big brother IS WATCHING

Long-term studies of animal populations are critical to answering questions in ecology, evolutionary biology and conservation, including how to conserve species in the face of ever-increasing global change. However, monitoring individuals over their lifetime is challenging because it requires researchers to be able to distinguish between individuals. In some species, such as giraffes and leopards, distinctive coat patterns enable biologists to recognise individuals. Among birds, Peter Scott used subtle variations in the facial patterns of Whooper Swans to gauge the birds' survival and site fidelity when they returned to the UK each winter. But for most species we need to add unique markers, such as field-readable rings, to identify individuals.

Having a way to recognise individuals without marking them would be a major breakthrough for animal research. This dream is now becoming a reality as a result of recent advances in artificial intelligence (AI) techniques. Computers can learn how to reliably identify individual humans using AI and this ability is now used in our daily lives; for example, we use facial recognition to unlock our smartphones.

ANNIE BASSON & ANDRÉ FERREIRA

A photograph from the RFID camera trap. By landing on the RFID perch, the bird triggers the camera and a computer labels the photograph with the bird's identity.

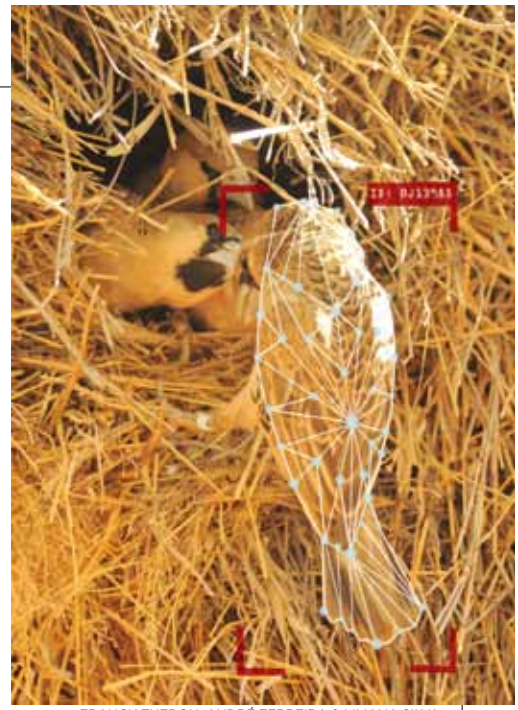
This success in human identification is inspiring biologists to develop similar techniques for animals. However, computer learning requires thousands of individually labelled pictures to train AI models. This is fairly easily done for people because of the rapid growth of social media. Although ethically questionable, companies such as *Clearview AI* trawl the internet for as many images of people as possible to build up their database containing hundreds of labelled images per person. Computers can then learn to distinguish humans by repeatedly analysing pictures of the same person in different contexts.

For biologists, it is more difficult to get sufficient images of known individuals in their study populations to train an AI model. However, a new study of Sociable Weavers by André Ferreira and colleagues (doi: 10.1111/2041-210X.13436) overcame this challenge by building a series of radio-frequency identification (RFID) camera traps. In this study population, most individuals carry a passive integrated transponder (PIT) tag on their leg rings. PIT tags are familiar to pet owners as the tiny chips that can be implanted into a dog or cat to allow them to be identified. Powered by the external 'reader', these tags can be as small as a grain of rice.

Rita Covas's team studying Sociable Weavers at Benfontein near Kimberley have been attaching PIT tags to the birds' leg rings for several years. By installing readers around nest entrances or at feeders, they can repeatedly 'recapture' individuals as they go about their daily lives. By adding cameras at the feeders, the researchers are able to photograph known birds every time they visit a feeder. A computer automatically labels each image with the bird's identity and stores it for later analysis.

The study reports how this huge collection of pictures was used to train a computer programme to recognise individual birds in different contexts. It then used a set of images of Great Tits from a similar study in Germany and showed that the approach also worked for that species. There are still some important questions to answer, such as how moulting will affect the ability of the models and whether feather patterns remain constant over time. However, this research sets the stage for the development of powerful AI programmes capable of identifying individual birds. Most excitingly, the models for humans suggest that once you have trained the AI, it can recognise 'unknown' individuals that are completely unmarked and have not been 'manipulated' by researchers. Such a tool would revolutionise field studies of wild birds.

ANDRÉ FERREIRA AND RITA COVAS



FRANCK THERON, ANDRÉ FERREIRA & LILIANA SILVA

The computer programme looks at the pattern in the back and wing feathers (the blue network) and determines the identity and position of the bird (the red bounding box and the alphanumeric code).

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