Lily Xu

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lily-x.github.io

EDUCATION	**Harvard University**. Cambridge, MA	(expected) 2024

PhD Candidate in Computer Science
Advised by Prof. Milind Tambe

Dartmouth College. Hanover, NH — 2018
A.B. with Honors in Computer Science, minor in Spanish
Magna cum laude

HONORS AND AWARDS

Stanford Rising Star in Management Science and Engineering (MS&E) — 2023

Google PhD Fellowship — 2022
One of 13 awardees in machine learning globally, with two years of funding support.

INFORMS Doing Good with Good OR Competition Winner — 2021
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".

AAAI Best Paper Award Runner Up — 2021
3 best papers and 3 runner-ups were selected out of 9,034 submissions and 1,692 accepted papers.

Harvard University Certificate of Distinction in Teaching — 2021

Certificate of Appreciation from the SMART Partnership — 2019

Five Citations for Academic Excellence at Dartmouth College — 2014 – 2018
Special distinction rarely awarded by faculty members "for meritorious characteristics not indicated adequately by academic grades", received across five computer science and Spanish courses.

Adobe Women-In-Technology Scholarship – Honorable Mention — 2017

NON-PROFIT SERVICE

SMART Conservation Partnership.
AI Lead — 2022 – present
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 8 leading conservation NGOs: WWF, Wildlife Conservation Society, Wildlife Protection Solutions, Frankfurt Zoological Society, ZSL, NC Zoo, Panthera, and Re:wild.

WORK EXPERIENCE

Google Research. India, AI for Social Good lab
Student Researcher — Spring 2022

Google. Seattle, WA
Software Engineering Intern — Summer 2017

Dyn, Inc. Hanover, NH
Data Analytics Research Intern — 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*
(α–β) *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

PREPRINTS AND WORKSHOP PAPERS

Reflections from the Workshop on AI-Assisted Decision Making for Conservation
white paper
Lily Xu*, Esther Rolf*, et al.

Ranger patrols deter poaching: first causal insights for improving protected area management
under review; preliminary at EAAMO 2022
Rachel Guo[†]*, **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
(α–β) 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[†], **Lily Xu**, Andrew Plumptre, Drew Cronin, Francis Okeke, and Milind Tambe

Causal AI and Conservation

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

Minimax Regret Optimization: Robust Planning for Conservation and Maternal Health

Berkeley MARL. Multi-Agent Learning Seminar	March 2023
Brown University. Algorithmic Game Theory group	March 2023

Learning and Planning Under Uncertainty for Wildlife Conservation

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

Ranked Prioritization of Groups in Combinatorial Bandit Allocation

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

Envisioning Communities: A Participatory Approach to AI for Social Good

MIT. AI Ethics group	September 2022
Women's Forum. Women4AI Daring Circle workshop	June 2022

Robust Reinforcement Learning Under Minimax Regret for Green Security

Google Research India. AI for Social Good research group	January 2022

PAWS: AI to Predict and Plan Against Poaching

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

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

Beijing Academy of Artificial Intelligence.	March 2021

University College London. AI Society February 2021

INVITED PANELS	

Hertz Foundation Workshop. AI Science and Policy, *moderator* July 2022
    panelists: Jacob Steinhardt, Julie Owono, Jessica Fjeld
South by Southwest (SXSW). AI for Wildlife, *panelist* March 2021
Harvard CRCS. AI for Social Impact, *moderator* March 2020
    panelists: Susan Murphy, Erez Yoeli, Desmond Patton

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

Workshop Organization
Co-organizer, AI-Assisted Decision Making for Conservation Workshop 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

Tutorials
Lead organizer, AI for Social Impact tutorial August 2023
    with Emily Aiken, Priya Donti, Nikhil Garg, and Paul Gölz

Panels
Co-organizer and co-moderator. The Future of AI for Social Impact April 2022
    panelists: Fei Fang, Lynn Kaack, Danaë Metaxa, Bryan Wilder

Conference Event Organization
Social co-chair, ACM EAAMO'23 October 2023
Social co-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 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, 2023
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, 2023
FAccT. ACM Conference on Fairness, Accountability, and Transparency 2022, 2023
IAAI. AAAI Innovative Applications of Artificial Intelligence 2023
NeurIPS. Neural Information Processing Systems 2023
UAI. Uncertainty in Artificial Intelligence 2023

$\rightarrow$ *Workshops*

AI for Wildlife Conservation @ SIGSPATIAL	2023
Autonomous Agents for Social Good (AASG) @ AAMAS	2021, 2023
AI for Social Good @ AAAI	2023
Data-Driven Humanitarian Mapping @ KDD	2020, 2021, 2022
Regulating Machine Learning @ NeurIPS	2023
Cooperative AI Workshop @ NeurIPS	2022
Black in AI Workshop @ NeurIPS	2020, 2021, 2022
Machine Learning for the Developing World (ML4D) @ NeurIPS	2020, 2021
Machine Learning for Public Health @ NeurIPS	2021
Resistance AI @ NeurIPS	2020
AI for Social Good @ IJCAI	2020
Mechanism Design for Social Good (MD4SG)	2020
AI for Social Good @ 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, *subreviewer*	2021
NeurIPS, *subreviewer*	2020
IJCAI Special Track on CompSust and Human Well-being, *subreviewer*	2020
COMPASS, *subreviewer*	2019
Bloomberg Data for Good Exchange (D4GX), *subreviewer*	2019

STUDENTS ADVISED $\rightarrow$ *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

Adobe Research Women-In-Technology Scholarship Winner

Ezenia Diaz-Lembert '23	Spring 2021
Emilia Cabrera '21	Sept 2020 – Dec 2021

Thesis: Protecting the Lion's Share: Mitigating Illegal Wildlife Poaching with Multi-Agent Reinforcement Learning

Rachel Guo '22	June 2020 – May 2023

NCWIT Collegiate Award Winner
CRA Outstanding Undergraduate Researcher Award — Honorable Mention
Harvard Hoopes Prize for Outstanding Thesis
NSF Graduate Research Fellowship
Thesis: On the Effect of Ranger Patrols on Deterring Poaching: A Bayesian Approach for Causal Inference Using Field Tests as an Instrument
Next step: Stanford ICME PhD student

TEACHING	→ *Guest Lecturer*	
EXPERIENCE	*Cornell University.* INFO 6960. Data Science for Global Development	Spring 2023
	MIT. 15 076. Analytics for a Better World	Spring 2023
	Harvard University. CS 96. Machine Learning for Social Impact	Spring 2023
	Wellesley University. CS 115. Computing for the Socio-Techno Web	Fall 2022
	Ohio State University. CSE 3521. Survey of Artificial Intelligence I	Fall 2022
	Harvard University. 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. AInnovation 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.

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

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