Potential for a machine learning method to be applied to the study of herbivore diets

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Conclusions:

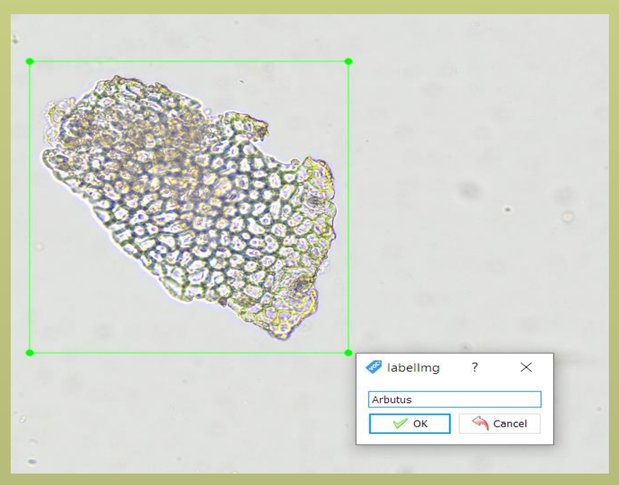
The software generated using artificial intelligence achieves great accuracy in the identification and counting epidermal plant fragments in microscope slides of faecal samples, improving the study of herbivore diets.

Introduction:

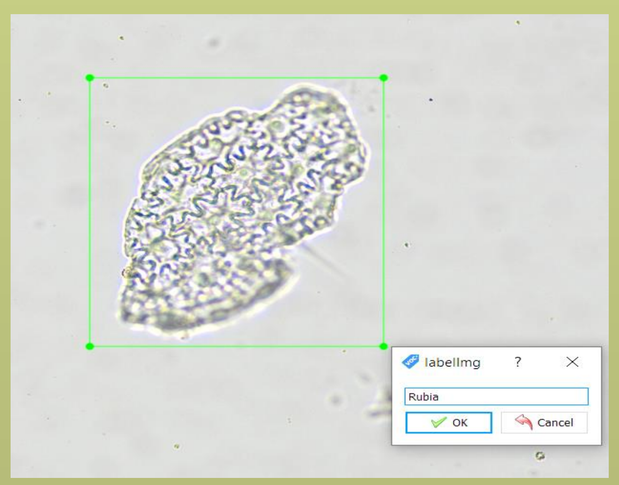
Food selection is a central concept in wildlife herbivore studies. Different non-invasive techniques have commonly been used to determine diet composition from faecal samples, including epidermal microhistological analysis. This method can provide reliable quantitative data through the identification of plant cell structures visualized under an optical microscope. However, significant expertise in microscopic identification is required and the method is also highly time-consuming. Since microhistological analysis is based on pattern recognition, the application of artificial intelligence (AI) could be applied to the study of herbivore diets for labour intensive pattern recognition tasks.

Materials and methods

We performed a trial to determine the correlation between the identification and counting of epidermal fragments using a trained observer and a model based in AI. Two species, *Arbutus unedo* and *Rubia peregrina*, with very different epidermal characteristics were used. The leaves of the plants were dried, crushed, mixed in different proportions in dry weight, subjected to acid digestion and bleached with NaClO. Then the microscopic preparations were mounted, and photographs were taken at 100x magnification. The images were examined by an observer and by trained model for identification and counting fragments. The machine learning process applied to the slide images included a set of algorithms and programming codes for image recognition. The training of AI was carried out with images taken from previously labeled microscope slides.



Epidermal fragment of *Arbutus unedo*



Epidermal fragment of *Rubia peregrina*

Results:

	Microhistological analysis		Artificial intelligence		
Samples composition (on dry matter basis)	*Arbutus*	*Rubia*	*Arbutus*	*Rubia*	Difference
Arbutus 5% - Rubia 95%	9,0%	91,0%	8,2%	91,8%	0,8%
Arbutus 25% - Rubia 75%	28,4%	71,6%	29,5%	70,5%	-1,1%
Arbutus 60% - Rubia 40%	59,0%	41,0%	58,5%	41,5%	0,5%
Arbutus 90% - Rubia 10%	83,6%	16,4%	81,0%	19,0%	2,6%

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