Obsidian classification using hyperspectral images to study the archaeological heritage of the Canary Islands

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Introduction and goals

The study of the historical heritage is a complicated task. For a long time, the analysis of archaeological artefacts found in archaeological sites such as ceramics, stones, or skins requires their destruction or deterioration. The main goal of this work is the study of non-invasive techniques for the analysis and classification of the samples from El Museo Canario to replace its current classification methods that require to sent the samples to the laboratory and its deterioration.
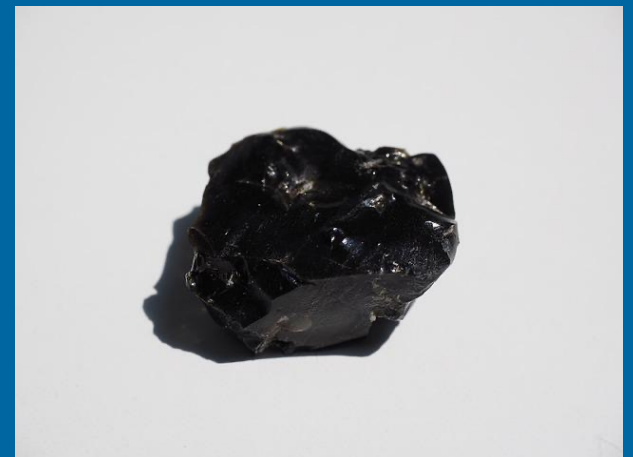

Figure 1: Obsidian

Figure 2: binary mask of one composition

Methodology

Using the available database of hyperspectral images of samples, an automated segmentation of images is performed to obtain the HS signature of the samples. Using the new classification based on lava flows provided by the museum, new classes are created to perform a supervised classification using the Super Vector Machine technique. Different SVM models are created in binary and multiclass classifications and then evaluated to be able to assess their possible use as an obsidian classifier.
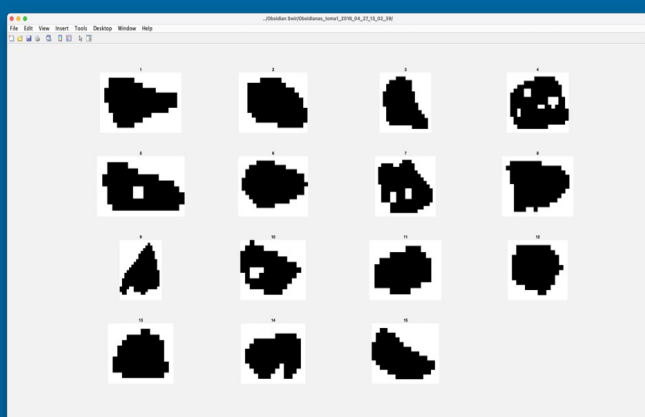
Results and conclusions

The results show a high accuracy (100%) for the classification in samples from different islands, even with binary or multiclass classification. But, this study yields some doubts to be studied in future work regarding the groups of lava flows of the same island that could be related to the low number of samples in the smaller classes, or the similarity of the HS signature.

Pair	Accuracy	Precision	Sensitivity	Specificity	F1 Score
HOG TAB	100%	1 1	1 1	1 1	1 1
HOG Balanced TAB Balanced	100%	1 1	1 1	1 1	1 1
HOG N1	95,49%	0,9549 0	1 0	0 1	0,9769 NaN
HOG Balanced N1 Balanced	52,25%	0,5146 0,1585	0,7992 0,2462	0,2462 0,7992	0,6795 0,7104

Table 1: Results of some binary classifications