Advanced Technologies and International Cooperation for a New Era of Conservation

By Prof. Fulvio Rinaudo, President of CIPA Heritage Documentation

Cultural heritage conservation is no longer merely a preservation effort. It is a dynamic process that connects the past, present, and future through the power of digitization

CHEDAR project is a tangible demonstration of how technology can serve memory and knowledge, transforming the way we preserve and narrate our cultural heritage

Cultural heritage conservation is facing an epochal challenge: on the one hand, the need to preserve the historical memory of sites and artifacts threatened by natural and human-induced factors; on the other, the opportunity offered by new technologies to document, analyze, and reconstruct cultural assets with unprecedent accuracy.

The CHEDAR project marks a decisive step in this direction, aiming to establish a center of excellence for cultural heritage digitization and reconstruction on an international scale.

As President of CIPA Heritage Documentation, an international organization dedicated to cultural heritage documentation through advanced technologies, I recognize CHEDAR as a strategic initiative capable of integrating science, technology, and education, fostering an innovative vision of conservation based on data interoperability, digital twins, and artificial intelligence applications.

The synergy between high-resolution 3D models, machine learning, augmented reality, and geospatial information systems will not only document the past but also make heritage more accessible and manageable in the future.

TECHNOLOGIES FOR DOCUMENTATION AND RISK MANAGEMENT

3D digitization has become one of the most powerful tools for understanding and protecting cultural heritage.

CHEDAR integrates advanced three-dimensional survey techniques such as digital photogrammetry, laser scanning, and multispectral imaging, which enable high-precision data acquisition and the creation of digital twins that are exact replicas of original artifacts and sites.

These digital models not only provide a permanent data repository for conservation and restoration but are also fundamental for risk management in the event of natural disasters or armed conflicts. The ability to monitor changes over time, comparing successive surveys and implementing predictive algorithms, allows for early detection of deterioration signals, optimizing conservation interventions.

CHEDAR aims to establish standardized protocols for digital data collection and archiving, ensuring their interoperability and international accessibility. The project aligns with global documentation standards set by organizations such as CIPA, ISPRS, and ICOMOS,

contributing to the development of a global digital ecosystem for heritage conservation.

VIRTUAL AND PHYSICAL RECONSTRUCTION: A NEW INTERDISCIPLINARY APPROACH

Beyond documentation, CHEDAR explores the possibilities of both digital and physical reconstruction of cultural assets, combining advanced modeling techniques with artificial intelligence.

The reconstruction methodologies are based on principles of sustainability, authenticity, and innovation, with an approach that merges tradition and technology. 3D printing and digital fabrication allow for the faithful recreation of architectural and decorative elements, facilitating accurate and respectful restoration interventions. At the same time, virtual and augmented reality provide immersive experiences, digitally reconstructing lost sites and artworks, thereby enhancing public engagement and education in heritage. A key aspect of the project is the scientific validation of reconstructions through AI-based methodologies, enabling the analysis of large volumes of archaeological, historical, and iconographic data to generate increasingly accurate reconstruction hypotheses.

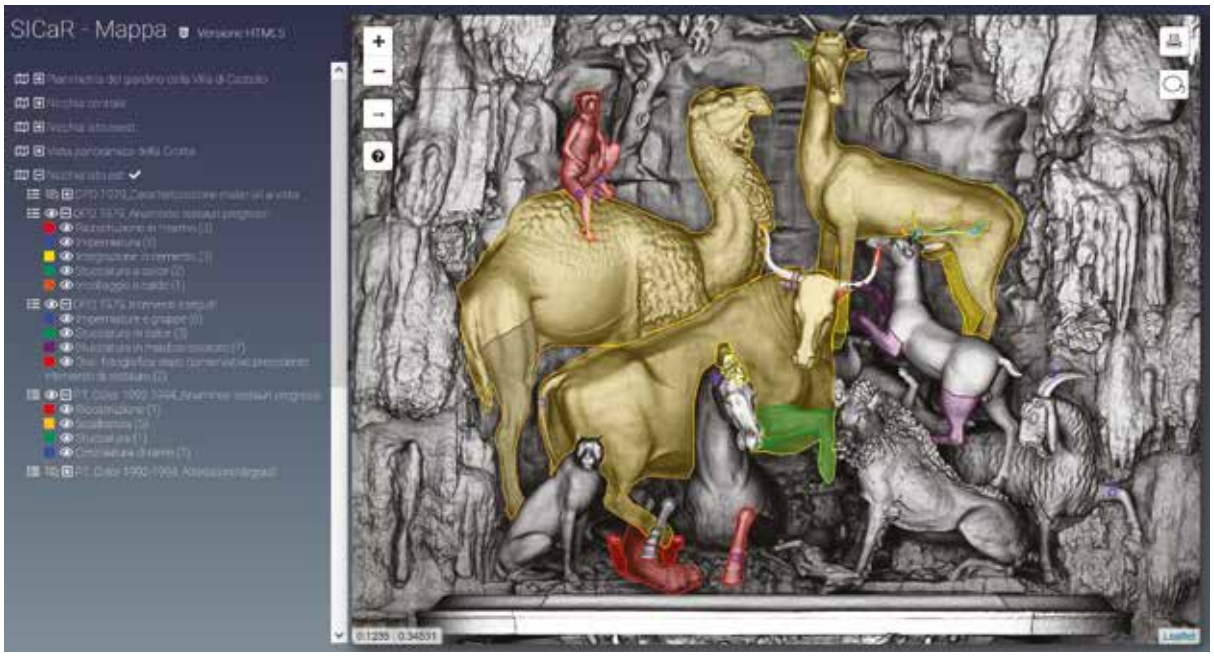
CHEDAR AS AN INTERNATIONAL HUB FOR TRAINING AND SCIENTIFIC COOPERATION

One of the primary objectives of CHEDAR is to establish a higher education center, attracting researchers, professionals, and students from around the world to develop advanced competencies in digitization and heritage management. The project's high-level training programs will provide theoretical and practical tools to train experts in geomatics, AI applications for cultural heritage, and emerging conservation technologies. CHEDAR's international dimension is a key strength: the project operates within a network of research institutions, universities, and international organizations, fostering strategic partnerships between Europe, the Mediterranean, and the Middle East. CHEDAR's participation in Expo Osaka 2025 represents a unique opportunity to showcase the project's results on a global stage, reinforcing Italy's leadership in research and innovation for heritage conservation.

TOWARDS A NEW ERA OF DIGITAL CONSERVATION

The CHEDAR project marks a significant advancement in cultural heritage digitization, defining a management model based on the integration of digital data, predictive analytics, and artificial intelligence. The synergy between science, technology, and human expertise will drive a transformational change that will not only improve the conservation of existing assets but also open new avenues for their accessibility and promotion.

CIPA Heritage Documentation fully supports this initiative, offering its expertise and global network to ensure the project's success.



Thematic mapping on mesh model of the Grotto of the animals (courtesy GeCo Lab and ISPC-CNR)