SATCULT Project: Good Practice Documentation Template

The application of satellite data in cultural heritage (CH) protection is still in its early stages, predominantly utilised by archaeologists. However, the SATCULT consortium has begun exploring its potential future uses in the wider CH area.

As part of an upcoming vocational training programme for CH practitioners , the SATCULT initiative gathers examples of Good Practices which show how satellite data can be used for the protection of CH including the benefits of accessing and utilising this data, and required skills for effective use. We are specifically interested in Good Practices from CH beyond archaeology.

The primary focus will be on desk research, collecting examples from European and international contexts with the assistance of Geoinformation and CH protection experts and practitioners. These examples will be analysed to determine the training needs of professionals and practitioners in CH protection and compiled into a compendium.

Please note filling this template requires knowledge to address properly the fields described throughout the survey. Although it is not long, it might take around 15 – 20 minutes to complete it thoroughly and properly.

A selected number of Good Practices, representing the working areas in cultural heritage, will be published in a European brochure and all Good Practices will be published on the SATCULT homepage and presented in the SATCULT LinkedIn group.

SATCULT:
Closing a knowledge gap by vocational training about satellite-based services in cultural heritage preservation

Erasmus+

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Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.
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Name/Title of the Good Practice *

Preserving Cultural Heritage of Aquileia and its territory

Name of the organisation *

Istituto Italiano di Tecnologia

Type of organisation in charge of the Good Practice *

- ○ Cultural Heritage organisation
- ○ Cultural Heritage site
- ○ Cultural Heritage -related public entity (Ministry, Prefecture, Municipality)
- ○ University
- ◉ Research Institute
- ○ Earth Observation -related organisation
- ○ Geo-Informatics (Geomatics) organisation/company
- ○ Private Company
- ○ Άλλο: .....

Domain of organisation's activities/expertise *

- ◉ Cultural Heritage
- ○ Archaeology
- ○ Earth Observation
- ○ Geo-Informatics
- ○ Άλλο: .....

Contact Information and Organisation's Logistics

Respondent's contact details

Full name of the contact person *

Giulio Poggi

Email address *

giulio.poggi@iit.it

Telephone number *

3285906521

Organisation's details

Country *

Italy

City *

Venezia

Address *

ViaTorino 155

Information about the Good Practice

Please name below the *Country*, *City* and *District* where the Good Practice took place *

Italy

Please provide below a *Google Maps link* or *GPS coordinates* to the Good Practice's location *

https://maps.app.goo.gl/YyfCtzv967BVDsWBA

Is this considered a sensitive* area ? *
*(protected, fragile, has restricted access, or located within a conflict zone, etc.).

Please elaborate further.

The archaeological center of Aquileia is not classified as a sensitive area. However, its surroundings encompass lagoonal zones, largely reclaimed today, yet highly vulnerable to transitional environmental changes and local instabilities caused by subsidence, agricultural practices, and hydraulic interventions.

Who owns the cultural asset (ministry, other public body, private institution, none), on which the Good Practice was applied ? *

The Soprintendenza Archeologia, Belle Arti e Paesaggio is the governmental institution responsible for the valorization and preservation of cultural heritage, including sites and landscapes. Additionally, a private foundation also contributes to enhancing and promoting the archaeological site.

Date(s) or period the Good Practice took place *

Please insert below the period when the good practice held. (eg. 2019-2020, March 2020 – June 2021, etc.)

2021-ongoing

Description of the Good Practice *

Please describe how the satellite data were collected (please mention the repositories or services where you acquired them); how they were used in your project; which were the aims of your study; and why these data were useful towards your research goals. (character limit: 1500)

The main data used in our study comes from the Copernicus Programme, particularly Sentinel-2 imagery, accessed through the Copernicus Open Access Hub and Google Earth Engine. Historical aerial photographs were obtained from the regional cartographic geoserver and directly requested from the Regione Friuli Venezia Giulia archives. Additionally, during certain projects funded by the Agenzia Spaziale Italiana (ASI), we acquired hyperspectral satellite data from the PRISMA satellite and high-resolution images from Copernicus Contributing Missions under ESA co-funded initiatives.

These datasets were primarily used to detect traces of subsoil archaeological features and analyze past landscape modifications. The primary aim of our research was to expand the archaeological trace map within the territory, focusing on three main objectives: (1) enhancing the study of landscape evolution through a diachronic perspective, (2) creating a comprehensive map of buried and surface features to support archaeological research, and (3) providing a tool for heritage protection in land-use planning.

Why is this considered a Good Practice for making satellite data beneficial for Cultural Heritage ? (character limit: 1500) *

This approach represents Good Practice in leveraging satellite data for cultural heritage because it integrates multi-source, multi-temporal, and multi-spectral datasets to maximize archaeological detection and landscape analysis. The integration of these datasets was invaluable, as it allowed for multi-temporal monitoring with varying spatial and spectral resolutions, significantly improving the visibility of archaeological features. This approach maximized our ability to identify, document, and safeguard the cultural landscape, ensuring a more effective strategy for long-term preservation and planning.

This method not only enhances research and conservation strategies but also provides a framework for policymakers to implement sustainable heritage protection measures, demonstrating the practical and long-term benefits of satellite data for cultural heritage preservation.

Required skills section

Skills required to conduct the Good Practice *

Please reflect here which skills – e.g. technical, technological, social, heritage-related – are/were needed for the successful implementation of this Good Practice.

This work requires a blend of technical, analytical, and interdisciplinary skills, including remote sensing and GIS analysis, image processing, archaeological and landscape analysis, machine learning, project management, and effective interdisciplinary communication.

Are/were there any technical skills required for this Good Practice that were not initially available within your organisation and had to be acquired or outsourced? *

- (●) Yes
- ( ) No

Please list the specific skills acquired or outsourced and describe their purpose (e.g. “I learned Python to automate the downloading and preprocessing of collected satellite data.”) *

The center gradually specialised in developing AI technologies tailored for remote sensing data, enabling faster analysis, efficient multimodal data integration, and enhanced feature detection. To achieve this, expertise in machine learning and deep learning was developed to automate the identification of archaeological features and analyze landscape changes. Python programming was used to streamline data acquisition, preprocessing, and feature extraction, improving workflow efficiency. Additionally, the integration of multimodal datasets, including multispectral, hyperspectral, and historical cartographic data, allowed for a more comprehensive understanding of archaeological traces and environmental dynamics.

Evidence of success *

Please describe the benefits they provide to the cultural heritage asset (e.g. a site can be protected from a hailstorm, looters can be deterred from illegal excavation, damage can be recorded online through international cooperation, etc.). (character limit: 1500)

The integration of AI-driven remote sensing technologies provides significant benefits to cultural heritage assets by enhancing detection, monitoring, and preservation efforts. Automated analysis through machine learning accelerates the identification of archaeological features, including buried structures and past landscape modifications, reducing reliance on time-consuming manual interpretation. The use of multimodal data fusion, combining satellite imagery, historical maps, and hyperspectral data, allows for a more comprehensive understanding of site evolution, improving historical reconstructions and conservation strategies.

Available references for the Good Practice *

Please mention below if there are any derived publications, media reports or any other content that refers to the described Good Practice. Please include also a web link if available.

(character limit: 1500)

10.36227/techrxiv.172833109.92524193/v1 ; https://doi.org/10.3390/geosciences7040128

Please upload 2-3 images that concern the Good Practice. *
(each image cannot exceed the size limit of the 100 MB)

Pasti_Satellite - ... Website_PhD_ad... Multispectral tra...

Προσθήκη αρχείου

Do you own the copyrights for these images ? *

- (•) Yes
- ( ) No

Should any form of media or outreach material will be created in the future, can we use them * to advertise your organization and the CH asset with proper acknowledgement?

- (•) Yes
- ( ) No

Please provide below the credits for the picture(s): *

Center for Cultural Heritage Techonology, Istituto Italiano di Tecnologia

Did you encounter any technical and/or technological challenges or issues associated with the implementation of this Good Practice? E.g. missing knowledge, doubts of colleagues, financial issues. *

Yes, technical and technological challenges were encountered during the implementation of this Good Practice,.The primary issue arose from the seasonal changes and environmental variability that affect the visibility of archaeological features. Vegetation cover, soil moisture levels, and crop cycles significantly alter the landscape, making it difficult to consistently detect features. To address this, we utilized Artificial Intelligence (AI) techniques to process multitemporal satellite imagery, allowing the system to learn seasonal patterns and adapt to environmental changes.
Another challenge involved the cost and availability of high-resolution imagery, which is often essential for detecting fine-scale archaeological features. Acquiring these images can be expensive, and in some cases, limited access to specific datasets posed a barrier.

Is there any potential for transferring this Good Practice to other cultural heritage organisations ? If so, please share more details. *

es, there is significant potential for transferring this Good Practice to other cultural heritage organizations, particularly in areas with similar environmental characteristics, such as agricultural landscapes, wetlands, and regions prone to seasonal changes. The use of AI-driven remote sensing technologies for detecting and monitoring archaeological features is highly adaptable and can be applied to diverse settings, as long as the local environmental and landscape conditions share similarities.

Additional Information. Please include below any other information or experience you wish to share.

The information provided will be used exclusively for the activities of the SATCULT project and within the rules and obligations defined by the GDPR rules. The EU General Data Protection Regulation (GDPR) regulates how personal data of individuals in the EU may be processed and transferred. *

- (●) I have taken note of this information and agree to the use of my responses within the SATCULT project.

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