

Pigeon power

Liz Sheffield explains how pigeons can be trained to identify signs of cancer in images of human breast tissue

Humans have been training animals to carry out useful tasks for hundreds of years. Now some researchers have been able to teach pigeons to identify images showing signs of breast cancer. The pigeons show an astonishing 99% accuracy. This rivals the accuracy of pathologists trained to do the same task. Let's see how they did it.

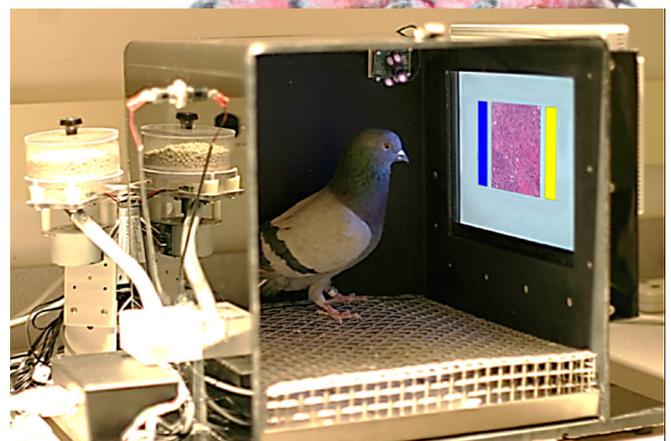
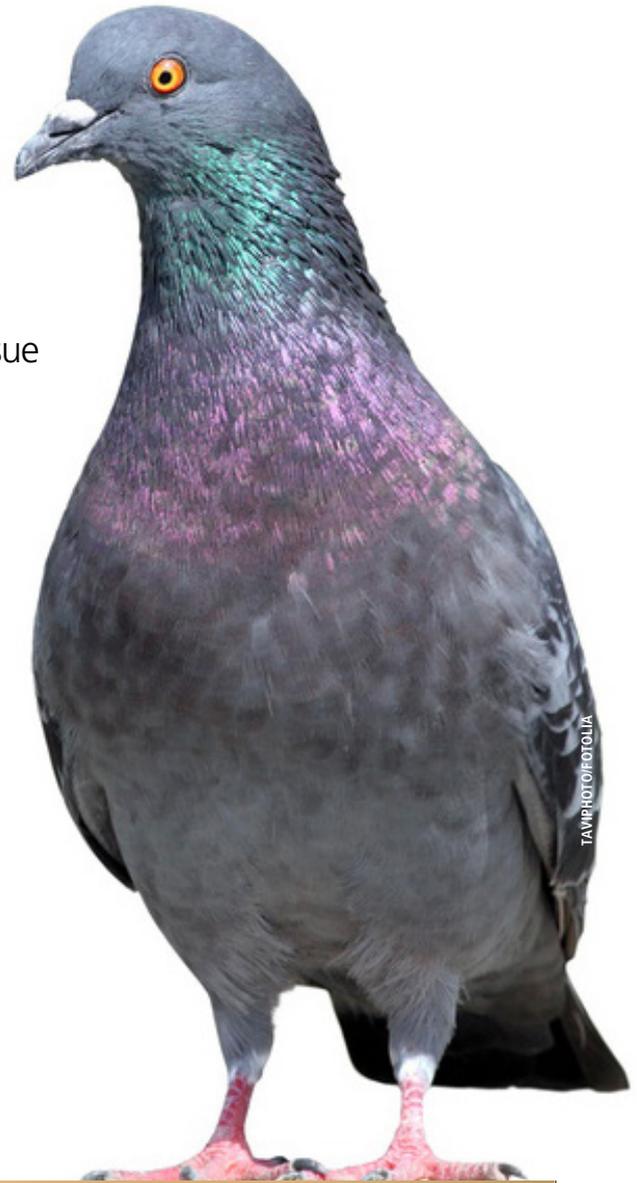
Operant conditioning

Operant conditioning means changing behaviour by rewarding the desired behaviour. This is called positive reinforcement. The subject learns what to do to gain the reward, and thus becomes more likely to repeat the behaviour.

In the pigeon experiments the researchers used birds kept at 85% the weight they would have if they fed to their natural preference — so they were hungry. The desired behaviour (correct identification) was rewarded with a pellet of food. Each bird was placed in an experimental chamber measuring 36 × 36 × 41 cm. It contained a touch screen on one wall, and a food cup on the opposite wall. Images were displayed on the screen and pecks to the screen were detected by a processor connected to a food dispenser.

Training in image identification

Human breast-tissue samples were sectioned and stained, and photographs taken under a light microscope. The photographs were selected by a pathologist and divided into two sets — benign (harmless), and malignant (cancerous). The birds were then trained to respond to enlarged images displayed in the chamber, by pecking at them on the screen. They



Levenson R.M. et al. (2015) Pigeons (*Columba livia*) as Trainable Observers of Pathology and Radiology Breast Cancer Images. PLoS ONE 10(11): e0141357. doi:10.1371/journal.pone.0141357

A pigeon in the experimental chamber

were then shown images with rectangles of colour on either side. On one side the rectangle was blue, and on the other the rectangle was yellow. The birds were shown training images and rewarded with a food pellet for pecking at the colour that corresponded to the correct diagnosis. They were then tested with images they had not previously seen.

Their ability to identify malignant samples accurately rose to nearly 85% correct after only a couple of weeks of training. Pooling the responses from four trained birds — a technique known as 'flock sourcing' — the accuracy rose to 99%.

What use is that?

No one is suggesting that pigeons should replace pathologists, but there may be some real-world applications of pigeons trained to identify cancerous samples. This relates to the routine creation of digital images from stained material under a microscope.

As you will have seen in documentaries and television shows about medical procedures, physicians and surgeons routinely look at images processed and projected on screens. New technologies to enhance the

Medical experts routinely study digital images on screens as part of diagnosis



PICTURE PARTNERS HOLLAND/FOTOLIA

acquisition of images and to display them accurately are being devised all the time. The products need validating, but at the moment, the only way to monitor the quality and reliability of potential advances for samples showing cancer is to take up the time of highly trained clinicians.

The sensitivity of pigeons to features that would cause a pathologist to diagnose cancer in medical images means that pigeons can provide valuable feedback on the variables at play in the production and manipulation of these important tools. Clinicians could be freed up to do what they do best, while pigeons assist researchers and engineers as they work on new technologies.

Things to do and weblinks

See how well you would do at distinguishing harmful from harmless images such as those used in the study: www.tinyurl.com/p7h9mmj

For full details of the experiments carried out to prove the power of pigeons see: www.tinyurl.com/nqe5b28

Operant conditioning has in the past included training where subjects learn to avoid punishment rather than gain reward. See more about this approach and find out why ethical considerations mean that many such experiments should not be repeated: www.tinyurl.com/l9g7ngs

Watch this movie explaining what operant conditioning is, and how to train a dog using this technique: www.youtube.com/watch?v=l4ll0hN0FYM

Find out more about our full range of magazines and online archives of back issues at www.hoddereducation.co.uk/magazines

Did you like this article?
Tell us what you think