AI provides more accurate analysis of prehistoric and modern animals

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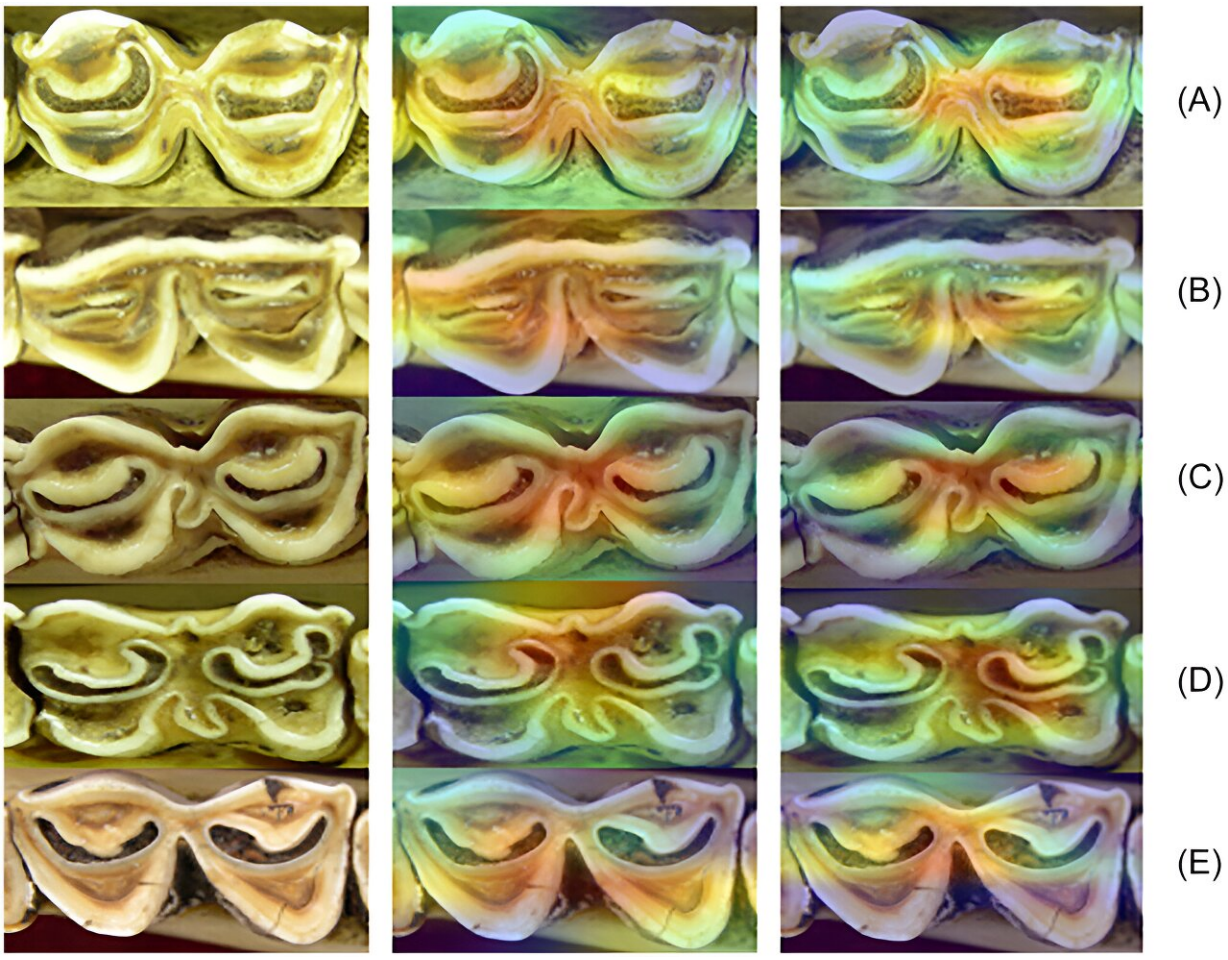

Saliency topographic heat maps overlaid on the original dental images for (A) Alcelaphini (Connochaetes gnou), (B) Antilopini (Antidorcas marsupialis), (C) Hippotragini (Oryx gazella), (D) Reduncini (Kobus ellipsiprymnus), and (E) Tragelaphini (Taurotragus oryx). The examples shown here belong to the left second molar of the inferior dental series. The left column shows the original

images. The central column displays the saliency heat map from the ResNet-50 model. The right column displays the saliency heat map from the VGG19 model. Credit: *Annals of the New York Academy of Sciences* (2023). DOI: 10.1111/nyas.15067

A new Rice University study of the remains of prehistoric and modern African antelopes found that AI technology accurately identified animals more than 90% of the time compared to humans, who had much lower accuracy rates depending on the expert.

Identifying these animals and their habits helps paint a broader picture of ancient ecosystems, and with the assistance of this new technology, it can be done with more speed and accuracy than previously done by paleontologists, according to the study.

The article "African bovid tribe classification using transfer learning and computer vision" was published in a recent edition of *Annals of the New York Academy of Sciences*. The study outlines the groundbreaking AI technology used to analyze prehistoric livestock remains.

So why does it matter how these ancient animals lived and what they ate? According to Manuel Domínguez-Rodrigo, visiting professor of anthropology at Rice, co-director of Madrid's Institute of Evolution in Africa and professor of prehistory at the University of Alcalá in Spain, the study sheds light on how the ecology of the time affected the evolution of mammal communities including humans, who over the past two million years have become highly dependent on other mammals.

"The evolution of ecosystems in Africa is of major relevance to understand what shaped our own evolution as humans," Domínguez-Rodrigo said. "Our prehistoric ancestors were highly dependent on

resources available in different habitats of African savanna ecosystems. Using fossil mammals—highly specialized in their adaptations to different habitats—to reconstruct these landscapes has been the most used method to interpret their ecology.

"Identifying those mammals by their teeth has not always been straightforward and was subjected to a high degree of expert knowledge and bias. Now we can do that with much more confidence. This will enable us to understand past environments but also understand better modern landscapes too when documenting the dead animals that they still contain."

And thanks to this technology, whose application to paleobiology is pioneered in Domínguez-Rodrigo's lab, he says archaeologists can now analyze information far more quickly and accurately than before.

"These AI methods are a revolution for the studies of paleobiology and human evolution in particular," he said. "They provide an objective, replicable way of identifying animals, including the degree of confidence with which identifications are made."

Domínguez-Rodrigo said the success of AI in other fields, such as image-based medicine, was a proof of concept for its widespread application to other fields.

"Now paleontology and archaeology are experiencing a profound—although still somewhat slow—revolution by incorporating these techniques," he said. "Not only can we now be more secure about identifying different types of African antelopes, but we are working already on doing things that archaeologists have been unable to do from screening landscapes as they were millions of years ago and discovering new sites, to identifying the specific carnivore types that were interacting with humans, to a better understanding on how fossils were modified by

all of them.

"The consequences to reconstruct how evolution shaped humans cannot be overstated."

More information: Manuel Domínguez-Rodrigo et al, African bovid tribe classification using transfer learning and computer vision, *Annals of the New York Academy of Sciences* (2023). DOI: 10.1111/nyas.15067

Provided by Rice University