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WILDLIFE WATCH

Rangers Use Artificial Intelligence to Fight Poachers

Emerging technology may help wildlife officials beat back traffickers.

BY JACKIE SNOW

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Poachers kill an estimated 96 African elephants every day, causing [conservationists](#) to warn that the iconic animals could disappear in our lifetime if the tide doesn't turn. But now scientists hope a new artificial intelligence (AI) tool could help wildlife officials get a leg up against poachers.

PAWS, which stands for Protection Assistant for Wildlife Security, is a newly developed AI that takes data about previous poaching activities and outputs routes for patrols based on where poaching is likely to occur. These routes are also randomized to keep poachers from learning patrol patterns. Using machine learning, a branch of AI, PAWS can continually find new insights as more data is added.

Milind Tambe, a professor of computer science at the University of Southern California, became interested in working on an AI solution for poaching after he went to a [Global Tiger Initiative](#) conference, where he says his eyes were opened to the threat of extinction for animals like the tiger and elephant.

"I found out just how stark things were for animals that I'd read bedtime stories to my kids about," Tambe says.

In 2013, Tambe put together a team of Ph.D. students to work on what turned into PAWS. The core algorithm of PAWS is based on security games, a subset of game theory where a defender tries to optimize limited resources to prevent attacks. Using security game theory, Tambe has built algorithms used by Homeland Security, the Transportation Security Administration, and the Coast Guard that predicts where resources like agents and surveillance would best be placed to interfere with smuggling and terrorism.

Fei Fang, one of the Ph.D. students working on PAWS, had previously written a paper about how security games could be used to prevent wildlife crimes. Fang coined the phrase "green security games" to describe the field. But PAWS is the first time green security game theory has been used in the real world. ([Learn about other ways technology is used to stop wildlife crime.](#))

Success in the Field

Tambe's team partnered with the Uganda Wildlife Authority at Queen Elizabeth National Park, where the UWA had collected 14 years of data about poaching activities. The database included more than 125,000 observations on things like animal sightings, snares, animal remains, and other signs of poaching, all with GPS coordinates. Using the data, Tambe and his students built the first version of PAWS for a trial deployment.

After a successful test in Uganda, PAWS was taken to Malaysia for a larger trial in 2014, where the team quickly realized the area's rugged terrain necessitated factoring in topographic information. The first patrols had some rangers on arduous routes.

After that, PAWS outperformed previous patrols in the number of animal and human activity signs seen per kilometer. The experience in the field helped Fang and the team refine the program even more.

"We've learned from our first-hand experience," Fang says. "We got to know how patrols really work."

In a published paper, Fang and the team caution that the previous patrols aren't a perfect comparison but that the data nonetheless prove "PAWS can guide the patrollers toward hotspots of poaching activity and provide valuable suggestions to the patrol planners."

No arrests have been made because of PAWS yet, but that could change later this year when there are plans to take PAWS back to Queen Elizabeth National Park for three months in a larger deployment.

Unlike other AI technologies developed to replace workers, PAWS is a tool *for* rangers. Tambe says that while PAWS is better at taking all data into account and providing truly random patrols, humans are better at other analyses and following up on leads.

"There is a need to have AI and human intelligence collaborate together," Tambe says.

High-Tech Rangers

The Uganda Wildlife Authority already has experience using advanced technology to better understand poachers. One such strategy is called SMART, or Spatial Monitoring and Reporting Tool. It's a database that compiles GPS-tagged observations from every patrol and it helps UWA see the big picture, says Andy Plumtre, the director of the Albertine Rift program with the Wildlife Conservation Society.

The SMART program has helped Uganda increase its elephant population to 5,739 in 2014, up from 2,497 in 2005, says Plumtre.

"Uganda is quite a success story," Plumtre says. "They are managing to control the poaching."

PAWS will expand the country's capability with more analysis and computer-generated routes, Plumtre says. The randomized routes could even help undermine any corrupt rangers who let poachers know ahead of time about patrols.

Making patrols smarter and more efficient could even have a far-reaching impact beyond the immediate saving of animals. Plumtre says Uganda Wildlife Authority uses 50 to 90 percent of its budget on ranger patrols. If patrols could be more efficient, more of the budget could go to programs like tourism development, invasive plant removal, and undercover operations to stop wildlife trafficking that comes through Uganda from other parts of Africa.

Beyond improving patrol strategies in the future, PAWS could help reduce wildlife smuggling and even demand for products like ivory by learning and then applying what social pressures work on consumers, Tambe says.

He adds that being the first to test green security games AI was a boon for his field but getting to leave the lab and see the ecosystems he was trying to protect was really gratifying.

"It's very easy for us just to do theory and mathematical models and be seduced by that," Tambe says. "But seeing these places in person had the subtle impact of saying that we should protect this and not let it disappear off the face of the Earth."

Editor's Note, June 1, 2017: Rangers on patrols set out by INTERCEPT, the next-generation AI software that followed PAWS, caught a poacher in December 2016 and found a dozen elephant snares in September 2016 before they could be used in Uganda's Queen Elizabeth National Park.