

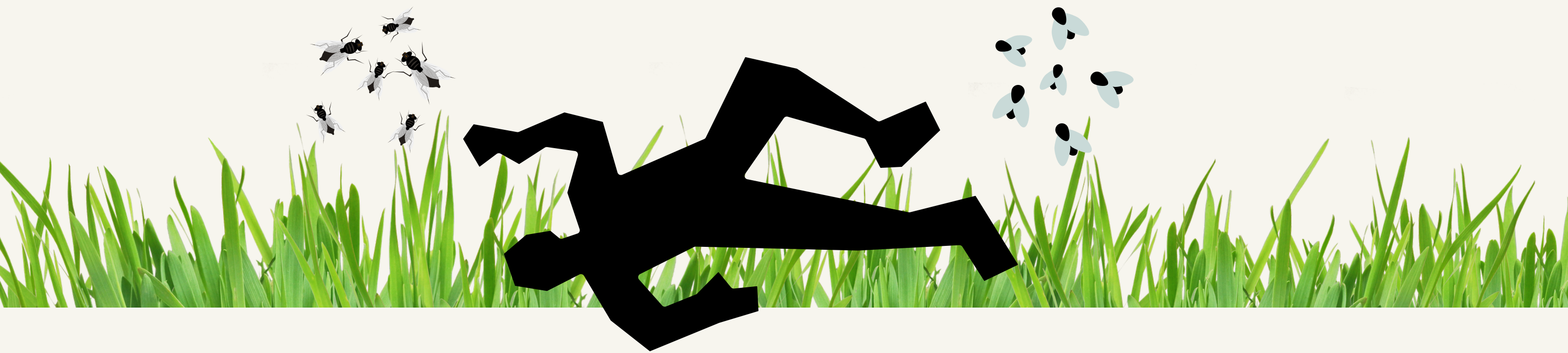


CAN ARTIFICIAL INTELLIGENCE TELL TIME... FROM A FLY?

How Machine Learning Is Transforming Forensic Entomology and Helping Estimate Time Since Death

NATURE'S TINY WITNESS:

Most people think of flies as little more than a nuisance, but in forensic science they can become some of the most valuable witnesses. Different fly species colonise a body at predictable stages after death, allowing forensic entomologists to estimate the postmortem interval-the time since death. Blowflies (Calliphoridae), for example, are often among the first insects to arrive, while flesh flies (Sarcophagidae) tend to appear later during decomposition. By identifying the species present, forensic entomologists can provide investigators with an estimate of the PMI. This information can provide investigators with an important timeline during an investigation. However, accurately identifying these flies is a specialised and time-consuming task that relies on trained experts.



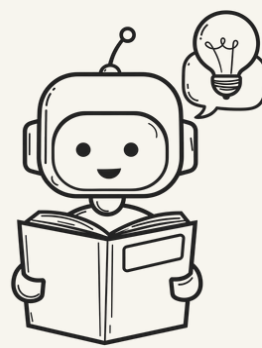
THE RESEARCH QUESTION:



With this in mind, researchers asked whether machine learning (ML) could accurately identify forensically important fly species and help forensic scientists estimate the postmortem interval more efficiently.

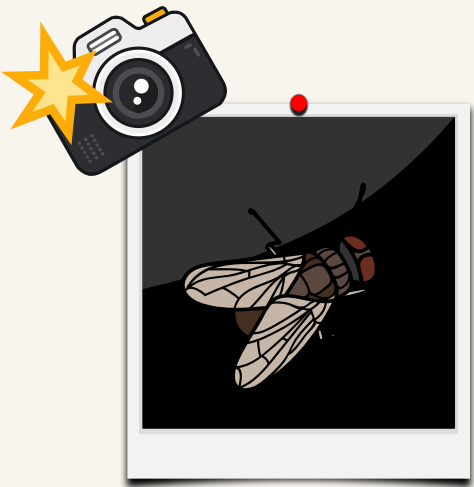
WHAT IS MACHINE LEARNING?

Machine learning is a type of artificial intelligence (AI) that learns to recognise patterns from large amounts of data instead of following fixed instructions. In this study, the model learned to recognise different fly species by analysing thousands of labelled images.



METHOD:

1 Build a image database

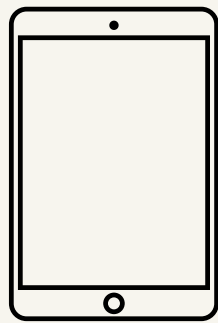


**2876
PHOTOS**
of 5 forensic fly
genera

2 Train AI models

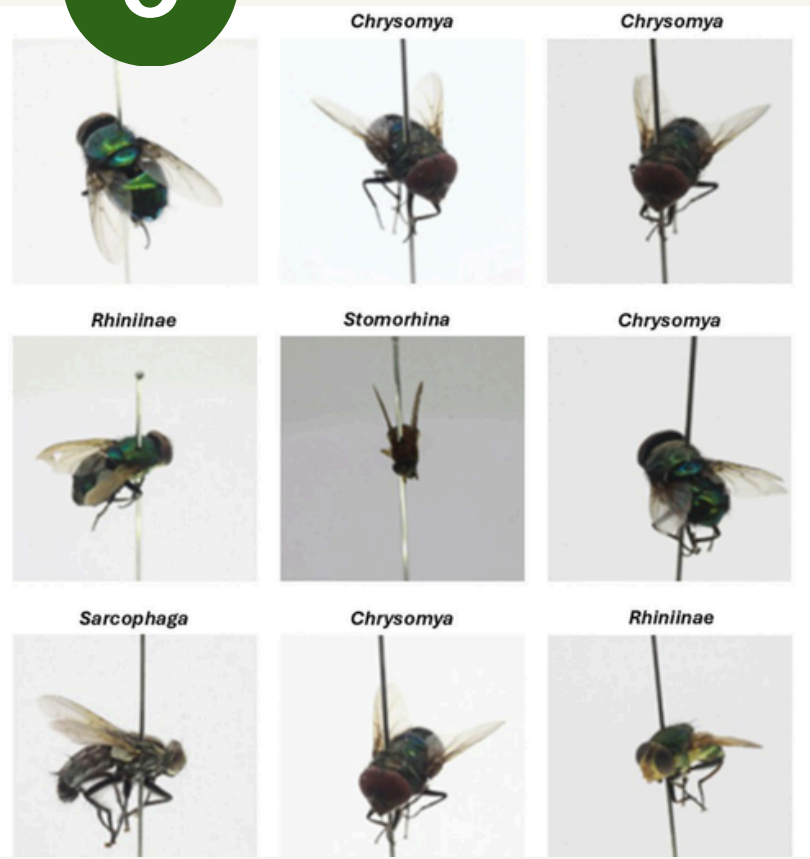


VGG19



MOBILENETV3-LARGE

3 Test the AI



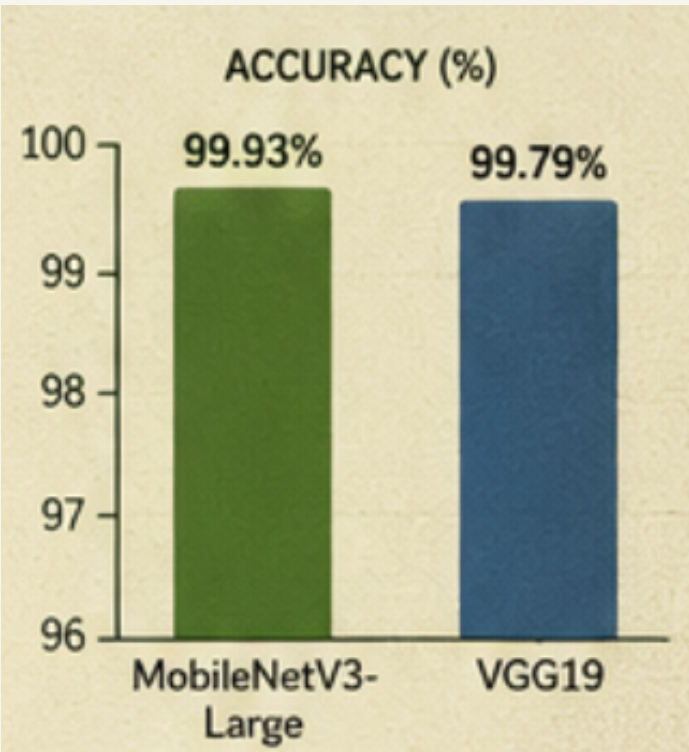
High quality images of 5 forensically important fly genera: Chrysomya, Lucilia, Sarcophaga, Rhiniinae and Stomorhina

Two deep learning models were trained to recognise fly species automatically

The AI classidied 5 genera and its predictions were comparedwih the correct species label

THE RESULTS:

The results were impressive. Both machine learning models were able to identify forensic fly genera with almost perfect accuracy. MobileNetV3-Large achieved an accuracy of 99.93%, while VGG19 closely followed at 99.79%. Remarkably, only one fly image was incorrectly classified during testing. Not only was MobileNetV3-Large highly accurate, but it was also faster, making it a promising option for real-time forensic applications.



WHY DOES THIS MATTER?

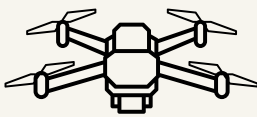
The findings suggest that machine learning could become a valuable assistant in forensic entomology. By identifying forensically important flies with near-perfect accuracy, AI has the potential to help forensic scientists estimate the postmortem interval more quickly and efficiently. The researchers also suggest that this technology could one day be integrated into drones or other automated systems to help detect and identify forensic flies in remote locations, disaster zones, or areas that are difficult or unsafe for investigators to access.



HELPS ESTIMATEEE PMI FASTER



REDUCES COST AND ADRESSES SHORTAGE OF FORENSICENTOMOLOGIST



ENABLES DRONES TO SEARCH IN LARGE AREAS

LIMITATIONS:

The models were trained on high-quality images of preserved flies and are therefore not directly applicable to real-world conditions. In practice, flies are constantly moving, and variations in lighting can affect their appearance in images, potentially resulting in misidentification. Additionally, the models were trained on only five selected genera, despite there being many forensically important insect genera. Further training and validation will be required before the models can be deployed widely in forensic casework. Furthermore, the models currently identify flies only to the genus level. This is an important limitation, as different species within the same genus can exhibit distinct behaviours and developmental rates, both of which are critical for accurate forensic entomological analysis.

TAKE HOME MESSAGE:



Machine learning has shown remarkable potential in forensic entomology, identifying forensically important fly genera with almost perfect accuracy. While it is not intended to replace forensic entomologists, it could become a valuable tool for speeding up species identification, supporting postmortem interval estimation, and improving the efficiency of forensic investigations.

LOOKING AHEAD:

The next step is testing AI in real world scenes with challenging environments



REFERENCES:

Gohe, A.K., Kottek, M.J., Buettner, R. & Penava, P. 2024. Classifying forensically important flies using deep learning to support pathologists and rescue teams during forensic investigations. PLoS One. 19(12):e0314533. DOI:10.1371/journal.pone.0314533.