

ARCHITECTURAL HERITAGE

DM 629/Patrimonio Culturale - Heritage at Risk and 3D Documentation. Geomatics, Crowdsourcing, and Artificial Intelligence for Knowledge

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] Politecnico di TORINO [P.iva/CF:00518460019]
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Context of the research activity	<p>Cultural heritage is essential as a testament to human history and art, representing cultural diversity through the ages. Today, this heritage is threatened by various factors such as conflicts, natural disasters, urbanization, climate change, and irresponsible human actions. The aim of the research is to develop strategies for documentation, analysis, safeguarding, protection, and management, using 3D low-cost technologies and artificial intelligence for a detailed representation of endangered assets.</p> <p>Progetto finanziato dal PNRR a valere sul DM 629/2024 - Patrimonio culturale - CUP E14D24002300006</p>
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	<p>Cultural heritage represents an irreplaceable treasure of humanity, a testament to past peoples and civilizations' history, art, and cultural diversity. However, countless sites and cultural assets around the world are currently at risk of destruction, degradation, or loss due to multiple factors, such as armed conflicts, natural disasters, unplanned urbanization, climate change, and irresponsible human activities.</p> <p>The research objectives are manifold. Firstly, the main threats to cultural heritage will be examined, along with solutions, guidelines, and initiatives at both national and international levels. The research will develop in synergy with some of the bodies responsible for heritage protection, such as Sovrintendenze per I Beni Architettonici e Paesaggistici and international entities like ICOMOS, ICOM, and UNESCO, aiming to develop strategies for documentation, analysis, safeguarding, protection, regeneration, and management of our Heritage. Currently, 54 UNESCO sites are included in the List of World Heritage in Danger. The scientific community dedicated to heritage has been involved for several years in the conservation and documentation of endangered sites, with digital resources playing an</p>
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Objectives

important role in their work.

A second aspect will involve studying new methodologies, tools, and techniques related to 3D documentation, following low-cost approaches and strategies that are able to use artificial intelligence systems for a comprehensive reading and documentation of endangered architectural heritage. In this context, the possibilities offered by new sensors integrated into some of the smartphones and tablets on the market today will be analyzed. These devices combine high-resolution images and laser scanner systems for 3D surveying. This scenario envisages the possibility of following approaches based on crowdsourcing methods, which have proven to be tools of great interest and effectiveness for 3D documentation of cultural heritage, examining the benefits, challenges, and best practices associated with this collaborative approach.

Thanks to the increasing diffusion of such sensors, it is expected that the research can involve a vast community of users, including experts, enthusiasts, researchers, and volunteers, engaged in the process of knowledge and documentation of cultural heritage. Collective participation will enable the collection of diverse data, which will be structured, cataloged, analyzed, and used for artificial intelligence applications useful in defining issues related to the conservation status of the studied heritage, helping to define conservation and monitoring strategies.

These themes are also at the heart of the National Recovery and Resilience Plan (PNRR), which aims at the conservation of cultural heritage through innovation and data sharing, promoting research, education, and enjoyment by a wide and diverse audience. They are integrated transversally across various areas related to Heritage, such as: Informatics, cultural heritage; Architecture, anthropized environment, cultural heritage; and Archaeology, with a view to developing new digital tools useful for the open sharing of data to promote research, education, and the enjoyment of cultural heritage by a wide and diverse audience.

Skills and competencies for the development of the activity

- Instruments and methods for 3D spatial data acquisition such as :
 - mobile and portable 3D systems
 - terrestrial laser scanning
 - photogrammetry SfM based
 - Topography and GNSS
 - SLAM based techniques
- Rapid Mapping
- Multi-scale data fusion and hybridization
- 3D modeling using metric data and integration with Historical information;
- Artificial Intelligence
- 3D visualization using interactive tools
- Underwater photogrammetry
- Virtual reality/ Augmented reality tools