australian wildlife conservancy

AWC Conservation Technology:
delivering efficient and effective outcomes for conservation

The need for technological innovation in conservation

Australia has the worst mammal extinction record in the world. Since European settlement, 34 mammals have disappeared. Sadly, this decline is ongoing: nearly one-third of Australian mammals are threatened with extinction and this number is rising. AWC represents a new model for conservation: one that is successfully halting the decline and restoring wildlife populations in Australia. AWC's approach, which is focused on delivering world-class science and land management across 6.5 million hectares, is making strong progress: our national network of sanctuaries are home to more Australian species (and more threatened species) than any other non-government organisation, including 74% of Australia's mammal species, 88% of bird species and 54% of reptiles/amphibians.

Delivering practical, *effective* and scientifically-informed conservation land management (i.e. fire management, feral animal control, weed eradication and threatened species reintroductions) is key to restoring biodiversity. We are proud that 87% of AWC's total expenditure is invested in conservation and we are committed to ensuring that resources are directed to where they can deliver the biggest ecological 'return' on investment. To this end we are continuously striving to achieve greater efficiencies in the field. Technological innovations are providing exciting opportunities to achieve greater efficiencies and generate substantially better outcomes for biodiversity across the country. AWC is therefore committed to trialling and deploying a suite of innovative new technologies in our science program and we welcome your support for this program.

Artificial Intelligence - Progress to Date

Camera traps are an essential tool for collecting data on species diversity and abundance. Traps are activated by motion sensors and record a colossal number of images: a three-month survey alone can capture more than 500,000 photos! Around 60% of these images are set off by non-animal motion such as leaves blowing in the wind, making camera traps both a boon and a bane for AWC ecologists, as every image is checked manually. Important metadata such as temperature, time and moon phase, also have to be recorded on each capture, making the process extremely labour intensive.

As a result, AWC is harnessing the power of technology to increase our efficiency in image processing. We launched the AWC Artificial Intelligence (AI) Program in November 2018 through an innovative partnership with Microsoft. Microsoft describes the relationship as a "true collaboration" – AWC is the only partner Microsoft has worked with who actively codes alongside their team. Using the AI program frees our ecologists for more direct action in the field and increases the speed at which the team can identify the presence of both feral and threatened species. AWC is leading the way in the conservation sector in this area, recognising the importance of investing in this technology to improve outcomes for Australia's wildlife.

The AWC AI Program has successfully developed the 'level 1' model. This model is capable of identifying images triggered by non-animal motion with success rates well above 90%. Utilising level 1 reduces the number of images that need to be processed manually by 60-70% – an astounding gain in efficiency.

Excitingly, AWC has now built its first Species Classifier (level 2) model. This machine learning technology has been 'trained' to identify common species in a specific area. As it was impractical to upload every single species known into the model, we prioritised the 20 most commonly seen species on camera traps in order to get the biggest 'bang for buck.' AWC has an extensive library of images derived from decades of on-ground conservation work with some of Australia's rarest and most threatened wildlife, such as Bilbies and Numbats. These images are uncommon on a global scale, therefore the program has less data to 'learn' from when compared to globally common animals such as a cow or pig. The more images we have available to upload – and the better *quality* they are, the higher our rate of accuracy.

In the North East region, the level 2 model can now identify 29 different species, including feral species, with accuracies approaching 90-95%. This process reduces the resulting dataset from the level 1 filter, by a *further* 80-90%. In 2020 4.52 million images were processed, focussing on the North East sanctuaries but in 2021 this is being expanded to all regions in which AWC operates.

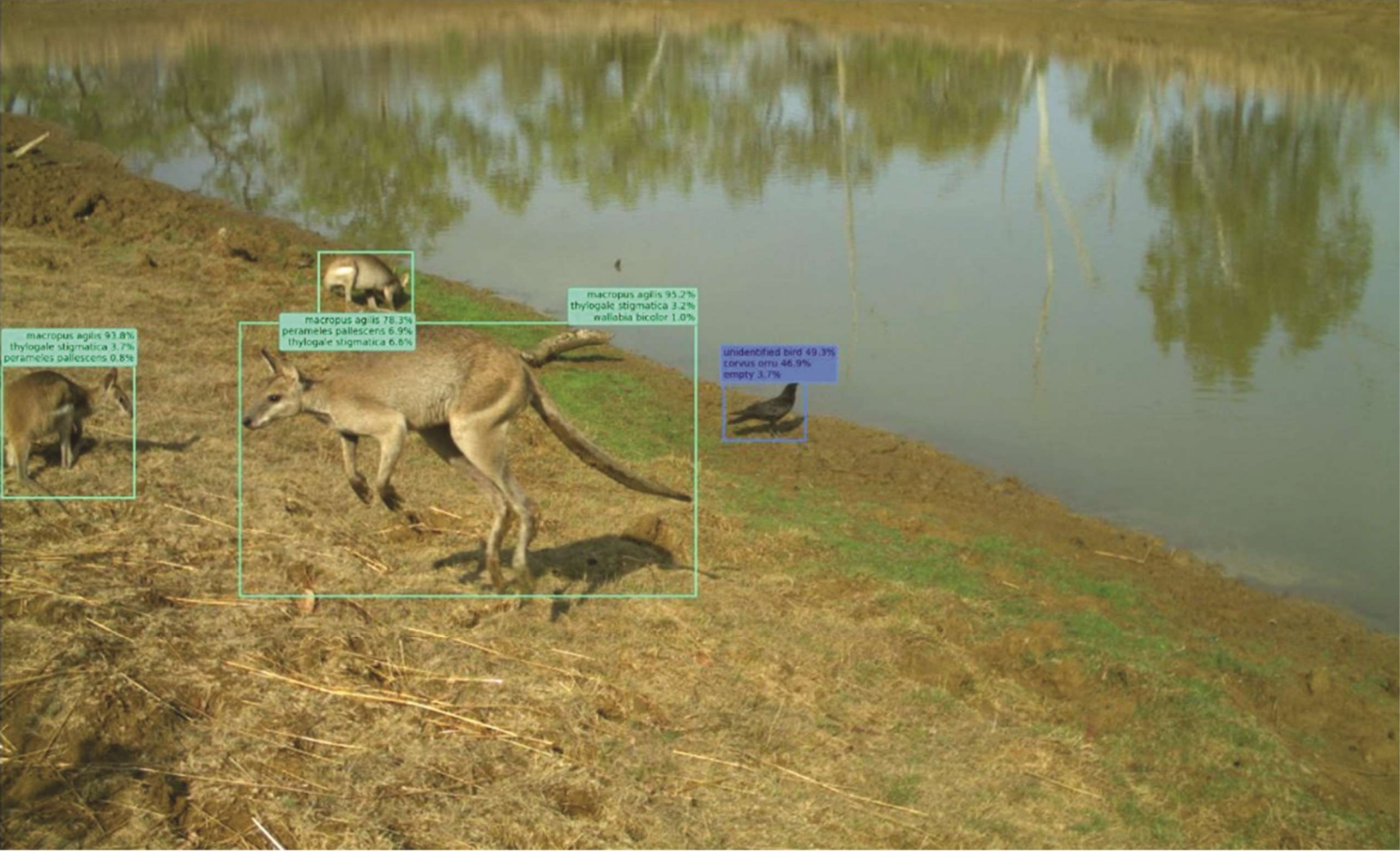
Implementation across regions however is complex and is not as simple as translating the same model in the North East region to say the South West. For example, when the model was trialed at Mt Gibson, the classifier failed to detect the relatively common image of rabbits. Rabbits are rarely seen in the north east so the choice of animal to 'train' the program, along with the quality of the images, becomes very important. AWC ecologists are uploading hundreds of thousands of images and the AI output and metadata is then analysed. When needed, the program can be corrected and tweaked to improve its capacity.

Raquel Parker, an AWC Ecologist who has had the opportunity to work with AI camera trap processing, is grateful for the efficiencies afford by AI technology. "As ecologists, we rely heavily, on remote camera traps to monitor wild species. Machine Learning has sped up the process of sorting through large data sets, which means we can spend more time in the field."

Using drones and AI together

AWC currently monitors reintroduced mammals using a combination of traditional methods, however difficulties trapping certain species, dense vegetation and cryptic animals can make accurate estimates challenging. AWC ecologists needed to identify whether using drone and thermal imaging camera (specifically a DJI M210 Aircraft fitted with a FLIR XT2 dual thermal/RGB sensor) could help us gain a greater understanding of the reintroduced Burrowing Bettong (Boodie) on Faure Island. Aside from the practical limitations of operating in challenging vegetation, AWC ecologists also wanted to confirm whether Boodies were potentially following staff through the landscape and introducing a population bias through double counting.

The drone mounted thermal camera proved to be highly effective at detecting mammals, however low resolution brought challenges in distinguishing between Boodies and Banded Hare-wallabies as they are similar sized macropods. The results indeed confirmed that the curious Boodies ‘investigated’ people as they walked through the bush. AWC now aims to eventually make thermal cameras a permanent survey approach.



Next steps

The next stage is to use footage obtained by thermal cameras mounted on drones to count or classify animals on sanctuaries. Trials are underway at AWC's Faure Island Wildlife Sanctuary off the coast of Western Australia. Being completely feral-free, the island sanctuary is critically important for the conservation of Australia's threatened mammals, and is also a crucial breeding area for seabirds – recognised as a RAMSAR internationally important wetland. Faure Island is a haven devoid of feral herbivores and predators, and is home to critically important populations of Burrowing Bettong (*Bettongia lesueur*), Banded Hare-wallaby (*Lagostrophus fasciatus*), Western Barred Bandicoot (Shark Bay Bandicoot) (*Perameles bougainville*) and Shark Bay Mouse (*Pseudomys fieldi*).

Continued improvements to the AI processing will enable AWC to count specific native species and identify the existence of targeted feral species such as Feral Cats at Scotia. This branch of the AI program requires industry leading research into analysing moving footage and attempt identification by thermal signature, or by specific motion type (e.g. 'hopping' vs 'hunting' motion of the animal).

We also envisage developing a 'level 3' model that will identify individual animals based on their stripes or patterns which will be further developed in tandem with 'level 2' as this technology continues to improve.

How you can support groundbreaking AI innovations

Effectively using AWC's AI program requires a subject matter expert - such as a data scientist – as well the time of qualified ecologists in each of the five regions in which AWC operates. We also need to invest in technology such as Satellite Data Services to enable AWC's ecologists to upload millions of images as well as a subscription to a cloud based AI engine provided by Microsoft Azure.

IoT Devices – enabling the efficient delivery of conservation at scale

AWC is researching opportunities offered by IoT devices (the Internet of Things) to create a Gate and Fence Monitoring Program, seeking efficiencies in monitoring sanctuary assets. At present, land managers monitor and inspect fence condition by traversing up to 44 kilometres of fence line every second day. It's a tedious, time-consuming task, but essential to ensure the sanctuary is not compromised by fence damage caused by falling trees or battling Kangaroos that could facilitate lethal incursions by feral predators. AWC is keen to build bigger fenced safe-havens but the need to manually check fence integrity for so many kilometres every second day is a major constraint.

Using a combination of GPS, vibration monitoring and acceleration, low-power and low-cost IoT devices can monitor the condition of the fence line and movements of fence gates 24/7. Deploying such devices could not only help maintain the integrity of the fence, it could also significantly reduce labour costs. As part of phase one trials, a number of devices have been deployed in the field for 18 months, relaying a monitoring message to AWC Head Office whenever the fence gate opens and closes. Since deployment of a trial device with three AA batteries at Mt Gibson, over 2,500 messages have been received during 2020. AW

Next steps

The next stage involves expanding the use of IoT devices to span the entire fence perimeter and send real-time notifications from traps. In the future, other possibilities include deploying drones or all-terrain vehicles (think pared-back Mars rover) to inspect the fence line or gather telemetry data from radio-collared animals.

How you can support the IoT for conservation

To scale up AWC's IoT trial at Mount Gibson Wildlife Sanctuary AWC needs to purchase 7 fence devices and 6 trap devices as well as infrastructure such as antennas and solar batteries to support a reliable communication system.

Budget

Project	Investment
AI Technology	
Employ AI SME (Data Scientist)	$116,000
AI Working Group: AWC ecologists scientific R&D	$50,000
Azure AI cloud platform and software service	$15,000
Sanctuary Satellite Data Services	$16,800
AI total cost per annum	**$197,800**
Internet of Things (IoT)	
Purchase 13x IoT devices (including 7 fence + 6 trap devices) plus infrastructure (antennas, batteries, solar power)	$19,700
Total (AI annual cost + IoT initial purchase)	**$217,500**

AWC would be grateful for any support you can provide to develop these projects and achieve ground-breaking technological outcomes for conservation.

For further information please contact:

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