Research Assistant</i> Advised by Prof. Emily Whiting and Prof. David Kotz	2016 – 2017
WORK EXPERIENCE	<b>Google Research.</b> India, AI for Social Good lab <i>Student Researcher</i>	Spring 2022
	<b>Google.</b> Seattle, WA <i>Software Engineering Intern</i>	Summer 2017
	<b>Dyn, Inc.</b> Hanover, NH <i>Data Analytics Research Intern</i>	Spring 2016
TEACHING EXPERIENCE	→ <i>Guest Lecturer</i>	
	<i>Ohio State University.</i> CSE 5539. Strategic Decision-Making for Social Impact	Fall 2022
	<i>University of Southern California.</i> ISE 599. Analytics for Social Impact	Spring 2022
	<i>University of Pennsylvania.</i> OIDD 941. Recent Advances in Data-Driven Decision-Making	Spring 2022
	<i>Harvard University.</i> CS 96. Machine Learning for Social Impact	Spring 2022
	<i>Harvard Business School.</i> HBSMBA 2231. From Data to Decisions	Fall 2021
	<i>Cornell Tech.</i> ORIE 5355/INFO 5370. People, Data, Systems	Fall 2021
	<i>Wellesley University.</i> CS 115. Computing for the Socio-Techno Web	Fall 2021
	<i>Australian National University.</i> CECS8001. Building Cyber-Physical Systems	Fall 2021
	<i>University of Pittsburgh.</i> CS 1699. AI for Good: Ethics and Implications	Spring 2021
	<i>University of Michigan.</i> SI 431. Algorithms and Society	Spring 2021
	<i>Harvard University.</i> CS 182. Artificial Intelligence	Fall 2020
	<i>Dartmouth College.</i> CS 11. Foundations of Applied Computer Science	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	Winter 2017
	CS 11: Foundations of Applied Computer Science	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
STUDENTS ADVISED	Alejandra Perea Rojas '24, Harvard College	Summer 2022 –
	Rachel Guo '22, Harvard College	Summer 2020 –
	NCWIT Collegiate Award Winner	
	CRA Outstanding Undergraduate Researcher Award — Honorable Mention	
	Harvard Hoopes Prize for Outstanding Thesis	
	Thesis: <i>On the Effect of Ranger Patrols on Deterring Poaching: A Bayesian Approach for Causal Inference Using Field Tests as an Instrument</i>	
	Christopher Ong '23, Harvard College	Spring 2022
	Emilia Cabrera '21, Harvard College	Fall 2020 – Fall 2021
	Thesis: <i>Protecting the Lion's Share: Mitigating Illegal Wildlife Poaching with Multi-Agent Reinforcement Learning</i>	
	April Chen '22, Harvard College	Summer 2021
PROFESSIONAL SERVICE	Adobe Research Women-In-Technology Scholarship Winner	
	Ezenia Diaz-Lembert '23, Harvard College	Spring 2021
	<b>Initiative Organization</b>	
	Co-organizer, Mechanism Design for Social Good (MD4SG)	March 2021 –
	Co-lead, MD4SG Community Engagement	Oct 2020 – Apr 2021
	Co-organizer, MD4SG Working Group on Environment	Jan 2020 – Apr 2021
	<b>Program Organization</b>	
	Organizer, SMART/PAWS Workshop, Rio Bravo, Belize	August 2022
	Lead organizer, Harvard CRCS AI for Conservation Workshop	October 2022
	Social co-chair, ACM EAAMO'22	October 2022
	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
	Social co-chair, ACM EAAMO'21	October 2021
	Co-organizer, Harvard CRCS Rising Stars Speaker Series	April 2021
	Co-organizer, CompSust Open Graduate Seminar (COGS)	Spring 2020
	Social co-chair, Fourth Workshop on MD4SG	August 2020
	Lead organizer, Harvard CRCS Rising Stars Workshop	March 2020
	Co-organizer, Computational Sustainability Doctoral Consortium	October 2019
	<b>Conference Chair</b>	
	Session chair, INFORMS O.R. to Fight Climate Change / Sustainable O.R.	October 2022
	<b>Program Committee</b>	
	→ Conferences	
	AAAI. AAAI Conference on Artificial Intelligence	2023
	AAAI AISI track. AAAI Conference on Artificial Intelligence	2020, 2021, 2022
	IAAI. AAAI Innovative Applications of Artificial Intelligence	2023
	EAAMO. Equity and Access in Algorithms, Mechanisms, and Optimization	2021, 2022
	AIES. Artificial Intelligence, Ethics, and Society	2022
	FAccT. ACM Conference on Fairness, Accountability, and Transparency	2022
	COMPASS. ACM SIGCAS Conference on Computing and Sustainable Societies	2021
	→ Workshops	
	Cooperative AI Workshop @ NeurIPS	2022
	Data-Driven Humanitarian Mapping @ KDD	2020, 2021, 2022
	Black in AI Workshop @ NeurIPS	2020, 2021
	Machine Learning for the Developing World (ML4D) @ NeurIPS	2020, 2021
	Machine Learning for Public Health (ML4PH) @ NeurIPS	2021
	Autonomous Agents for Social Good (AASG) Workshop @ AAMAS	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.</i> AI Science and Policy, <i>moderator</i>	July 2022
	Jacob Steinhardt, Julie Owono, Jessica Fjeld	
	<i>Harvard CRCS.</i> The Future of AI for Social Impact, <i>co-moderator</i>	April 2022
	Fei Fang, Lynn Kaack, Danaë Metaxa, Bryan Wilder	
	<i>South by Southwest (SXSW).</i> AI for Wildlife	March 2021
	<i>Harvard CRCS.</i> AI for Social Impact, <i>moderator</i>	March 2020
INVITED TALKS	<b>Causal AI and Conservation</b>	
	WWF. Fuller Seminar Series on Conservation AI	January 2023
	<b>Ranger Patrols Deter Poachers: Causal Inference with Bayesian Modeling and Field Tests as an Instrument</b>	
	<i>IJCAI Workshop.</i> Complex Data Challenges in Earth Observation	July 2022
	<b>Learning, Planning, and Optimization Under Uncertainty for Wildlife Conservation</b>	
	<i>Analytics for a Better World.</i>	September 2022
	<i>Universität Tübingen.</i>	August 2022
	<i>Harvard Kennedy School.</i> “Leading in AI” Executive Education	July 2022
	<i>Harvard SEAS.</i> Summertime Seminar Series	June 2022
	<i>UC Berkeley.</i> Ethics and Practices of Algorithmic Conservation	April 2022
	<i>MD4SG.</i> Environment Working Group	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
	<b>Ranked Prioritization of Groups in Combinatorial Bandit Allocation</b>	
	<i>INFORMS Annual Meeting.</i> “Fairness in Sequential Decision Making”	October 2022
	<i>Sony.</i> Computer Science Laboratories (CSL)	October 2022
	<i>IJCAI.</i> 31st International Joint Conference on AI, Vienna, Austria	July 2022
	<b>Envisioning Communities: A Participatory Approach to AI for Social Good</b>	
	<i>Women’s Forum.</i> Women4AI Daring Circle workshop	June 2022
	<i>AIES.</i> Conference on AI, Ethics, and Society	May 2021
	<b>Robust Reinforcement Learning Under Minimax Regret for Green Security</b>	
	<i>CompSust.</i> Computational Sustainability Doctoral Consortium	March 2022
	<i>Google Research India.</i> AI for Social Good	January 2022
	<i>UAI.</i> Uncertainty in Artificial Intelligence Conference	July 2021

AAMAS Workshop. Autonomous Agents for Social Good (AASG) May 2021

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

ICCB. International Congress for Conservation Biology, Kigali, Rwanda December 2021  
IUCN WCC. World Conservation Congress, Marseille, France September 2021  
WILDLABS. Tech Tutors: Season Three September 2021  
AI for Climate. Mexico Lightning Talks Series powered by Huawei July 2021  
SMART Partnership. International Women's Day Webinar March 2021  
WWF. Webinar on SMART April 2020

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

Beijing Academy of Artificial Intelligence. March 2021  
University College London. AI Society February 2021  
AAAI. Thirty-Fifth AAAI Conference on Artificial Intelligence February 2021  
CompSust. Computational Sustainability Doctoral Consortium October 2020  
Harvard CRCS. AI for Social Good Workshop July 2020  
Carnegie Mellon University. AI and Social Good Symposium April 2020  
Harvard University. EconCS Seminar March 2020

#### Poaching Prediction and Patrol Planning Under Uncertainty

AI LA. Earth Summit April 2021  
Harvard CRCS. Rising Stars Workshop March 2020  
ICDE. IEEE International Conference on Data Engineering April 2020  
Harvard University. PhD on Tap February 2020  
Carnegie Mellon University. CompSust Doctoral Consortium October 2019  
KDD Workshop. Data Mining and AI for Conservation August 2019  
AAMAS Workshop. Strategic Reasoning for Societal Challenges May 2019

#### OUTREACH

##### Speaking

Harvard. Tech for Social Good, *panelist* April 2021  
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

##### Podcasts

<i>INFORMS Resoundingly Human Podcast.</i>	May 2022
<i>Rethinking Economics NL.</i> Disruptive Technologies podcast series.	May 2021

## Video

*Voice of America (VOA) News.* Wildlife Rangers Use AI to Predict Poachers' Next Moves.  
January 2022

## Text

*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

*Alhub.* 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