# Explainable AI for wood classification based on SEM images

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## Description

The methods used by archaeobotanists to identify wood families from charcoal recovered from archaeological sites are based on a combination of several anatomical criteria. However, many families have very similar morphological characteristics that limit the identification of wood at the family level, especially when the wood pieces are not well preserved, broken or fragmentary. Certainly, machine and deep learning techniques can support the archaeobotanists in the identification process, as long as the automatic classifiers are not black boxes. Researchers need to know *why* an image is assigned to a family or not. Based on a database of scanning electron microscopy (SEM) 2D images of wood charcoals, the students will be provided with a trained classifier able to assign each wood image to a class/family (e.g. *anacardiaceae*, *lamiaceae*, *sapindaceae*, etc.). The supervised classification problem, consists of 1068 pre-processed images (80% used for training, 20% for validation) as the one in Figure 1 and 29 classes/families. The aim of the case study is to implement an algorithm to *explain* how the classifier works, adopting an explaining tool such as LIME (Ribeiro et al., 2016), Grad-CAM (Selvaraju et al., 2017) and/or its extensions or SHAP (Lundberg and Lee, 2017). A comparison between two different explaining tools would be appreciated.

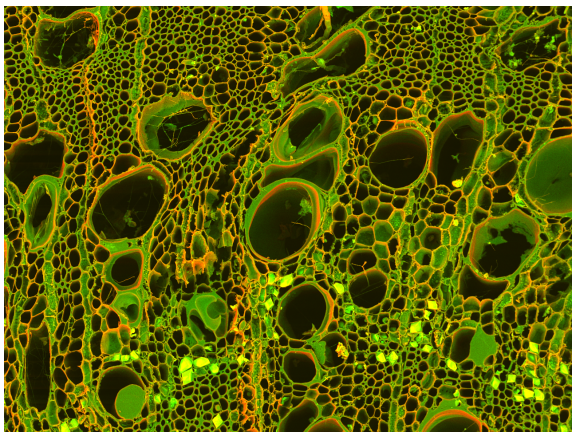

Figure 1: Example of a SEM image belonging to the class FABACEAE.

## References

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R. R. Selvaraju, M. Cogswell, A. Das, R. Vedantam, D. Parikh, and D. Batra. Grad-cam: Visual explanations from deep networks via gradient-based localization. In *Proceedings of the IEEE international conference on computer vision*, pages 618–626, 2017.