How should a young researcher navigate the AI landscape without feeling overwhelmed:
An "AI for Social Good" perspective

MILIND TAMBE

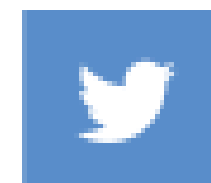*Director, Ctr for Research on Computation & Society*

Harvard University

Director "AI for Social Good"

Google Research India
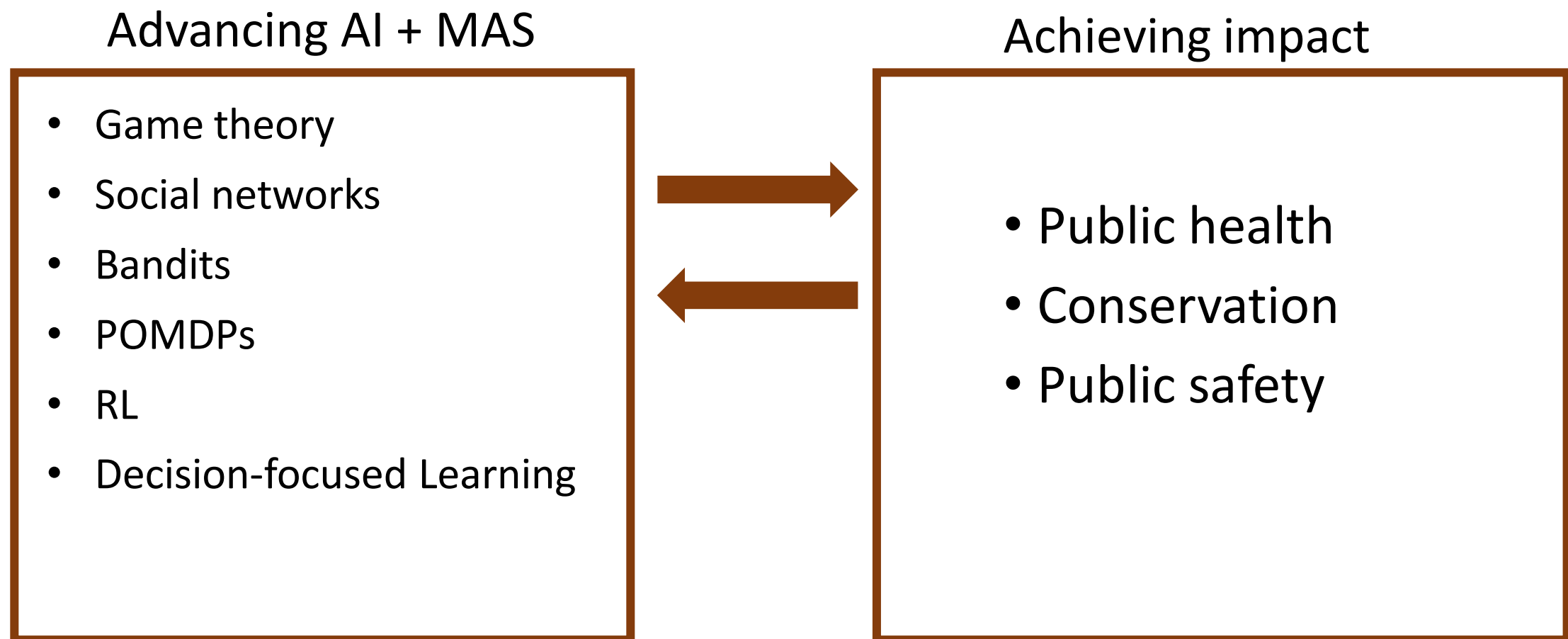
@MilindTambe_AI

AI Explosion and its benefits

- *AI is not benefiting everyone equally*

"Social Impact Driven" Approach to AI Research

- *AI research & Social Impact go hand-in-hand*

Advancing AI + MAS

- Game theory
- Social networks
- Bandits
- POMDPs
- RL
- Decision-focused Learning

Achieving impact

- Public health
- Conservation
- Public safety

AI & Multiagent Systems Research for Social Impact

Public Health

Conservation

Public Safety and Security

Optimize Our Limited Intervention Resources

Examples

Public Health: Influence maximization & social networks

Conservation/Wildlife Protection: Green Security Games

Public Safety & Security: Stackelberg Security Games (brief)

Information dissemination & behavior change
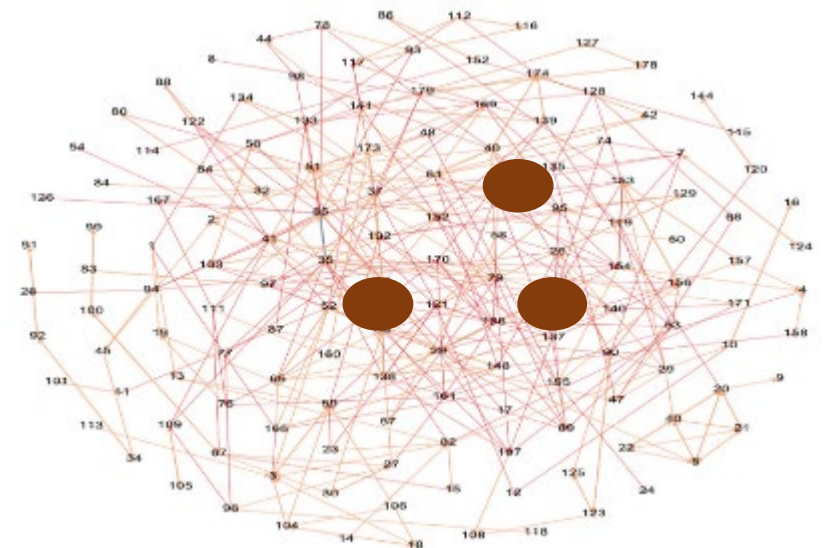# Optimizing Limited Intervention (Social Worker) Resources

Preventing HIV in homeless youth in Los Angeles: Rates of HIV 10 times housed population

➢ ***Shelters****: Limited number of peer leaders to spread HIV information in social networks*

➢ *"Real" face-to-face interactions; not Facebook etc*

Research Advance:
Influence Maximization in Social Networks

- Given:

  - Social network Graph G

  - Given edge propagation probabilities

  - Choose K "peer leader" nodes

- Objective: Maximize expected number of influenced nodes

- *Address new research questions:*

  - *Unknown social network; unknown propagation probabilities…*

  - *Social impact driven AI research*

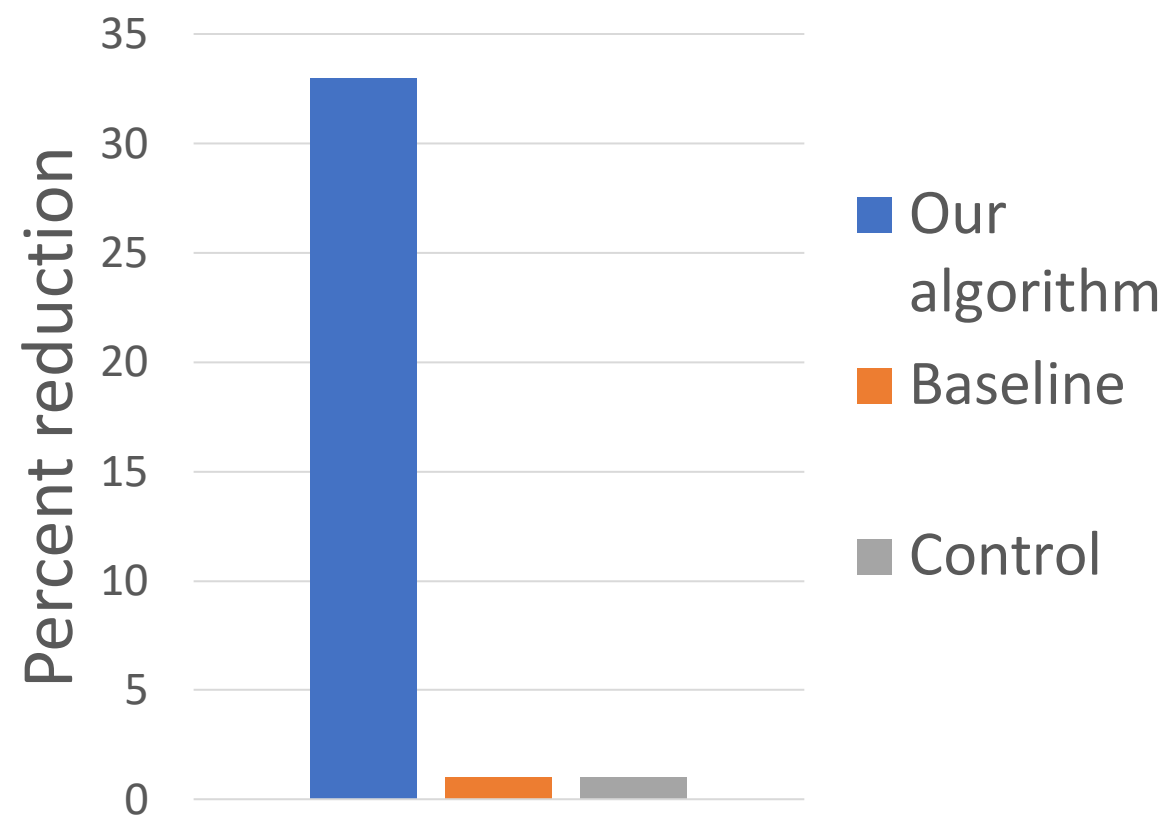# First large-scale application of Influence maximization for public health
(AAAI 2021)

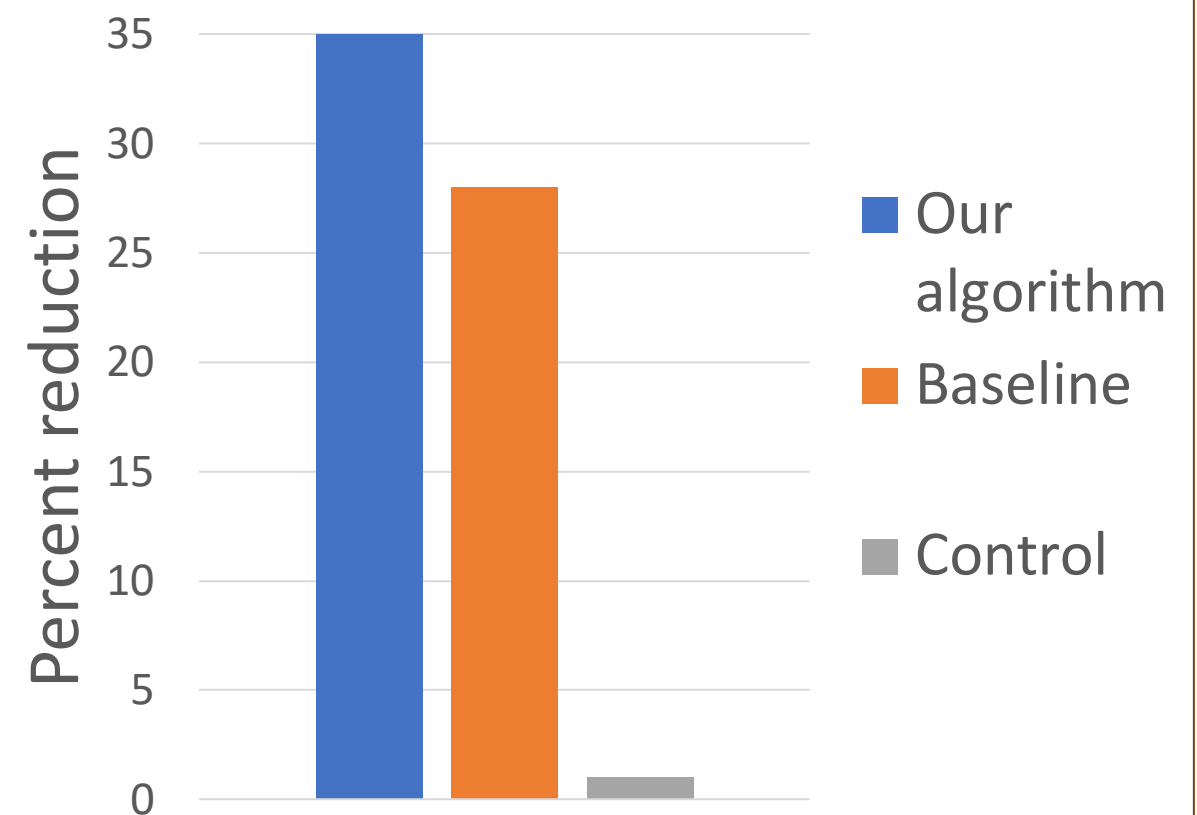## *Results of study with 750 Youth experiencing homelessness in Los Angeles*

Reduction in condomless anal sex (1 month) — Our algorithm ≈ 33, Baseline ≈ 1, Control ≈ 1 (Percent reduction)
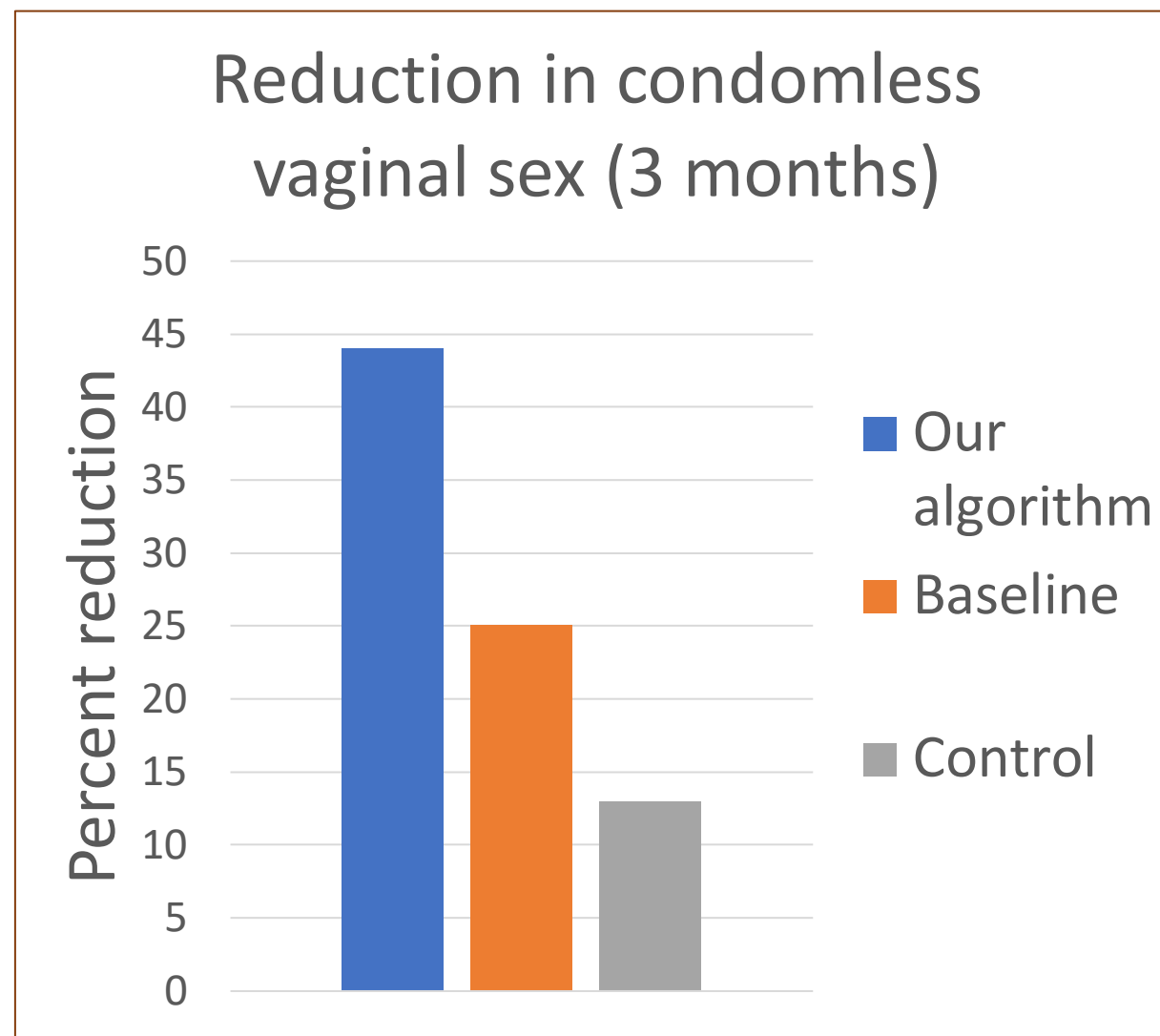
Reduction in condomless anal sex (3 months) — Our algorithm ≈ 35, Baseline ≈ 28, Control ≈ 1 (Percent reduction)
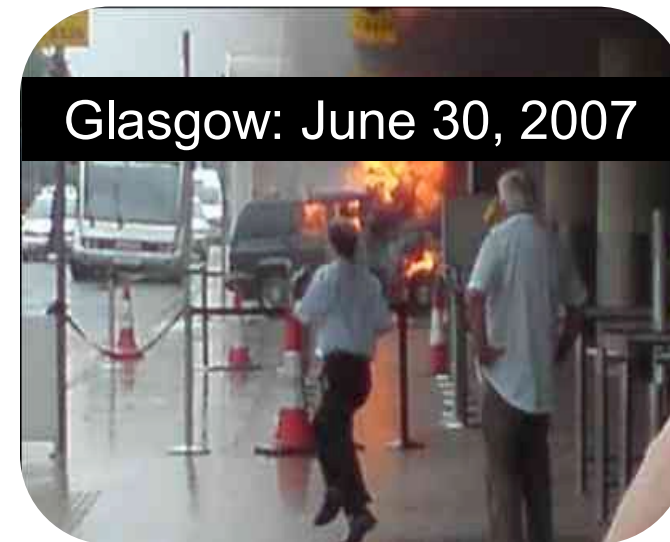
Results of 750 Youth Study [with Prof. Eric Rice]

ARMOR Airport Security: LAX(2007)
Game Theory direct use for security resource optimization?

Erroll Southers

LAX Airport, Los Angeles

Glasgow: June 30, 2007

Research Advance:
Game Theory for Security Resource Optimization

New Model: Stackelberg Security Games

Stackelberg: Defender commits to randomized strategy, adversary responds

Security game: Played on targets, payoffs based on calculated losses

New Algorithms: Solve massive scale games for optimal randomized allocation

Adversary

Defender

	Terminal #1	Terminal #2
Terminal #1	4, -3	-1, 1
Terminal #2	-5, 5	2, -1

First Application of Computational Game Theory for Operational Security

ARMOR deployed at Los Angeles Airport 2007

January 2009

- January 3rd   *Loaded 9/mm pistol*
- January 9th   *16-handguns,*
                 1000 rounds of ammo
- January 10th   *Two unloaded shotguns*
- January 12th   *Loaded 22/cal rifle*
- January 17th   *Loaded 9/mm pistol*
- January 22nd   *Unloaded 9/mm pistol*

Deployed Security Games Systems…

ARMOR
2007

IRIS
2009

PROTECT
2011

**Erroll Southers testimony
Congressional subcommittee**

**TSA testimony
Congressional subcommittee**

**US Coast Guard testimony
Congressional subcommittee**

Protecting Conservation Areas: Green Security Games
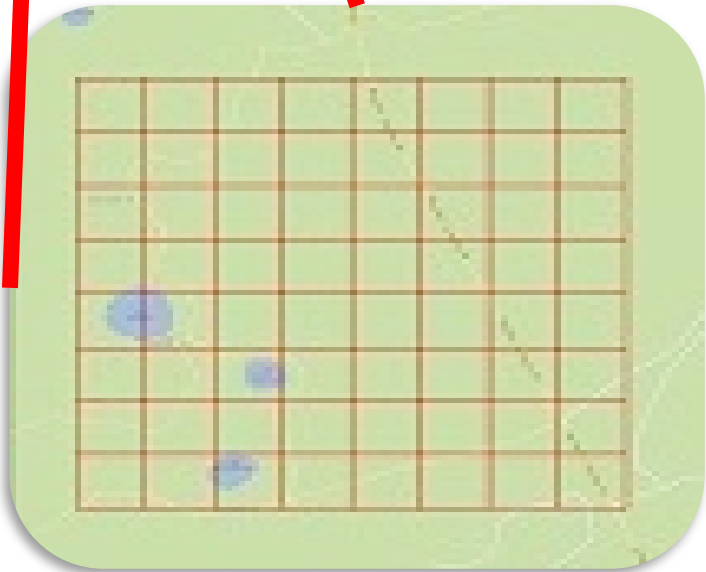*(IJCAI 2015)*

Snare or Trap   **Wire snares**

From Stackelberg Security Games to Green Security Games
(IJCAI 2015)

➢ **Green security games**

	Area1	Area2
Area1	4, -3	-1, 1
Area2	-5, 5	2, -1

PAWS Real-world Deployment
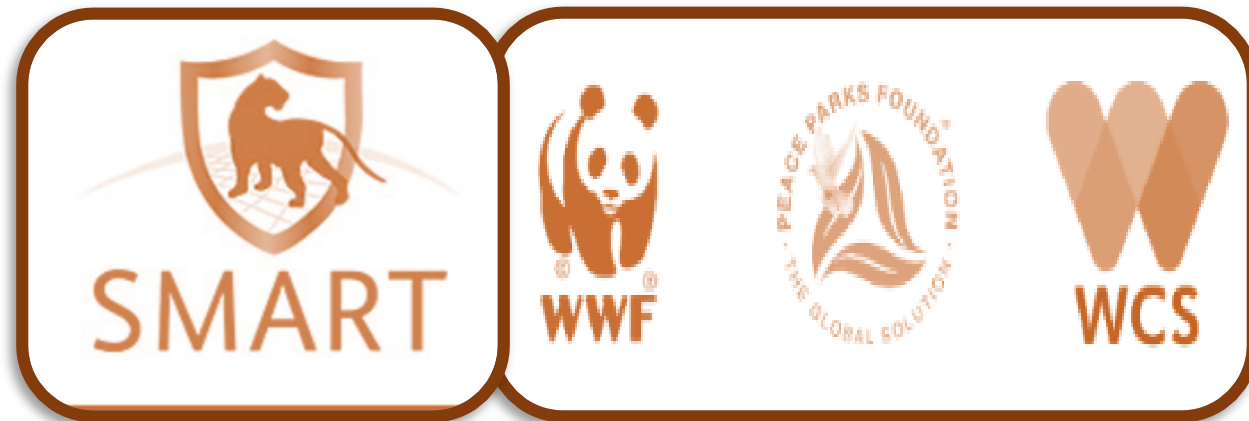# Cambodia: Srepok Wildlife Sanctuary
(ICDE 2020)

- *521 snares/month our tests*

  vs

- *101 snares/month 2018*

First large scale application of AI for Wildlife Conservation
PAWS GOES GLOBAL with SMART platform!!

SMART · WWF · PEACE PARKS FOUNDATION · WCS

AI for Earth

Protect Wildlife
800
National Parks
Around the Globe

Also: Protect Forests, Fisheries…

Interdisciplinary Partnerships

Empower non-profits to use AI tools; avoid being gatekeepers to AI4SI technology

Advice to New Researchers to Navigate AI Landscape:
Social impact driven approach to AI research

Research has to be for something, not just writing more papers… ☺

In our research AI research and social impact has gone hand in hand:

- *Stackelberg security games, uncharted influence maximization, Green Security Games*

Team up with non-profits to find new AI challenges

@MilindTambe_AI

AI4SG Workshop - November 2019
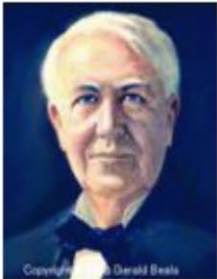## Bringing AI researchers & NGOs together

- NGOs, Academics (AI, Policy, Sociology), Googlers

- 25+ Proposals submitted in 2 days

- Selected six projects as combination NGO+academics +Googlers

Google Research

Pasteur's Quadrant
"Social Impact Driven" Approach to AI Research

Donald E. Stokes Pasteur Quadrant

		Considerations of use?	
		✗	✓
Quest for fundamental understanding?	✓	Niels Bohr	Louis Pasteur
	✗		Thomas Edison

Source: Donald E. Stokes, *Pasteur's Quadrant*, p. 73