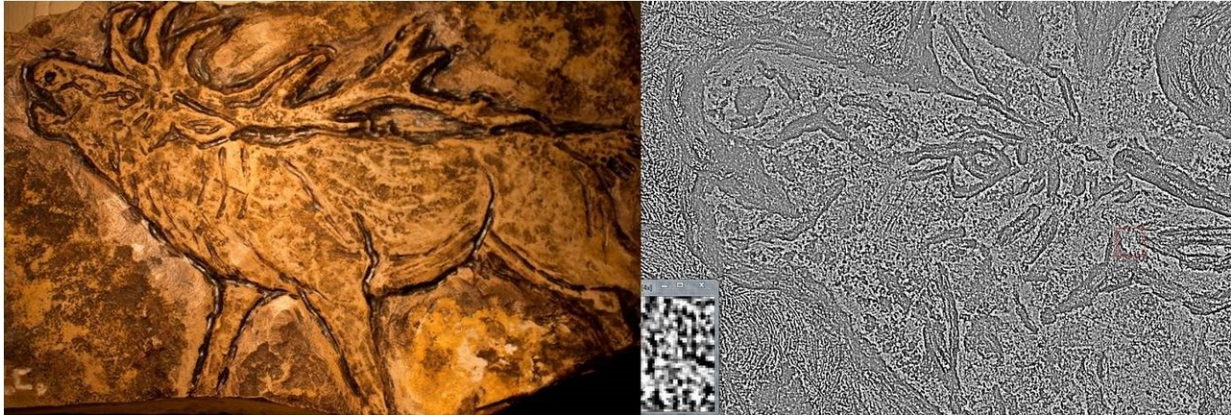


Detection of invisible archaeological elements

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Test model and texture filter image. Credit: Aroa Gutiérrez Alonso

Two researchers from Universidad Politécnica de Madrid (UPM) in collaboration with a researcher from Czech University of Life Sciences Prague (CULS) have developed a methodology to detect archaeological elements invisible to the naked eye.

Starting from photographs taken with common digital cameras and the range of the visible spectrum, a team of researchers from School of Land Surveying, Geodesy and Mapping Engineering at UPM and Faculty of Environmental Sciences from CULS suggest a new non-invasive [methodology](#) of archaeological documentation and analysis to show digital elements that are invisible to the [naked eye](#). The method consists of applying techniques of both remote sensing and spectral treatment in

order to uncover hidden elements and later carry out their morphometric analysis.

Mercedes Farjas, Aroa Gutiérrez and José Antonio Domínguez started by studying a limestone mold in the lab. The first goal was to assess the influence of the angle of the light of the photographs.

Later, after studying the effect of diverse filters on the mold, the researchers carried out combination tests of the filters in order to create a protocol of sequential application that allowed them to obtain conclusive results. As a result of these tests, they selected a set of filters and established an order of application.



Detailed picture of a bovine animal after applying the methodology. Credit: Aroa Gutiérrez Alonso

Mercedes Farjas says, "The digital treatment protocol starts with different taken photographs. After a selection of the optimal pictures, we apply a convolution filter and morphology, a texture filter and a standardized index of prints that allows us to reject aspect within the image."

Additionally, in order to study the existing pigments on the engraving, researchers applied additional techniques of detection such as the supervised classification and 3-D rendering algorithms to assess the surface from a single photograph.

After numerous lab trials, the verification and validation of the complete methodology of the processing were carried out in various caves of a high archaeological value from the Tamanart Valley in Morocco and the Casares Cave in Guadalajara, Spain.

The results show the viability of the proposal to detect hidden information in engravings and to provide researchers with digital supports to carry out a detailed study of the geometries. Aroa Gutiérrez says, "We especially recommend this methodology for studies about the deterioration of national heritage since this methodology can provide information on erosion the stone and carry out relevant qualitative and quantitative analysis."

The deterioration of the support material does not allow a unique reading and interpretation of the texts and to define the content is of great importance for the historical reconstruction of the facts.

More information: Aroa Gutiérrez Alonso. Representación Morfométrica de Grabados y Petroglifos: Nuevas Tecnologías y Procesos en el Tratamiento Digital de Imágenes RGB, (2017). [DOI: 10.20868/UPM.thesis.47745](https://doi.org/10.20868/UPM.thesis.47745)

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