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Earth Observation for Cultural Heritage Monitoring: Examples from Cyprus

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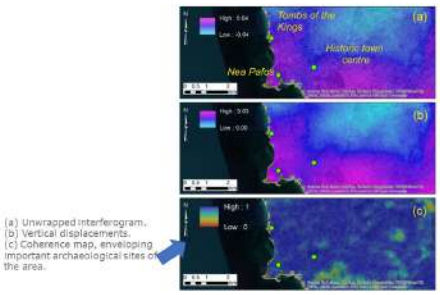
Advancements of geoinformatics and remote sensing for cultural heritage

Earth observation (EO) technologies have emerged as invaluable tools for monitoring and preserving cultural heritage sites worldwide.
By harnessing Remote sensing techniques, including the use of multispectral, hyperspectral and radar data from Copernicus and other high-resolution sensors, supported by UAVs campaigns and ground -based measurements, EO enables the comprehensive assessment of historical structures, archaeological sites, and cultural landscapes all around Cyprus island with unprecedented detail and efficiency.
These technologies facilitate a variety of applications such as the assessment of site conditions, identification of potential threats including natural disasters, urban sprawl and environmental degradation, allowing for timely interventions to safeguard irreplaceable cultural assets.

Detecting Displacements Within Archaeological Sites in Paphos City

The distribution of free and open access radar satellite datasets, like those of Sentinel-1, has provided new opportunities for monitoring archaeological sites and monuments around Paphos City in Cyprus.
Results were obtained from the exploitation of Hybrid Pluggable Processing Pipeline (HyP3) system cloud platform that integrates GAMMA software, for detecting ground displacement after a 5.6 magnitude scale earthquake in 2015, revealing small relative ground displacements in the area under study.
The processing chain was performed on ascending and descending pairs of Sentinel-1 images, acquired before and after the event.



(a) Unwrapped interferogram.
(b) Vertical displacements.
(c) Coherence map, enveloping important archaeological sites of the area.

Ceramic detection through AI and UAV images in Kofinou village, in Xeros River valley

Recent advancements in unmanned aerial vehicles (UAVs) and image processing analysis can be utilized to support time consuming ground surface archaeological investigations. To this end, implementation of artificial intelligence image processing methods over two areas of interest near Kophinou village in Cyprus, in the Xeros River valley.
Specifically, random forest classifier through the Google Earth Engine platform and a Single Shot Detector neural network in the ArcGIS Pro environment were applied, supported by true color high-resolution orthophotos and a multispectral camera covering both the visible and the near-infrared parts of the spectrum in each case respectively for the investigation.
The overall results indicate that such an approach can be used in the future as part of ongoing archaeological pedestrian surveys to detect scattered potsherds in areas of archaeological interest, even if pottery shares a very high spectral similarity with the surface.

Monitoring Urban Sprawl in Limassol City

In order to study the urbanization process and its patterns, satellite images were used to identify land-use changes and detect individual buildings and constructions.
To this end, we implemented a quick, automatic and low-cost exploration of large areas, to address the Urban sprawl phenomenon which can negatively impact the archaeological record of Limassol, Cyprus area.
Through Copernicus Radar Sentinel-1 images exploitation and big data cloud platform, Google Earth Engine integration for processing purposes, we implemented three different change detection methods and managed to monitor and detect multi-temporal landscape changes during 2015–2020 period in Limassol, at a medium resolution.

About EOCult:

Our focus is on developing and applying earth observation-based and ground remote sensing methods to better explore and understand landscapes. We concentrate on advance our understanding of the landscape and natural environment by systematic mapping and image processing analysis. Applications are particularly extended from observations of single monuments to archaeolandscapes and their diachronic changes. The core research areas of the team are the use of multispectral, hyperspectral and radar data from Copernicus and other high-resolution sensors, supported by UAVs campaigns and ground measurements.

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