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Editorial

Religious Cultural Heritage: Diagnostics, Documentation, and Valorization

Olimpia Niglio[1] and Gireesh Kumar T K[2]

Abstract

Religious cultural heritage encompasses sacred architecture, archaeological sites, monuments, manuscripts, artworks, music, rituals, and living traditions that embody humanity's diverse spiritual and cultural experiences. Its preservation requires interdisciplinary approaches integrating scientific diagnostics, digital documentation, conservation practices, and Heritage Informatics. This collection, Religious Cultural Heritage: Diagnostics, Documentation, and Valorization, examines how technologies such as non-invasive imaging, laser scanning, photogrammetry, LiDAR, building information modelling, virtual reality, artificial intelligence, and digital archives support the investigation, recording, conservation, and interpretation of religious heritage. Its contributions explore diverse contexts, including religious music, medieval madrasas, Buddhist traditions, prehistoric landscapes, post-Byzantine monasteries, Gothic epigraphy, and digital knowledge systems. Together, they demonstrate the potential of technological innovation to improve documentation, knowledge access, and public engagement while addressing challenges of authenticity, sustainability, and cultural continuity. The volume advocates responsible valorization grounded in interdisciplinary collaboration, ethical practice, and community participation, ensuring that heritage remains a meaningful resource for future generations.

Keywords: Religion, Culture, Heritage, Informatics. Diagnostics, Documentation, Valorization, Conservation, Archaeology.

Introduction

Religious cultural heritage embodies humanity's diverse spiritual, artistic, architectural, and intellectual traditions. Extending beyond monuments and places of worship, it includes archaeological sites, sacred landscapes, manuscripts, ritual objects, music, oral traditions, and living practices transmitted across generations. Preserving this heritage requires approaches that combine historical understanding, scientific investigation, technological innovation, and community participation. Advances in Heritage Informatics, non-invasive diagnostics, digital documentation, artificial intelligence, three-dimensional modelling, and virtual reality are transforming how heritage is investigated, recorded, interpreted, and sustained. Yet technological progress must remain grounded in reliable evidence, cultural sensitivity, and respect for the religious and social values associated with heritage. Studies included in this issue brings together interdisciplinary studies that examine how diagnostic methods, information technologies, and responsible valorization can strengthen the conservation and transmission of religious cultural heritage while making its significance accessible to present and future generations.

[1]Professor of Architectural Restoration and Cultural Heritage, University of Pavia, Italy. [2]Faculty Memeber, Dept of Library and Information Science at Banaras Hindu University (BHU), Varanasi, India.

Religious Cultural Heritage: Meanings, Continuity, and Responsibility

Religious cultural heritage constitutes one of humanity's most enduring and diverse cultural legacies. It encompasses places of worship, monumental architecture, archaeological remains, sacred landscapes, burial sites, ritual objects, paintings, sculptures, textiles, icons, manuscripts, archives, historic musical instruments, devotional songs, oral traditions, festivals, processions, and practices transmitted across generations. Some of these assets are tangible and materially identifiable; others are intangible, embodied in performance, memory, belief, craftsmanship, and community participation. In many contexts, these dimensions are inseparable. A religious building may derive much of its significance from the rituals, music, objects, narratives, and continuing practices associated with it, while an intangible tradition may depend on a particular place, route, or acoustic environment.

The historical significance of religious heritage extends from prehistoric and ancient ritual landscapes to the major religious traditions and institutions that shaped subsequent societies. Archaeological sites and funerary contexts provide evidence of beliefs, symbolic systems, social relationships, and practices surrounding death and remembrance. The Indus Valley Civilization, for example, is important for understanding ancient urban life, material culture, burial practices, and possible ritual meanings. Such evidence must, however, be interpreted cautiously. The Great Bath, reflecting the importance attached to ritual purity and hygiene in sacred spaces, together with evidence of Mother Goddess worship and the Pashupati symbol, suggests a religious worldview in which reverence for nature and the conservation of biodiversity may have been important elements. But the religious significance of many Indus objects and practices remains debated, and can not be presented as established archaeological fact without reliable evidence. Responsible heritage interpretation must distinguish documented discoveries from hypotheses and popular assertions.

Across regions and historical periods, religious places have served as centres of learning, artistic production, community organization, music, pilgrimage, cultural exchange, and the preservation of written knowledge. Temples, churches, mosques, synagogues, monasteries, shrines, madrasas, sacred groves, cemeteries, and pilgrimage routes are therefore not merely isolated monuments. They form part of wider cultural landscapes shaped by people, beliefs, materials, environments, and historical change.

The significance of religious heritage may be architectural, artistic, archaeological, historical, social, spiritual, or a combination of these dimensions. Its preservation consequently requires an integrated understanding of physical structures, associated objects, historical records, living traditions, and community relationships. Conservation and documentation must recognize this plurality rather than reducing heritage to its material fabric alone.

The Evolution of Diagnostics and Conservation

Since the early 1970s, the application of scientific diagnostic technologies to cultural heritage has substantially improved the understanding of historic buildings, artworks, and materials. In Italy, this transformation included the adaptation of technologies originating in military and medical fields, such as endoscopy, X-ray imaging, ultrasound, and computed tomography. These methods enabled researchers and conservators to investigate the internal condition and composition of heritage objects with limited intervention in their physical fabric.

The twenty-first century has brought further advances through sophisticated computational systems for representing, analysing, documenting, and managing heritage. These developments have expanded the possibilities for understanding complex structures, monitoring deterioration, reconstructing historical conditions, and communicating heritage knowledge to wider audiences.



Figure 1: Mamallapuram Shore Temple (c. 725 AD), in India located at Mahabalipuram, 60 km from Chennai, overlooks the Bay of Bengal. Built of cut granite blocks, it is one of South India's oldest structural stone temples and a UNESCO World Heritage Site since 1984. The complex comprises three shrines - two dedicated to Shiva and one to Vishnu—built on a common platform. The east-facing shrine, with its pyramidal five-tiered structure, is richly sculpted with Nandi figures, lions, pilasters and details.

Religious cultural heritage provides a particularly important field for applying these approaches. Churches, chapels, monasteries, crypts, temples, and other sacred structures often contain complex architectural phases, varied construction materials, decorative surfaces, and artworks that require careful investigation. Paintings, textiles, icons, sculptures, and objects made from different materials present additional conservation challenges.

Diagnostic technologies bring the sciences of construction and materials into dialogue with the principles of preventive and active conservation. They help establish the condition of an asset, identify deterioration and alterations that may not be visible to the naked eye, and provide evidence for planning appropriate conservation interventions. As in medical diagnosis, the objective is to understand the condition of the subject before deciding on treatment. However, heritage diagnostics must account for the unique historical, artistic, material, and religious significance of each object or site.

The choice of diagnostic method should therefore be guided by a clearly defined research or conservation question. Non-invasive and minimally invasive approaches are particularly valuable when dealing with fragile or sacred objects, provided that their suitability and limitations are properly assessed. The findings should inform preventive measures, maintenance, and proportionate restoration, helping to minimize unnecessary intervention and preserve the authenticity of the heritage asset.

Several important conservation projects illustrate the contribution of advanced diagnostics. The restoration of the wooden Volto Santo crucifix in Lucca Cathedral, for example, employed carbon-14 dating and accelerator mass spectrometry to support its dating to the eighth or ninth century. In another example, ultraviolet fluorescence diagnostics were used to examine protective treatments previously applied to natural stone, providing information relevant to conservation decisions. The restoration of



Figure 2: The Pashupati image, with the central figure surrounded by diverse animals, found in Indus Valley can be read as an early symbolic expression of the interconnectedness of all life. Rather than placing humanity outside nature, it presents the human or divine presence within a living community of animals - an idea that resonates strongly with biodiversity conservation, ecological balance, and the principle that every form of life has intrinsic value and deserves respect. In this sense, the image can be viewed as a powerful visual metaphor for equality among living beings: nature is not merely a resource for humanity, but a shared community in which all species are interconnected and worthy of protection.

the Sistine Chapel frescoes in the Vatican also demonstrated the need for careful scientific assessment and controlled cleaning to address thin, whitish surface deposits associated with calcium lactate.

These examples, together with the studies presented in this volume, demonstrate how scientific investigation can deepen our understanding of religious heritage and support conservation strategies grounded in evidence.

Documentation: From Physical Records to Digital Representation

Diagnostics and documentation are complementary but distinct activities. Diagnostics investigates the condition, composition, behaviour, or history of a heritage asset; documentation records and organizes the evidence required to understand, manage, conserve, and interpret it. Both are essential for informed decision-making and the long-term transmission of heritage knowledge.

Documentation may include measured drawings, photography, written descriptions, archival research, oral histories, inventories, condition reports, geospatial mapping, and three-dimensional recording. Together, these methods establish what exists, where it is located, how it has changed, which materials and techniques were used, and what risks may threaten its survival. They also facilitate communication among researchers, conservators, heritage institutions, religious custodians, public authorities, and local communities.

Recent advances have expanded the scope and precision of digital documentation. Laser Scanning, Photogrammetry, LiDAR, Unmanned Aerial Vehicle (UAV)-based mapping, and Heritage Building Information Modelling (HBIM) can support the recording and analysis of complex structures and sites. Digital repositories and carefully designed databases make records easier to manage, compare, update, and share. Three-dimensional models, virtual reconstructions, and immersive visualizations can further assist research, interpretation, education, and conservation planning.

Digital twins and other sophisticated representations can be valuable when based on reliable, well-documented evidence. Their usefulness, however, depends on transparent methods, clear distinctions between observed conditions and reconstructed or hypothetical elements, and appropriate communication of uncertainty. A visually convincing model should not be mistaken for an exact representation of historical reality.

Long-term digital preservation also requires more than the creation of models or image collections. Metadata, consistent terminology, provenance, version control, suitable file formats, secure storage, interoperability, and continuing maintenance are essential to ensure that digital records remain accessible and intelligible. Without these provisions,

technologically advanced documentation may become unusable or unreliable over time.

Digital records can also strengthen preparedness and recovery in situations involving environmental hazards, conflict, neglect, or accidental damage. Nevertheless, digital surrogates cannot replace the material original, the lived practice, or the community relationships that give religious heritage its meaning. Their greatest value lies in supporting the care, interpretation, and transmission of the heritage they represent.



Figure 3: Parthenon Temple Dedicated to Athena, Greece. Religion is a fundamental dimension of cultural heritage, giving sacred places their meaning, identity, and continuity. The Parthenon, originally dedicated to Athena, illustrates how religious belief shaped architecture, sculpture, spatial organization, and artistic expression. Its enduring significance extends beyond its physical remains, preserving the spiritual, cultural, and intellectual values of ancient Greek civilization. Thus, conserving religious heritage means safeguarding not only monuments, but also the beliefs, memories, traditions, and identities embodied within them.

Heritage Informatics, Artificial Intelligence, and Knowledge Access

Heritage Informatics provides an interdisciplinary framework for bringing information science, conservation, archaeology, architectural history, museology, computer science, and community knowledge into a shared field of investigation. It addresses not only the creation of digital records but also their organization, interpretation, integration, retrieval, preservation, and responsible dissemination.

Artificial intelligence (AI) and machine learning are creating new opportunities for heritage research. Depending on the available data and the specific research question, these technologies can assist with image analysis, pattern recognition, transcription, translation, classification, and the identification of relationships across large collections. They can also support the analysis of architectural features, inscriptions, historical documents, sound recordings, and other forms of cultural evidence.

Knowledge organization is equally important. Controlled vocabularies, ontologies, linked data, multilingual search systems, and interoperable databases can connect information that is otherwise dispersed across institutions, languages, collections, and geographical locations. These approaches improve discoverability and enable researchers to investigate relationships among buildings, objects, historical events, religious practices, and cultural communities.

However, digital systems and automated analytical tools are not neutral or infallible. Errors, incomplete datasets, algorithmic bias, uncertain attribution, and misleading reconstructions can distort the interpretation of culturally sensitive material. AI-generated descriptions or classifications may overlook local terminology, contested histories, minority traditions, and the contextual knowledge of custodians and practitioners. Human expertise, source verification, and cultural consultation must therefore remain integral to heritage research.

The purpose of Heritage Informatics is not simply to introduce new technologies, but to develop reliable knowledge infrastructures that serve research, conservation, education, and society. Technological innovation is most effective when it complements disciplinary expertise and makes heritage information more accurate, accessible, interoperable, and sustainable.

Responsible Valorization, Community Participation, and Sustainability

Valorization refers to the process of enabling heritage to be understood, appreciated, and

responsibly sustained. It encompasses research, interpretation, education, public engagement, and the transmission of cultural knowledge. It should not be equated solely with commercial exploitation, increased visitor numbers, or tourism development.

Religious heritage may possess profound spiritual significance for the communities that use, care for, or identify with it. Some spaces, objects, images, texts, and practices may be sacred, private, restricted, or subject to particular cultural protocols. Documentation and dissemination must therefore respect the wishes of religious custodians and communities, as well as privacy, copyright and other rights, and the potential risks associated with disclosing sensitive information.

The publication of precise locations, detailed images, or descriptions of vulnerable objects and sites may, in certain circumstances, expose them to theft, vandalism, or other forms of harm. Decisions concerning access should be proportionate to the purpose of documentation and informed by consultation with those responsible for the heritage. Community participation is not merely an additional consideration; it is an essential component of responsible interpretation and sustainable conservation.

At the same time, appropriately designed educational resources, accessible publications, digital exhibitions, cultural routes, and carefully managed tourism can broaden public understanding and encourage appreciation of religious heritage. Digital technologies may help people engage with sites that are geographically distant or difficult to access, while multilingual resources can make heritage knowledge available to wider audiences.

Religious heritage faces increasing pressures from climate change, extreme weather, pollution, urban development, neglect, conflict, mass tourism, and changes in religious practice. Responding to these challenges requires systematic risk assessment, regular monitoring, preventive maintenance, emergency planning, and cooperation among heritage professionals, custodians, public authorities, and local communities.

Digital documentation can support risk management, preparedness, and recovery, but it cannot replace sustained care of the original asset or the living traditions associated with it. Sustainable valorization must therefore balance technological opportunity with conservation priorities, cultural rights, community needs, and the responsibility to transmit heritage to future generations.

The Contributions in This Issue

The studies included in this issue of Informatics Studies approach religious and related cultural heritage from complementary geographical, historical, and methodological perspectives. The studies draw on cases and contexts associated with Belgium, Canada, Denmark, Greece, India, Italy, Spain, and the United States, while also engaging with heritage in other countries, including Sri Lanka and Lebanon. Collectively, they demonstrate the breadth of contemporary research at the intersection of religious heritage, cultural documentation, scientific investigation, and informatics.

Carmen Rodríguez Márquez and Martín Gómez-Ullate García de León examine the saeta in Cáceres as a living religious-musical practice. Their work highlights the importance of historical and ethnographic evidence and cultural mapping in documenting an intangible tradition. It illustrates how religious heritage extends beyond physical monuments to include performance, memory, and community participation.

Francesco Mariano investigates cultural coverage gaps in general-purpose audio models in relation to live religious radio. This contribution raises important questions about the recognition of religious sound within computational systems and the limitations of automated audio classification. It also draws attention to the need for culturally informed approaches to the analysis of religious audio material.

Despoina Lampada and co-authors explore the digital documentation and virtual-reality-based valorization of the post-Byzantine Monastery of Profitis Ilias at Zeli. Their study demonstrates the potential of digital representation to support the documentation,

interpretation, and communication of religious architectural heritage.

Luigi De Marchi addresses the conservation and verification of digital religious-heritage records at scale, emphasizing the importance of reliable information and correction processes. His contribution draws attention to the continuing responsibility to maintain the integrity and trustworthiness of digital heritage resources.

Antoine Dib focuses on the architectural heritage of medieval madrasas in Tripoli, connecting digital documentation with conservation. His contribution highlights the value of informatics-based approaches to recording and interpreting historic religious and educational structures.

Vinay Kumar and co-authors investigate the adaptive continuity of Buddhist Dhamma in India and Sri Lanka through archaeological, historical, and semiotic approaches. Their study demonstrates how religious heritage can be examined through the relationships among material evidence, historical development, signs, and cultural transmission across geographical contexts.

Liz A. Kennedy examines the relationship between Internet tools, creativity, faith-based arts, and the preservation of intangible heritage. This study broadens the discussion of digital heritage beyond architectural documentation to consider the role of networked technologies in sustaining and communicating creative and religious practices.

Jose Tom Rapheal explores how informatics can contribute to the documentation and sustainable interpretation of open-air prehistoric landscapes. His work extends the discussion beyond built religious structures to landscapes whose archaeological and cultural significance requires integrated recording and interpretation.

Annik Meulemans examines digital epigraphy and the multisensory Gothic archive through stone, light, and sound. This contribution draws attention to the multiple forms of evidence through which historic architecture and its associated cultural meanings can be documented and interpreted.



Figure 3: LUCCA-Church San Cristoforo: San Cristoforo in Lucca, dating from the 11th–12th centuries, is an important example of medieval Romanesque religious architecture, reflecting the city's artistic, spiritual, and urban heritage. Its historic fabric, architectural details, and continuing association with religious life embody the cultural memory and identity of medieval Lucca (Photograph by Olimpia Niglio, May 2023)

Together, these studies demonstrate that religious and related cultural heritage requires approaches extending across architecture, archaeology, music, sound, texts, inscriptions, digital systems, and living cultural practices. They also illustrate the importance of selecting methods appropriate to the particular research question and cultural context, rather than assuming that a single technological solution can address every heritage challenge.

A Shared Direction for Research and Practice

Taken together, the contributions to this volume encourage a critical and interdisciplinary approach in which diagnostic knowledge, systematic documentation, reliable information systems, and responsible valorization reinforce one another. They also show that the boundaries between tangible

and intangible heritage are often interconnected and overlapping. A monument may be inseparable from its chants and ceremonies; an archive may preserve the history of a community's devotional life; and a digital model may clarify the form and development of a site while raising questions about interpretation, authenticity, access, and representation.

The central challenge is to use technological innovation without losing sight of historical evidence, cultural context, spiritual significance, and the human relationships that make heritage meaningful. Diagnostics must inform appropriate conservation decisions; documentation must preserve reliable evidence; informatics must make knowledge discoverable and sustainable; and valorization must encourage understanding and participation while respecting cultural and religious values.

These objectives require sustained collaboration among researchers, conservators, information professionals, architects, archaeologists, heritage institutions, religious custodians, and local communities. Interdisciplinary research is most productive when different forms of expertise are brought together from the beginning, enabling technological methods to respond to genuine conservation and knowledge needs.

We hope the papers included in this issue will contribute to further dialogue among these communities and stimulate new research at the intersection of religious cultural heritage and informatics. By bringing diverse case studies and methodologies into conversation, we seek to strengthen the documentation, conservation, interpretation, and transmission of religious heritage. Ultimately, responsible valorization depends on combining scientific rigour and technological innovation with cultural sensitivity, community participation, and a long-term commitment to sustaining the material remains and living traditions of humanity's shared heritage for future generations.

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Cover Image:

Lucca. 18th-century Bishop's Chapel, Archibishopric of Lucca. Residential house of archbishop. Project of the liturgical adaptation by Mgr. Paolo Giulietti and Olimpia Niglio. In this both altars are present - the old and the new - offering an example of dialogue between the old and the new in



the restoration of religious heritage. (Photo by: Olimpia Niglio, October 2026)