

Lily Xu

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lily-x.github.io

EDUCATION	Harvard University. Cambridge, MA PhD Candidate in Computer Science <i>Advisor: Milind Tambe</i> <i>Thesis committee: Dimitris Bertsimas, Yiling Chen, Andrew Davies</i> Dartmouth College. Hanover, NH A.B. with Honors in Computer Science, minor in Spanish <i>Magna cum laude</i>	expected 2024 2018
HONORS	Siebel Scholar GATech Rising Star in EECS Stanford Rising Star in Management Science and Engineering (MS&E) <i>Selected participant at workshop to “celebrate and fast-track the careers of exceptional young scholars at a critical inflection point in their career”.</i> Google PhD Fellowship <i>One of 13 awardees in machine learning globally.</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> Certificate of Appreciation from the SMART Partnership <i>Recognition for contribution to developing PAWS system.</i> 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	2024 2023 2023 2022 2021 2021 2019 2014 – 2018 2017
NON-PROFIT SERVICE	SMART Conservation Partnership. 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 8 leading conservation NGOs: WWF, Wildlife Conservation Society, Wildlife Protection Solutions, Frankfurt Zoological Society, ZSL, NC Zoo, Panthera, and Re:wild.</i>	2022 – present
WORK EXPERIENCE	Google Research. India, AI for Social Good lab <i>Student Researcher</i> Google. Seattle, WA <i>Software Engineering Intern</i> Dyn, Inc. Hanover, NH <i>Data Analytics Research Intern</i>	Spring 2022 Summer 2017 Spring 2016

PREPRINTS

* indicates equal contribution

† indicates undergraduate I advised

(α – β) indicates alphabetical ordering

Reinforcement learning with combinatorial actions for coupled restless bandits

Under review

Lily Xu, Bryan Wilder, Elias B. Khalil, Milind Tambe

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

Working paper

Rachel Guo^{†*}, **Lily Xu**^{*}, Andrew Perrault, Luke W. Miratrix, Andrew J. Plumptre, Joshua Mabonga, Herbert Kitimbo, Fredrick Wanyama, Simon Nampindo, Milind Tambe, Andrew B. Davies

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

Reflections from the Workshop on AI-Assisted Decision Making for Conservation

White paper

Lily Xu^{*}, Esther Rolf^{*}, Sara Beery, Joseph R. Bennett, Tanya Berger-Wolf, Tanya Birch, Elizabeth Bondi-Kelly, Justin Brashares, Melissa Chapman, Anthony Corso, Andrew Davies, Nikhil Garg, Angela Gaylard, Robert Heilmayr, Hannah Kerner, Konstantin Klemmer, Vipin Kumar, Lester Mackey, Claire Monteleoni, Paul Moorcroft, Jonathan Palmer, Andrew Perrault, David Thau, Milind Tambe

PUBLICATIONS
(JOURNALS)

Bridging adaptive management and reinforcement learning for more robust decisions

Philosophical Transactions of the Royal Society B (2023) Volume 378, Issue 1881
Melissa Chapman, **Lily Xu**, Marcus Lapeyrolerie, Carl Boettiger

PUBLICATIONS
(CONFERENCES)

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

ICDE 2020. 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

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

AAAI 2021. 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

Envisioning Communities: A Participatory Approach Towards AI for Social Good

AIES 2021. 4th AAI/ACM Conference on AI, Ethics, and Society

Elizabeth Bondi^{*}, **Lily Xu**^{*}, Diana Acosta-Navas, Jackson A. Killian

Robust Reinforcement Learning Under Minimax Regret for Green Security

UAI 2021. 37th Conference on Uncertainty in Artificial Intelligence

Lily Xu, Andrew Perrault, Fei Fang, Haipeng Chen, Milind Tambe

Oral Presentation

Top 6.17% of submissions

Coordinating Followers to Reach Better Equilibria: End-to-End Gradient Descent for Stackelberg Games

AAAI 2022. 36th AAAI Conference on Artificial Intelligence

Kai Wang, Lily Xu, Andrew Perrault, Michael K. Reiter, Milind Tambe

Ranked Prioritization of Groups in Combinatorial Bandit Allocation

IJCAI 2022. 31st International Joint Conference on Artificial Intelligence

Lily Xu, Arpita Biswas, Fei Fang, Milind Tambe

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

UAI 2022. 38th Conference on Uncertainty in Artificial Intelligence

Jackson A. Killian, Lily Xu, Arpita Biswas, Milind Tambe

Optimistic Whittle Index Policy: Online Learning for Restless Bandits

AAAI 2023. 37th AAAI Conference on Artificial Intelligence

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

Robust Planning over Restless Groups: Engagement Interventions for a Large-Scale Maternal Telehealth Program

AAAI 2023. 37th 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

Flexible Budgets in Restless Bandits: A Proximal Primal-Dual Algorithm for Efficient Budget Allocation

AAAI 2023. 37th AAAI Conference on Artificial Intelligence

Paula Rodriguez Diaz, Jackson A. Killian, Lily Xu, Aparna Taneja, Arun Sai Suggala, Milind Tambe

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

FUNDING:
PROPOSALS AND
AWARDS

Co-I. Hannah Kerner, Sara Beery, Lily Xu, Jacob Muise, Shay Chan Hodges, Nicholas Winfrey. *Combating Invasive Axis Deer in Maui, Hawaii with Earth Observations and Machine Learning*. Submitted to NASA in response to 2022 Research Opportunities in Space and Earth Sciences (ROSES) A.40 Earth Science Applications: Ecological Conservation (ECON)

Lily Xu. Google PhD fellowship, awarded 2022. \$88,029

High-stakes decisions from low-quality data: AI decision-making for planetary health

<i>Georgia Tech.</i> EECS Rising Stars	November 2023
<i>UC Berkeley.</i> Data Science Toolbox Series	October 2023
<i>INFORMS Annual Meeting.</i> ML for Social Good session	October 2023
<i>Cornell ORIE.</i> Young Researchers Workshop	October 2023

Causal AI and Conservation

<i>ICCB.</i> SMART Symposium, Kigali, Rwanda	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>Berkeley MARL.</i> Multi-Agent Learning Seminar	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	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
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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

	WWF. Webinar on SMART	April 2020
	AI LA. 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>	July 2022
	panelists: Jacob Steinhardt, Julie Owono, Jessica Fjeld	
	<i>South by Southwest (SXSW). AI for Wildlife, panelist</i>	March 2021
	<i>Harvard CRCS. AI for Social Impact, moderator</i>	March 2020
	panelists: Susan Murphy, Erez Yoeli, Desmond Patton	
PROFESSIONAL SERVICE	Mechanism Design for Social Good (MD4SG)	
	Nonprofit incorporation and Executive Director recruitment, lead	April 2023 –
	MD4SG initiative-wide co-organizer	March 2021 –
	<i>with Charles Cui, Francisco J. Marmolejo Cossío, George Obaido, Matthew Olckers, and Ana-Andrea Stoica;</i>	
	<i>previously with Rediet Abebe, Irene Lo, and Wanyi Li</i>	
	Community Engagement team, founder and co-lead	Oct 2020 – Apr 2021
	Working Group on Environment, co-founder and co-organizer	Jan 2020 – Apr 2021
	Workshop Organization	
	Co-organizer, AI-Assisted Decision Making for Conservation Workshop	October 2022
	<i>with Esther Rolf and Milind Tambe</i>	
	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
	<i>with Priya Donti, Genevieve Flaspohler, Aaron Ferber, and Sebastian Ament</i>	
	Tutorials	
	Lead organizer, AI for Social Impact tutorial @ EAAMO	October 2023
	<i>with Emily Aiken, Priya Donti, Nikhil Garg, and Paul Gölz</i>	
	Panels	
	Co-organizer and co-moderator. The Future of AI for Social Impact	April 2022
	<i>panelists: Fei Fang, Lynn Kaack, Danaë Metaxa, Bryan Wilder</i>	
	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)	
	→ <i>Conferences</i>	
	<i>AIES. Artificial Intelligence, Ethics, and Society</i>	2022, 2023
	<i>AAAI. AAAI Conference on Artificial Intelligence</i>	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

→ *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
 Computational Sustainability @ 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 → *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
EXPERIENCE

→ *Guest Lecturer*

<i>Cornell Tech.</i>	CS 6382. Data Science for Social Change	Fall 2023
<i>Cornell Tech.</i>	ORIE 5355/INFO 5370. Applied Data Science: Decision-making beyond prediction	Fall 2023
<i>Harvard.</i>	CS 182. Artificial Intelligence	Fall 2023
<i>Cornell.</i>	INFO 6960. Data Science for Global Development	Spring 2023
<i>MIT.</i>	15 076. Analytics for a Better World	Spring 2023
<i>Harvard.</i>	CS 96. Machine Learning for Social Impact	Spring 2023
<i>Wellesley.</i>	CS 115. Computing for the Socio-Techno Web	Fall 2022
<i>Ohio State.</i>	CSE 3521. Survey of Artificial Intelligence I	Fall 2022
<i>Harvard.</i>	CS 288. AI for Social Impact class	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.</i>	CS 96. Machine Learning for Social Impact	Spring 2022
<i>Cornell Tech.</i>	ORIE 5355/INFO 5370. People, Data, Systems	Fall 2021
<i>Harvard Business School.</i>	HBSMBA 2231. From Data to Decisions	Fall 2021
<i>Wellesley.</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.</i>	CS 182. Artificial Intelligence	Fall 2020
<i>Dartmouth.</i>	CS 11. Foundations of Applied Computer Science	Spring 2018

Harvard University

→ *Head Teaching Fellow*

CS 182: Artificial Intelligence	Fall 2020
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Certificate of Distinction in Teaching

Dartmouth College

→ *Teaching Assistant, Department of Computer Science*

CS 31: Algorithms	Winter 2017
CS 11: Foundations of Applied Computer Science, <i>head TA</i>	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

<i>Harvard.</i> Tech for Social Good and Harvard Computer Society	March 2023
<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>	AInnovation 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>	AI for Conservation - Using Machine Learning to Stop Poaching	2023
<i>Cold Call (Harvard Business School podcast).</i>	Can AI and Machine Learning Help Park Rangers Prevent Poaching?	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

Articles

<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