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the European Union

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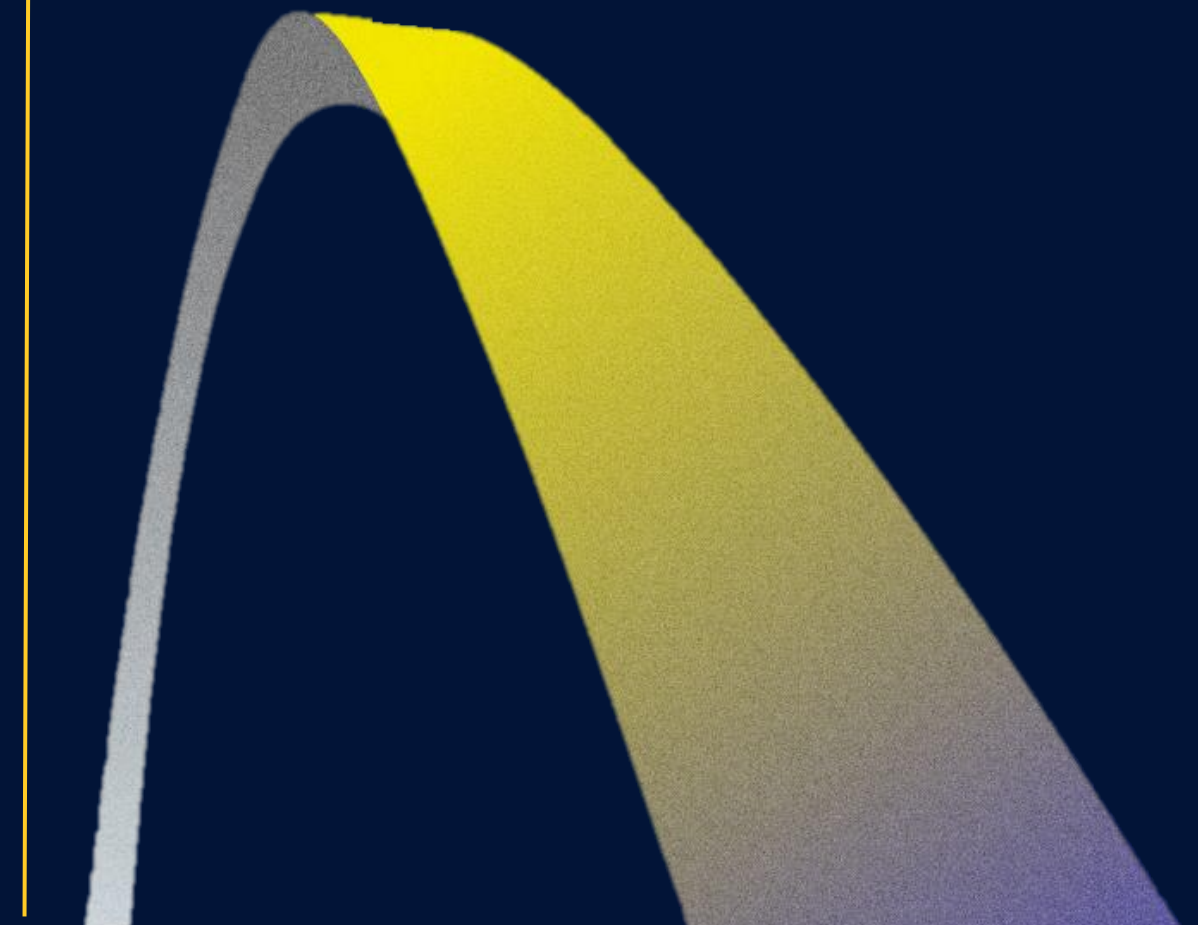


ENIGMA

Endorsing safeguarding, protection, and provenance management of cultural heritage

Training Workshop for CH Experts

Safeguarding Heritage

What will we cover?

Duration	Activity
15 mins	**Introduction - Theory:** What is ENIGMA + Questionnaire
15 mins	**Demonstration:** ENIGMA platforms and tools
10 mins	**Break**
30 mins	**Workshop – Practice:** Participants test the ENIGMA platform and tools
10 mins	**Conclusion:** Recap + Questionnaire
10 mins	**Q & A**

- Login details have been provided prior to this session. Please use the to login to the system during the workshop:
  enigma.cellock.com
- Access to a folder has been given prior to this session. This includes data on several objects for you to use during the workshop

Who are we?

Prof. Georgiadis Charalampos
Associate Professor of Photogrammetry, Remote Sensing, GIS, AUTH
Project Coordinator ENIGMA

Dr. Themistocles Roustanis
CTO and Owner, KIKLO
Technical Partner ENIGMA

Olga Veiga Martínez
European Projects, Anysol
Communication and Dissemination Partner ENIGMA

Dr. Nick M. L. Mols
Scientific Attaché Art History and Cultural Heritage, KMKG
Training and Cultural Heritage Partner ENIGMA

ENIGMA project overview

- EU Research: Horizon Europe Grant
- 2023-2025
- € 4.000.000 total budget
- € 325.000 by KMKG
- 12 consortium partners
- Bringing together museology, archaeology, computer science and law enforcement
- Developing tools for identification, traceability and provenance

Scale and scope of the illicit trade

- Global problem of illicit trade and looting of cultural goods
- Threats include armed conflict, natural disasters, and human activities.
- 69% of seized good are small objects
  - e.g., coins, seals, fragments, jewelry
- 140.000-700.000 objects illicitly traded in Europe each year
- Total value of around € 320 mln. per annum

The ENIGMA solution

- The illicit market is large and expanding
- Most stolen art and artefacts are never recorded
- ENIGMA's technological solutions:
  - Site monitoring
  - Apply AI for identifying cultural goods
  - Create a platform to increase efficiency for object handling and confiscation
  - ENIGMA is a prototype (TRL 6)

ENIGMA overview

Tools for end users

LEA officer GUI
- RS Tool
- UAI and similarity checking tool
- Public participation tool

Expert GUI
- RS Tool
- UAI and similarity checking tool
- Public participation tool

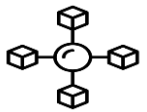
Auxiliary tools

EO/GIS data

Public participation / crowdsourcing

Joint Data Workspace

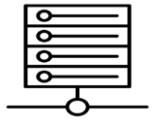
Decision support based on the UAI (RS, AI/ML similarity, Crowd sourcing)



Main Graph Database (EDM and Vocabularies standardized)

AI/ML Tools for data curation

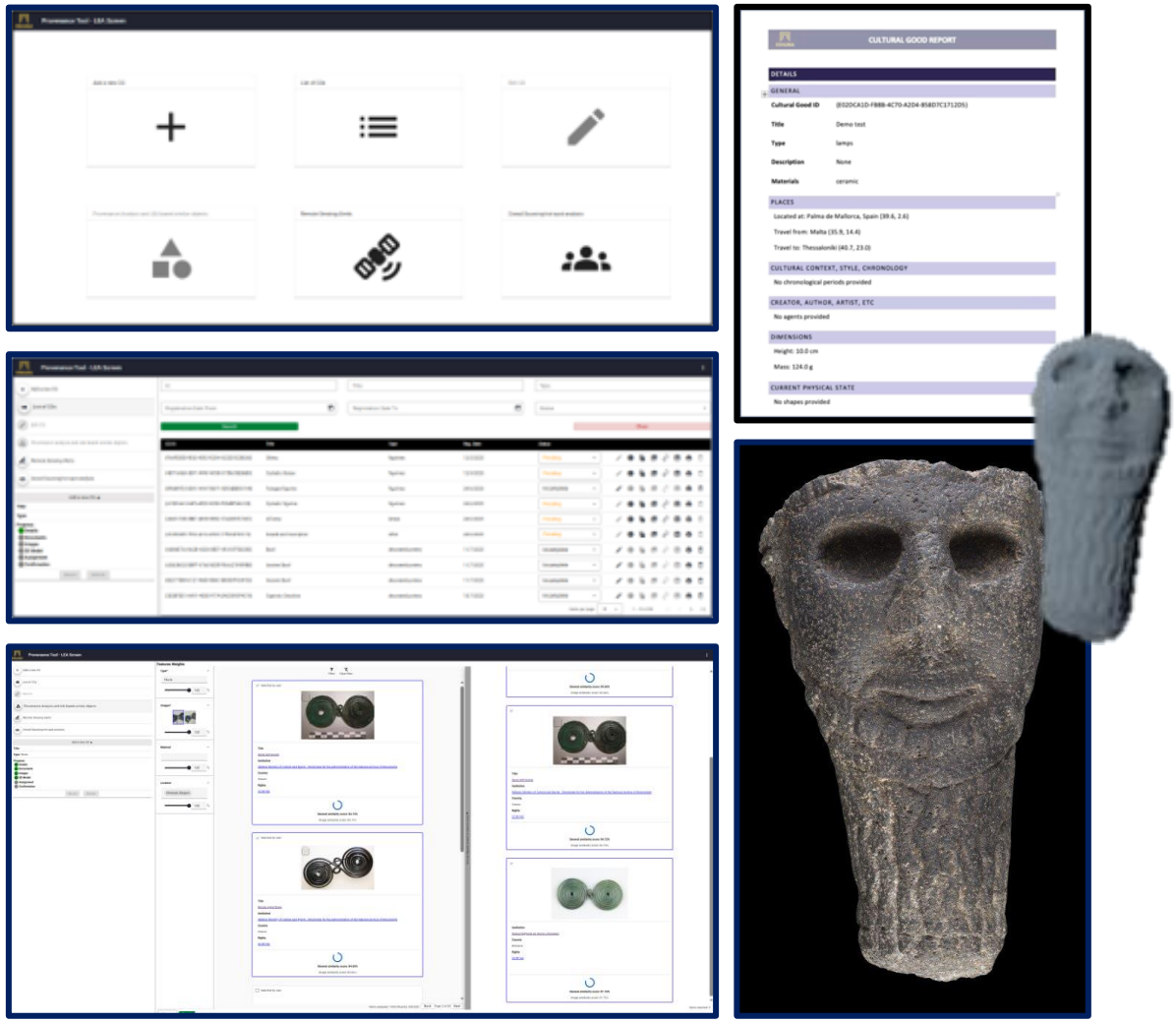
Intermediate data storage



API connected databases

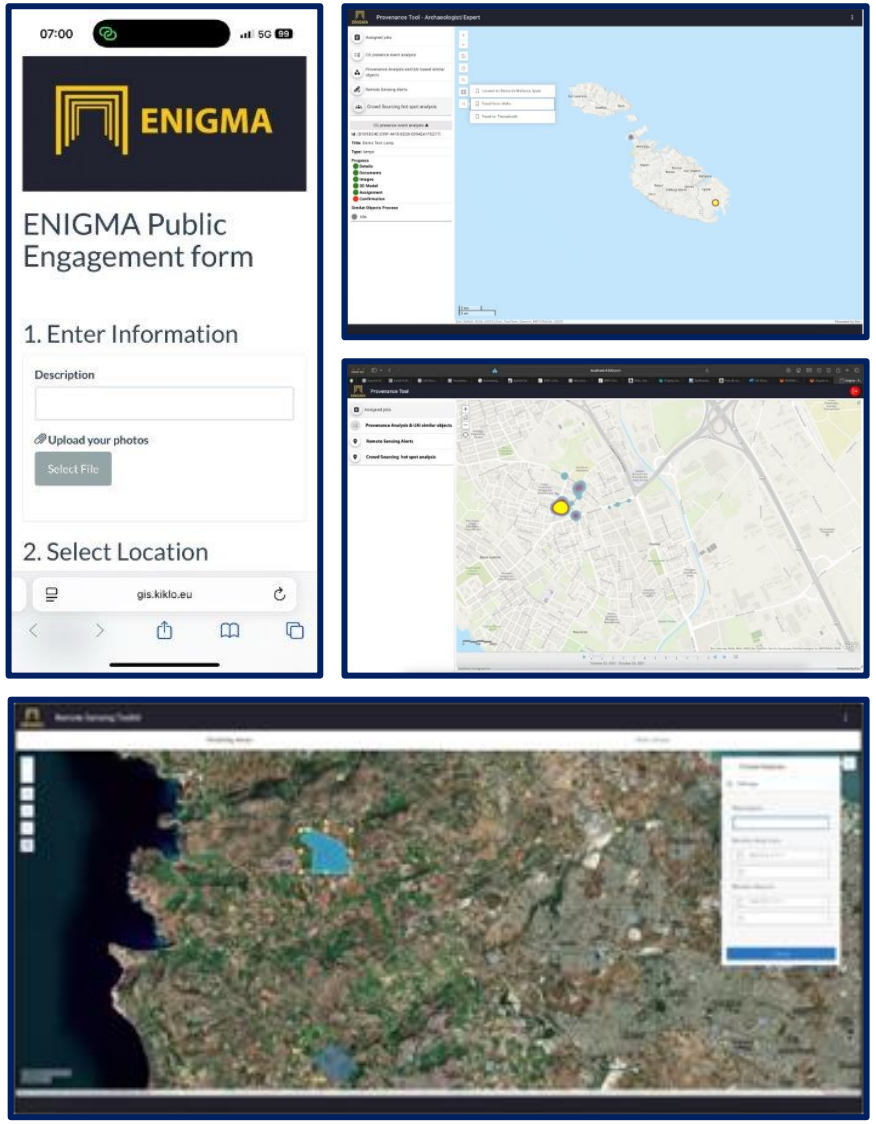
Web Crawler

Backend Infrastructure



The ENIGMA tools

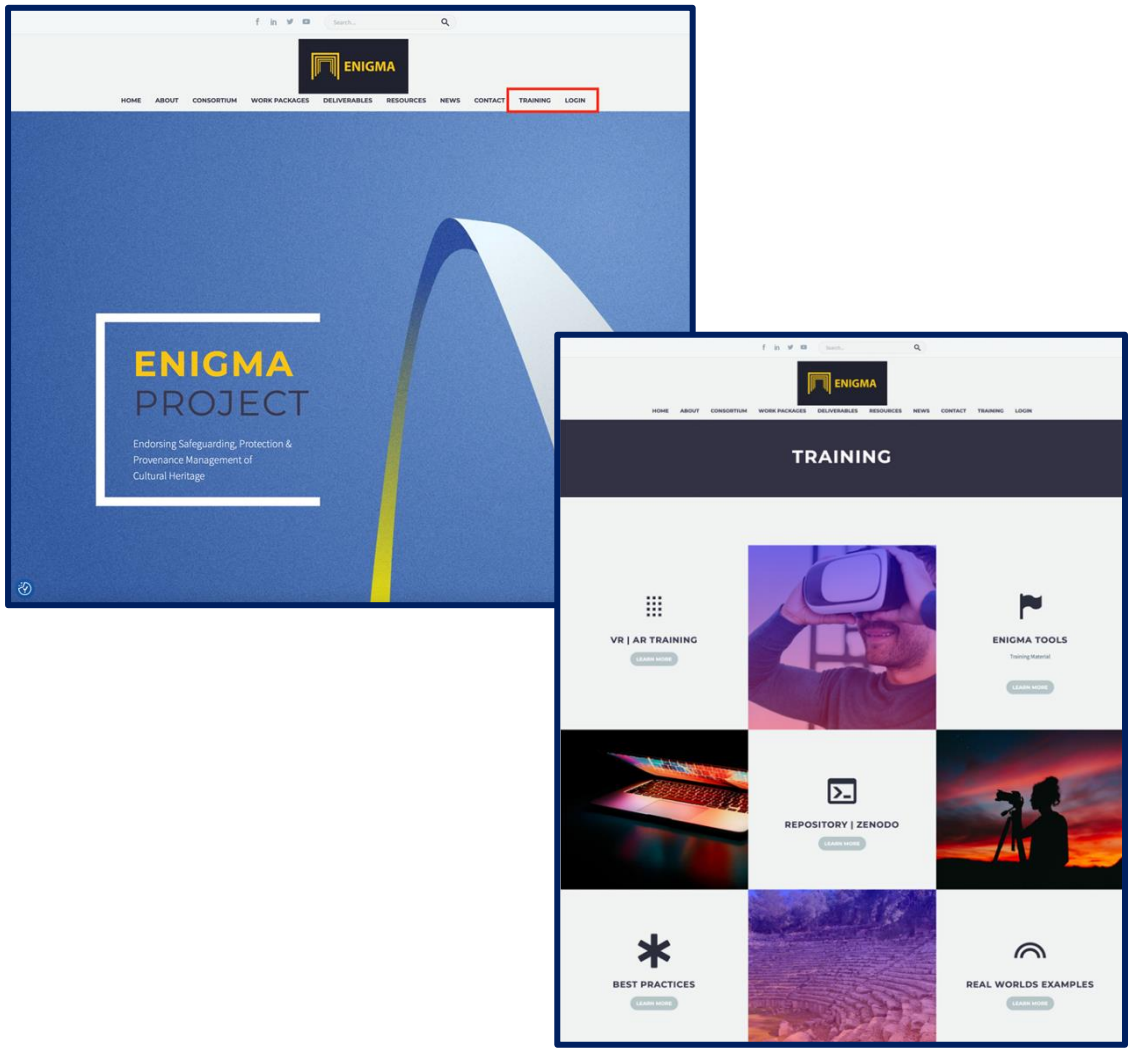
- **Provenance Research Tool:** Web platform for in-depth investigations with AI-powered similarity checks.
- **Similarity Score:** Uses AI to compare inputs with objects in existing databases
- **3D Reconstruction Tool:** Creates 3D models from a few photos.
- **Unique Authenticity Identifier (UAI):** Links all metadata, locations, 2D and 3D inputs to a digital record linked to the object



The ENIGMA tools

- **Web Crawler:** Continuously extracts metadata from various databases.
- **Crowdsourcing Tool:** Enables the public to report potential illicit activities.
- **Earth Observation Toolkit:** Uses satellite imagery to detect illegal excavations.

Learning Objectives(LOs)



- LO1: Recognize the benefits that ENIGMA offers for professional settings
- LO2: Categorize and organize information in real-world simulations and scenarios
- LO3: Assess and formulate ENIGMA workflows to enhance performance
- LO4: Apply ENIGMA tools to facilitate collaboration in protecting cultural goods

Accessing ENIGMA

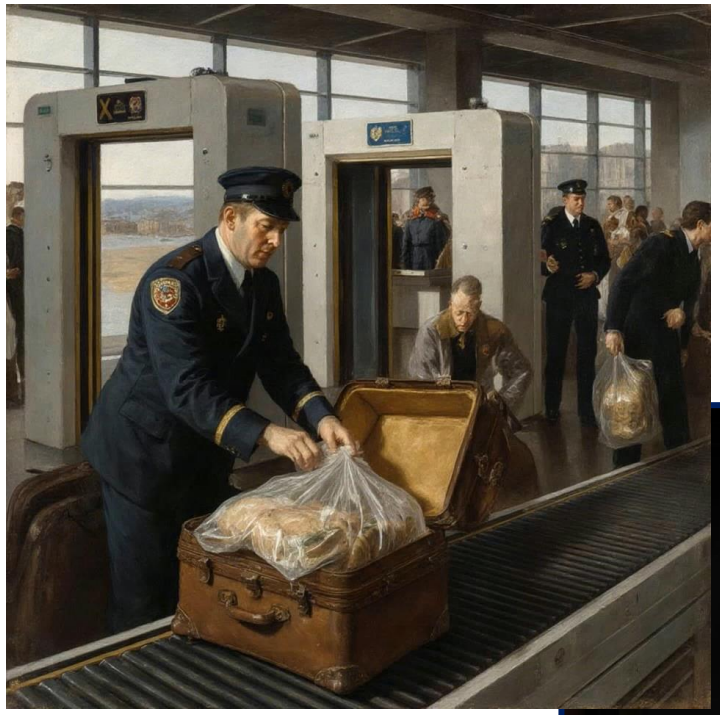
- Login to **enigma.cellock.com** to access the tool
- Login details for you have been provided
- Data has been provided for you to use during the training.

ENIGMA Real-life applications

- Real-life demonstration at Malta International Airport, May 2025
- Aug-Sep 2025: Pilot tests with Law enforcement and cultural heritage experts
- Law enforcement recorded items, entered the data in ENIGMA, collaborated with museum experts to trace the legal status of the object
- Refinements recognized, but ENIGMA proved to work effectively

ENIGMA recap

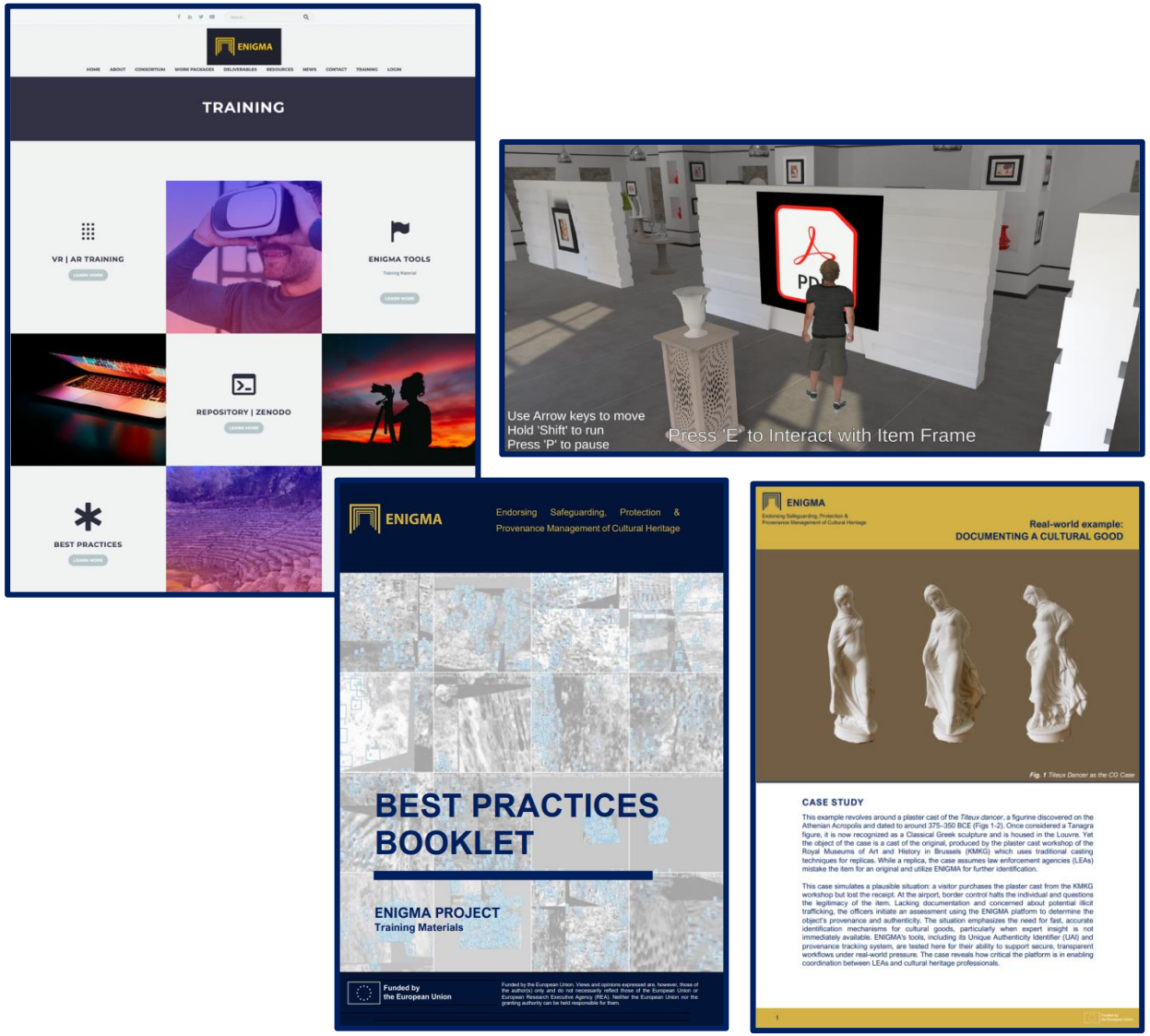
1. Develop a technological solution for cultural heritage protection
2. Co-create solutions with stakeholders, including law enforcement, museums and CH professionals
   - User-based, easy-to-use
3. Develop tools that are accurate and adaptable
   - Fool-proof: modular and dynamic
4. Bring the technological level to that of a prototype



ENIGMA's impact

- Database mostly work for known objects, not for undocumented artefacts.
- Difficult for law enforcement and museums to collaborate
- Web crawling and image recognition exists, but not for unprovenanced goods
- ENIGMA combines web crawling, image recognition, 3D scanning and earth observation
- This creates a digital footprint to deter buyers and detect early looting

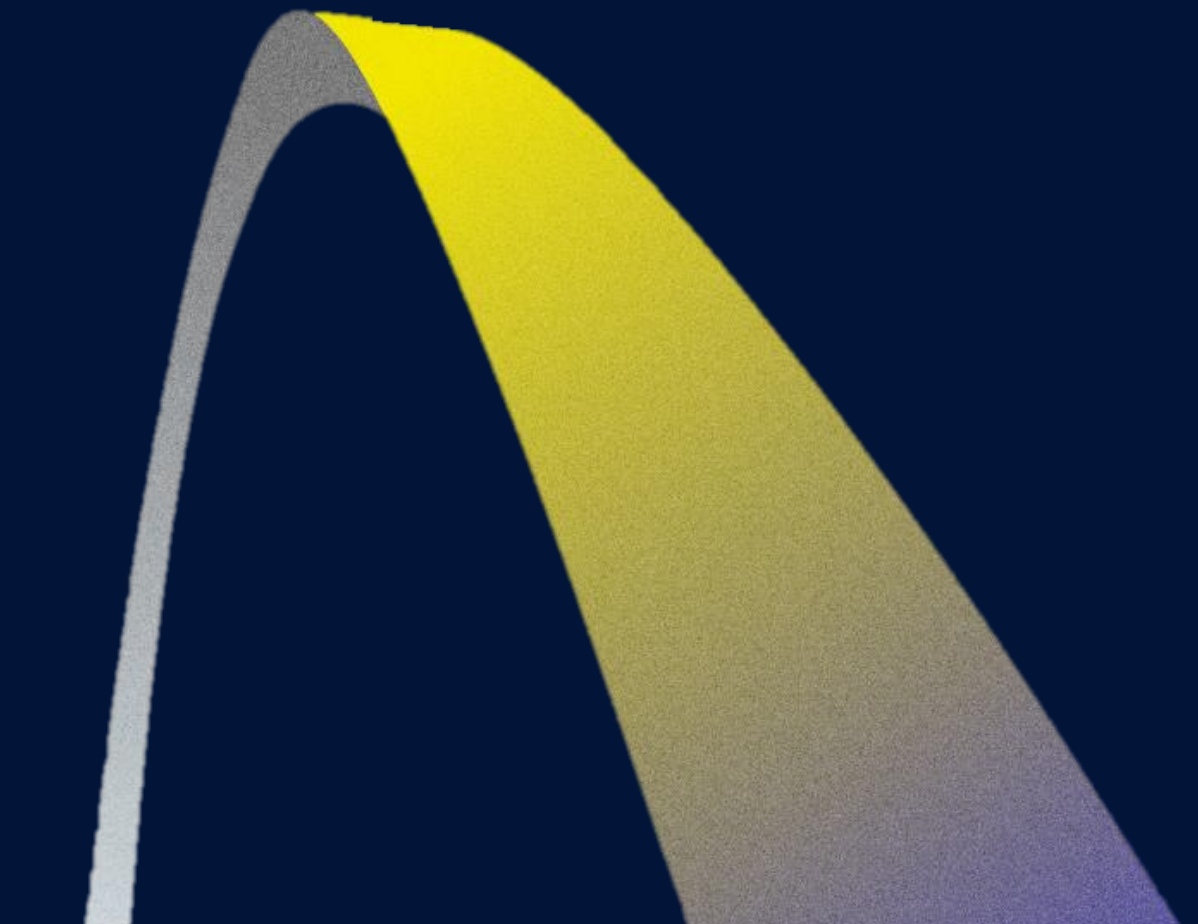
Further Resources



Further training resources will be made available online towards the end of the project: https://eu-enigma.eu/training/

Platform registration is required

- VR immersive environment
- Tool Manuals
- Training videos and slides
- Best Practices booklet
- Real-world examples



ENIGMA

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