



STARION



SmartDIG

SmartDIG – Preserving Cultural Heritage

AI-Driven Preventive Archaeology through Multi-Seasonal Remote Sensing

Public

The need for Cultural Heritage preservation

- Urgency to preserve cultural heritage globally
- Many initiatives underway
- Preserve known and **unknown** heritage
- Risk for damaging hidden heritage
- Projects delays / costs
- Legal obligations and archaeological surveys



Roman ruins with a prophet, by Giovanni Pannini, 1751

How to preserve
what is not visible?



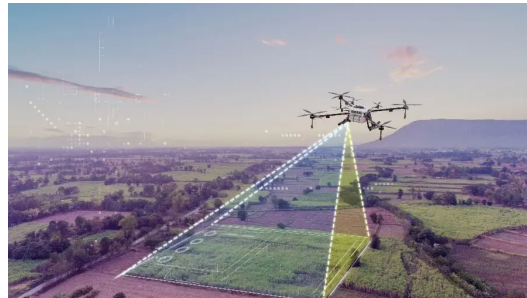
Revealing the unseen from above



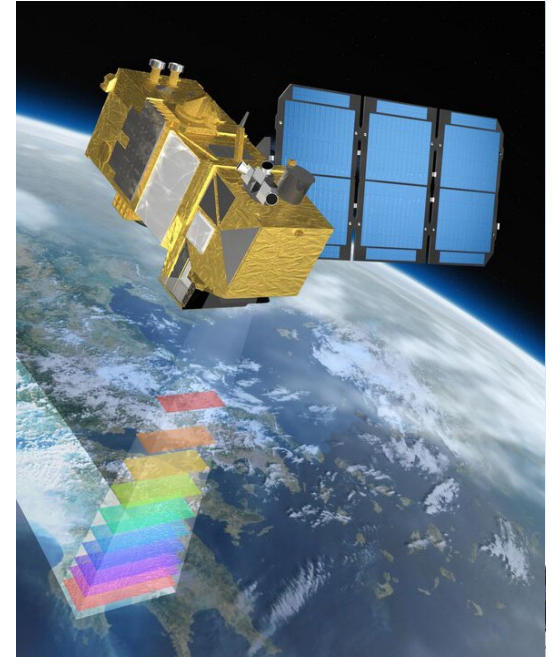
Air balloon



Aerial photography

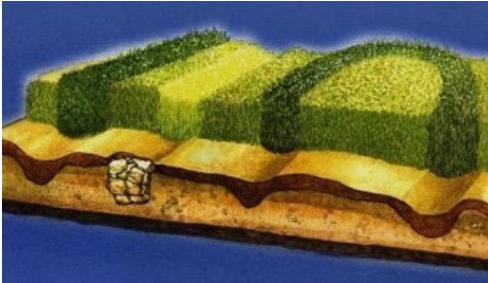


Drone photography



Remote Sensing

Ground indicators: crop marks & ground anomalies



VEGETATION MARKS

Underground structures affect regular growth of vegetation roots

→



SOIL MOISTURE MARKS

Soil moisture content underlines underground structures presence

→

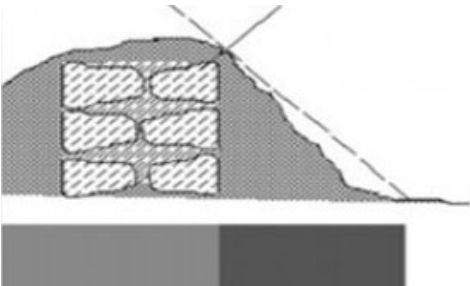


Surface alterations and micro-relief marks



SURFACE ALTERATION MARKS

Agricultural activity
Brightness ground color



MICRORELIEF MARKS

Underground features are visible at a given hour and moment of the day



Preventive Archaeology



Preventive archaeology

Whenever a public or private construction project is planned, it is important to make sure that any archaeological or cultural heritage in the area is protected.

The "verifica preventiva dell'interesse archeologico (VPIA) ai sensi dell'art. 25 del Codice dei Contratti Pubblici" is a legal requirement that applies to public contracts involving construction, excavation, or other ground-disturbing activities.

This requirement ensures that cultural heritage is safeguarded during public works projects and promotes responsible and sustainable development.

This is performed by professionals in the Cultural Heritage domain.

Preventive archaeology



BEFORE

Before any excavation or construction work can begin, legal obligations require that a non-invasive analysis of the area is done first.

Professionals are contacted for a preventive assessment of the area.



TODAY

Today, archaeologists refer to Google Maps, aerial photographs, drones' acquisitions, cartography.

It can take up to 60 days, to retrieve the photographic/satellite dataset and perform the preventive analysis.



AFTER

Following the VPIA form, professionals who identified any potential heritage that might be affected, can discuss with involved stakeholders and support the modification of the project design accordingly.

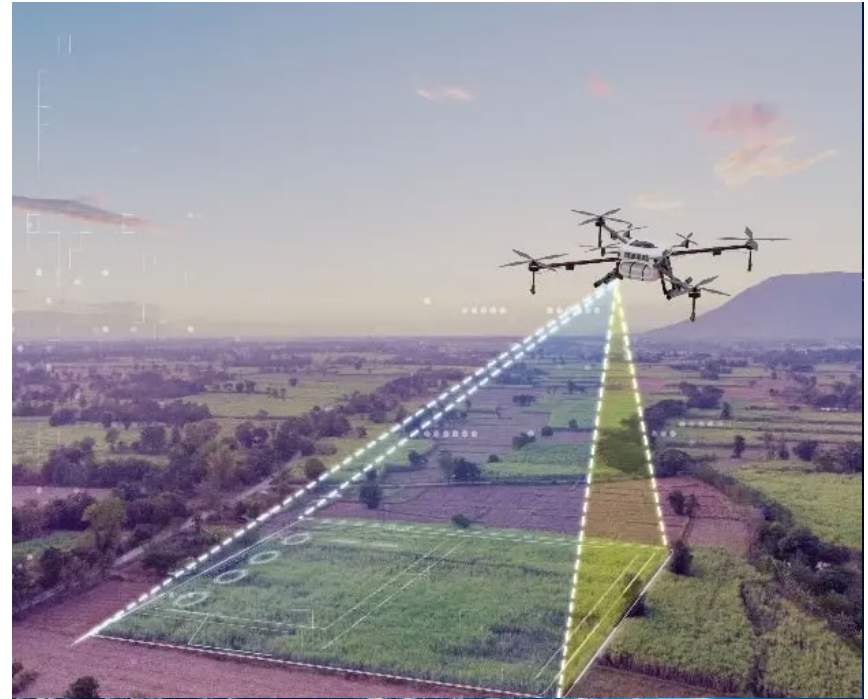


The needs for accuracy and precision



Limits of aerial photography ,drones, GPR,

- Favourable weather conditions
- Small area coverage
- Challenges for large-scale surveys
- Terrain inaccessibility
- Very expensive
- **Constrained to terrain situation during survey**



The role of seasons and terrain conditions



Not visible



Partially visible



Visible



SmartDIG project



- Starion Group is leading the development of SmartDIG project
- SmartDIG is funded as part of the ESA InCubed Programme
- Investing in Industrial Innovation – InCubed – is a European Space Agency open call programme managed by φ-lab



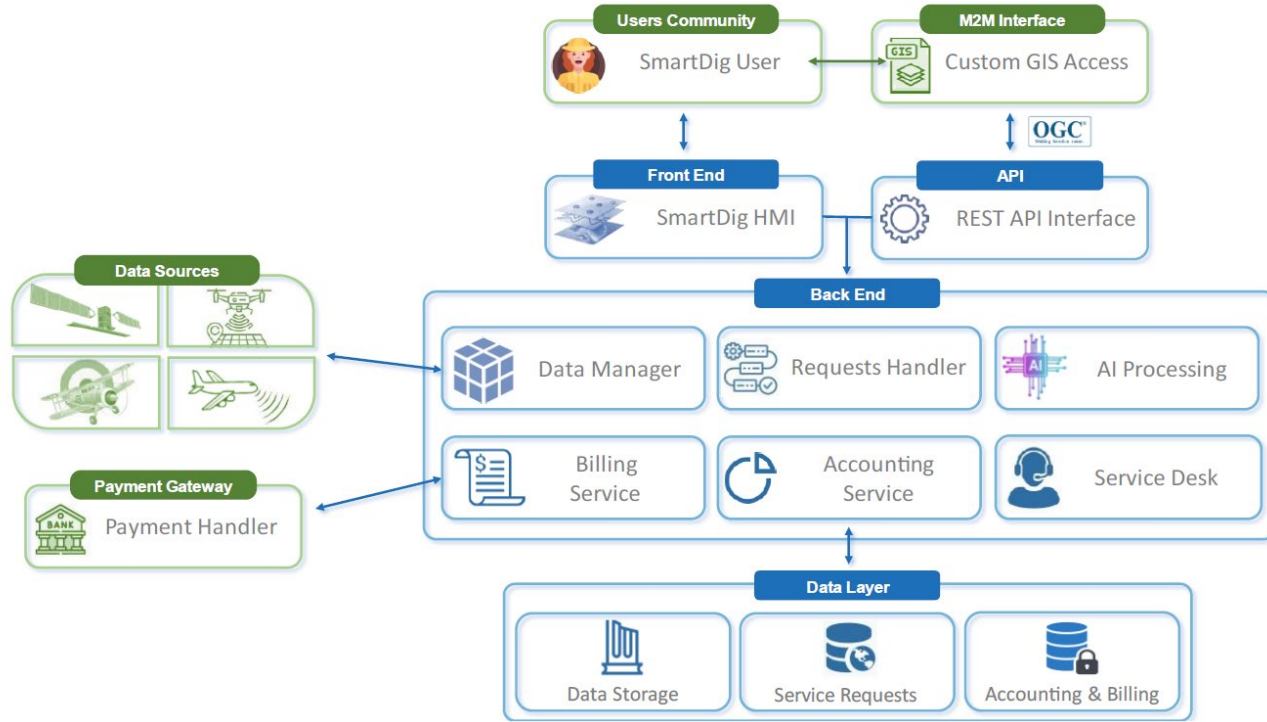
SmartDIG in a nutshell



SmartDIG

- Web-GIS service for on-demand & systematic use
- AI-Driven Preventive Archaeology service
- Leverages EO data both optical and radars
- Cutting-edge AI and multitemporal exploitation
- Detects optimal ground conditions
- Patterns and temporal coherence over time for accuracy and reliable detections
- Customer oriented service
- API integration with existing GIS systems

High-level architecture



Global Application

- Not only for Italian market
- EO overcomes local constraints also in inaccessible areas
- Usage of historical data from different sites increase the accuracy
- Crucial for many areas affected by urban growth in last decades



ESA Heritage Space Programme (HSP) support

- Support to the project demonstrating how historical data can be exploited
- Customized datasets tailored to project needs
- Historical satellite data provides long-term temporal insight
- Pre-urbanization imagery uncovers hidden heritage no longer easily visible
- Multi-seasonal and multi-spectral data spanning decades enhances AI accuracy



Protecting the past, empowering the future

- **SmartDIG:** leading the future of Preventive Archaeology
- **Fast, non-invasive detection** reduces delays, costs, and risks
- **AI and EO Data** protect cultural heritage with precision and accuracy
- **Global Solution** for safeguarding heritage on every scale
- **Ideal for urban and inaccessible sites**, overcoming local constraints
- **Scalable and efficient**, adaptable to diverse users needs
- **Built for experts with experts** to meet real-world preservation needs
- **Ensures legal compliance** for responsible development



SmartDIG

Thank You!

Join us in supporting the future of Preventive Archaeology.
Visit www.stariongroup.eu or contact us at a.cavallini@stariongroup.eu

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