Microsoft

AI for Earth Grantee Profile

Conservation Metrics
Automated wildlife monitoring

Summary

Conservation Metrics is developing automated solutions using Microsoft Azure that collect, process, and analyze terabytes of wildlife metrics. By moving its infrastructure to Azure, Conservation Metrics hopes to give researchers more time and resources to meet their conservation goals by significantly closing the gap between field work and information and discovery.

Closing the gap between field work and analysis

Capturing and analyzing rigorous wildlife metrics are important tasks for conservation biologists. Wildlife surveys are used to estimate population trends, detect rare species, quantify impacts of human activities, and provide researchers with data on the success of conservation programs to optimize investments. These statistically powerful monitoring efforts can help ensure the relatively small amount of money available to conservation is applied effectively.

> Researchers collect terabytes of wildlife data with automated sensors, yet often lack the resources to process and analyze the data efficiently.

Currently, monitoring outcomes in conservation lags behind other sectors because of the logistical challenges, costs, and low-statistical power of most traditional survey efforts. Finding and counting animals in the wild is a difficult challenge, particularly in remote wilderness areas. Historically, human surveyors have used boot-on-the-ground methods such as point counts or similar census methods.

The advent of automated wildlife sensors provides researchers with tools for rapid evaluation and monitoring, even in areas that are difficult to access. This technique allows researchers to collect a huge amount of wildlife metrics; however, processing these large data streams using traditional analytical methods requires extensive computer resources and human labor.

Expanding wildlife survey analysis with Conservation Metrics

Conservation Metrics develops automated solutions that collect, process, and analyze wildlife survey data to provide metrics for the conservation sector. Using deep-learning techniques, it builds predictive models that help identify species from data captured through remote sensors such as passive acoustic sensors or game cameras. Conservation Metrics also works with clients who have already developed techniques for identifying animals but are looking to scale data analyzing and processing.

One of their biggest challenges is simply gathering data from clients and collaborators. Currently, hard drives with survey data are most often mailed from remote locations and may take weeks or months to reach Conservation Metrics. Analysts then process the data internally using an on-premises datacenter. The entire process, from field work to analysis and reporting, can take up to six months.

As the startup grows, so do its computing needs. Conservation Metrics is outgrowing its ability to quickly iterate on different models because of the computation time it takes on the local servers. Ideally, Conservation Metrics would like to test three or four approaches when developing a new model. Presently, it is limited to testing one or two versions because of training time.

Improving data analysis by moving to the cloud

In 2018, Conservation Metrics was awarded a grant from Microsoft as part of the AI for Earth program. Conservation Metrics is using the grant to build a cloud-based workflow in Azure for analyzing and processing wildlife metrics. By moving its data infrastructure to the cloud, Conservation Metrics hopes to significantly close the gap between field work and information and discovery. Potential benefits include:

- **Improved model confidence.** Azure will help improve overall model confidence and reporting by allowing analysts to run many different versions of a model against each other.
- **Increased scale.** With Azure, Conservation Metrics expects to reduce processing time by as much as 30 percent per project and will be able to quickly scale up and down as needed. Wildlife monitoring tends to be seasonal, so computing needs tend to vary depending on the time of year. “We will be able to spin up any number of virtual machines to meet our evolving needs and then spin them down again," says Matthew McKown, CEO of Conservation Metrics.
- **Lower costs.** Azure Data Box, Data Box Edge, and Blob Storage will save Conservation Metrics up to $1,000 per project by eliminating costly hard drive shipping, insurance, and customs fees. McKown also expects to see significantly lower storage, compute, and network equipment costs.

- **Increased productivity.** Conservation Metrics expects to see up to a 30 percent gain in productivity. The ability to process projects efficiently will allow analysts to spend less time reviewing model output and eliminate the time-consuming task of uploading data from hard drives.

McKown also sees other potential benefits for his organization. Hiring and retaining top talent is a challenge for any company, but is especially pressing for a small startup in the conservation field. "Finding talented technical folks who are interested in our mission and paying them a livable wage in Santa Cruz, California, is a huge challenge," says McKown. His highly skilled staff will be able to spend more time working on a variety of projects, including interesting R&D and pro-bono work. A cloud-based infrastructure will also allow Conservation Metrics to set up remote offices while maintaining a cohesive workflow.

> McKown expects up to a 30 percent reduction in processing time per project with Azure.

Conservation Metrics is currently deploying its new cloud-based workflow on Azure. As proofs of concept, Conservation Metrics will use metrics from two wildlife monitoring initiatives—Australian night parrot research and the Elephant Listening Project—that are unable to scale effectively using traditional methods. This project is the beginning of a broader vision to develop online wildlife monitoring tools that are open and cost effective for researchers around the world.

Identifying the endangered night parrot

The night parrot (*Pezoporus occidentalis*) is a small bird endemic to Australia that was presumed extinct until it was rediscovered in Queensland five years ago. This endangered species is extremely cryptic and nocturnal. Previously found throughout arid central Australia, the species underwent a severe decline in the late 19th and early 20th centuries, coinciding with the arrival of European settlers, new predators, and the spread of pastoralism.

In 2013, a surviving population of the night parrot was discovered in western Queensland, kicking off the first systematic and sustained research on the species. Given the remote and rugged country where the birds occur, and their extreme shyness and nocturnal habits, research proved to be difficult. However, night parrots are relatively vocal with a predictable pattern of calling at dusk and dawn. This means that passive acoustic monitoring provides an efficient and repeatable method for detecting parrots at other locations. The technique has been used to discover populations at several new sites across central Australia.

The bird is extremely rare, though. The collection and analysis of significant volumes of acoustic data led to the discovery of the handful of now-known populations. The volume of data already collected suggests that the

ability to evaluate the true status of this iconic Australian species depends on cost-effective and efficient workflows that make it possible to process large volumes of data efficiently.

That's where Conservation Metrics comes in. The team is currently building a workflow in Azure to process about 90 terabytes of acoustic data from over 60 sensors deployed in potentially suitable night parrot habitats throughout remote central Australia. The sensors will provide researchers, land managers, and conservation authorities with data on the distribution and occurrence of night parrots.

Partnering with the Elephant Listening Project

African forest elephant (*Loxodonta cyclotis*) populations are in catastrophic decline throughout their current range in the rainforests of Central Africa. Conservation efforts are hampered by the scarcity of information about their ecology and their movements. They roam landscapes which almost always include ecologically arbitrary boundaries between protected areas and concessions where resource extraction is permitted, and concomitant human activity is high.

The Elephant Listening Project uses passive acoustic monitoring to provide detailed temporal and spatial information about elephant movements. A network of 50 acoustic sensors is deployed across the Nouabalé-Ndoki National Park in the Republic of Congo. Nouabalé-Ndoki is part of a tri-national system of protected areas critical to the conservation of forest animals. The acoustic network, listening in on 1,250 km^2 of tropical forest, is the largest terrestrial acoustic array attempted anywhere.

However, extracting elephant calls from the recorded sound stream is time-intensive and severely limits how rapidly results can be communicated to and used by protected area managers and anti-poaching teams. In addition, to be a truly effective tool in elephant conservation, it is necessary to monitor exceptionally large areas of the landscape, which generates a volume of data that requires new approaches to analysis. Currently, Conservation Metrics is building a workflow in Azure to help the Elephant Listening Project efficiently process and analyze about 42 terabytes of acoustic data from these sensors.

About Conservation Metrics

Conservation Metrics provides technology services to improve wildlife survey efforts, an endeavor that is historically labor intensive. The California startup combines cutting-edge remote sensing technology, machine learning techniques, statistical rigor, and extensive scientific expertise to drive down costs and increase the scale and effectiveness of wildlife monitoring efforts, thereby improving conservation.

Resources

Websites

Conservation Metrics
The Elephant Listening Project
Microsoft AI for Earth
Microsoft environmental sustainability

Press

Developer Blog—Kittywakes Project (project completed before AI for Earth grant)