Supplementary Material

Hybrid MSRM-based deep learning and multitemporal Sentinel-2-based machine learning algorithm detects near 10k archaeological tumuli in North-western Iberia

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1. Introduction

The purpose of this document is to promote the understanding of the followed process for the detection of burial mounds in North-western Iberia in order to facilitate its reproducibility by other users in other regions.

2. Process

2.1. Digital terrain model pre-processing

Pre-processing of the DTM is a common practice in DL-based detection. To obtain the filtered DTM (MSRM x RF) of our DTM (resolution of 1 m/px) we must use the provided code (script1.txt) in the GEE Code Editor, Repository and Cloud Computing Platform. GEE requires authentication and allows a maximum file size for our DTM of 1GB. The resulting file will be saved in the associated Google Drive.
In the same way, we must crop the filtered DTM in multiple PNG images for the detection, which size must be 1024 x 1024 pixels. To cut the DTM in multiple TIFF images we have used QGISv3.10. Like GEE, Colab requires authentication. The conversion of the TIFF images into PNG has been done using Photoshop. The images were first converted to JPEG (quality: 5) using the image processor and then saved as PNG using an automated action which is provided (JPEGtoPNG.atn).

2.2. Deep learning shape detection

Once the PNG images are obtained, we proceed to the detection of the burial mounds in them using the YOLOv3 shape detection algorithm. To do this, we must upload the images to Colab and follow the steps in the Colab notebook (script2.ipynb) (2. Processing).
Finally, we must download the resulting file (result.txt) with the list of detected burial mounds and use MATLAB, used for this article, or another programming language to extract the points with the exact coordinates (script3.txt).
Before using MATLAB, the obtained data (result.txt) must be entered into an excel workbook as indicated in the script3.txt. The resulting workbook (resultGIS.xlsx) and its associated point distribution will have the following information for each mound: index, X coordinate, Y coordinate, size in meters, percentage of similarity, and number of the associated PNG image.

3. Results

We make available two shapefiles: 1.the results of the hybrid algorithm with the 10527 tumuli detected as points (GaliciaTumuli.shp and associated files). 2) the results of the validation with the collection of 324 FPs detected (FalsePositives.shp and associated files). Please, take into account that these are not all the FPs present in GaliciaTumuli.shp but

the ones found after carful examination of 3086 tumuli. Also, note that the nature of the FPs has also been noted in the shapefile associated table as follows: 1. Rock outcrops, 2. Isolated houses' roofs, 3. Swimming pools, and 4. Other features.