Microsoft

AI for Earth Grantee Profile

Dr. Monique Mackenzie

Saving endangered vultures through AI modeling

Summary

Vultures perform essential ecosystem services by scavenging on dead animals, which is crucial in preventing the spread of disease to other animals and humans. However, deliberately poisoned carcasses—a result of human-wildlife conflict—can result in several hundred vulture deaths at a single poisoned carcass. Dr. Monique Mackenzie, a statistician and Provost at the University of St. Andrews in the United Kingdom, is working with a team in Namibia to stop the decline of the vulture population. By analyzing the locations and activity of GSM/satellite tagged animals which locate carcasses as part of normal foraging behavior, the team can quickly locate and attend to the carcasses, preventing many deaths. Through an AI for Earth grant, Dr. Mackenzie can help the team upscale their solution and create lasting impact.

Saving scavengers from poison through AI

Vultures perform essential ecosystem services, helping to keep the environment clean by scavenging on dead animals, which is vital in preventing the spread of disease (including anthrax) to animals and humans. However, seven of the 11 species of African Vultures are designated as Critically Endangered or Endangered on the IUCN Red List, and these populations are declining. Despite being endangered, vultures are being poisoned as a result of human-wildlife conflict. For example, livestock owners may poison carcasses with the intention of killing the carnivores which have eaten their livestock, and vultures fall victim to these indiscriminate poisonings. These tragic incidents can result in several hundred vulture deaths at a *single* poisoned carcass, and timely detection of poisoning events is crucial in order to mitigate against large-scale losses of the critically endangered birds.

“For the last 10 years or so, colleagues and I at St. Andrews have been teaching free statistical modelling workshops to various parts of Africa,” says Dr. Monique Mackenzie, the Provost and Head of St. Leonard’s Postgraduate College at the University of St. Andrews, Scotland. Dr. Mackenzie explains how she became involved in a project to save the vultures from these poisoning incidents through satellite tag data and computer modeling. “I was at a workshop in Namibia, and Dr Aschenborn (now based at the University of Namibia) gave a talk about tagged vultures, and came across with this idea that we could try to detect the size of the carcass the vultures were feeding on by somehow quantifying the activity. I didn’t know him at all, but I saw him after the talk, and I said I think I can help you, and then the collaboration started from there.”

Modeling scavenger behavior for real-time carcass detection

The concept of the project is to identify large-scale feeding events by analyzing the locations and activity data of GSM/satellite tagged animals which locate carcasses as part of normal foraging behavior. The project is primarily based on white-backed vultures but includes several other vulture species and land-based carnivores such as spotted hyena, lion, and black-backed jackals. These individual animals provide data on a 24-hour basis via satellite and mobile phone networks across large areas inside and beyond Namibia.

Using these large data sets from bespoke tags, Dr. Mackenzie and her team combine recently developed spatio-temporal statistical models and behavioral classification methods to automatically classify vulture behavior. This helps them to identify large feeding events and to mobilize field professionals to locations of concern for observation—sometimes within hours of death. To date, over 500 carcasses—ranging from a snake to the largest herbivores—have been located using this method, regardless of cause of death. Rapid attendance to poisoned carcasses enables the collection of fresh crime scene evidence (including poison samples), expedites scene decontamination, reduces further deaths, and enables the timely treatment of survivors. Attendance to naturally occurring carcasses has enabled the recovery of tusks and horns from the scene, ensuring their safeguarding in stockpiles.

Scaling the system with AI for Earth

While recent developments in tag technology have served the project by providing an increase in the frequency, quantity, and quality of the data available in real time, they have created computational challenges for extraction, analysis, and deployment of the bespoke decision-making tools created for field professionals. Therefore, Dr. Mackenzie applied for a Microsoft AI for Earth grant to help fund the research and expand the scope. "It was a good time to upscale what had been working," says Dr. Mackenzie. "It's not perfect, and we can certainly improve it, but at the moment there is nothing else like it operating elsewhere."

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> Dr. Mackenzie, University of St. Andrews

Vultures travel large distances, so the tracking and analysis system needs to be available across the continent to be fully effective. The AI for Earth resources will provide scalability and enable the project to extend from Namibia to include the Kavango-Zambezi Transfrontier Conservation Area (KAZA) and neighboring Botswana and Zambia.

Dr. Mackenzie has been working with colleagues to cobble together funding for the project over the years to purchase tags and continue the research. While the University of St Andrews has been a crucial form of financial support for this project, the AI for Earth grant helps relieve that pressure. "I'm absolutely determined that it must be free to the user and it shouldn't ever be monetized," says Dr. Mackenzie. "The animals we seek to protect often thrive in low-income environments, and so it's absolutely necessary that we share the expertise as widely as possible, we make it as easy to use as possible, and it's absolutely free to the user." This grant funding will allow the team to rapidly upscale a working solution and create lasting impact.

About Dr. Monique Mackenzie

Dr. Monique Mackenzie is the Assistant Vice-Principal (Provost) and Head of St. Leonard's Postgraduate College, University of St Andrews, United Kingdom. She is a PhD-qualified statistician with particular expertise in repeated measures/longitudinal data analysis. She also develops spatially adaptive modelling methods for spatio-temporal auto-correlated data, often in an environmental impact-assessment setting. She is passionate about teaching statistical methods to non-specialists/industry and she has extensive experience teaching statistical modelling workshops to non-specialists in the UK and in Africa.

Resources

Websites

Dr. Mackenzie's personal website

Assistant Vice-Principal (Provost) page (Dr. Mackenzie's faculty page) at St. Andrews University