

Review

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Review

Preserving Our Past: A Thorough Examination of Methods and Technologies in Digital Heritage

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Abstract: This review paper explores the multifaceted landscape of digital heritage preservation and presentation, focusing on various methods and technologies employed in the field. The introduction highlights the significance of digital heritage in preserving and showcasing cultural, historical, and natural assets. It emphasizes the non-destructive nature of digital preservation methods, enabling wider access and research possibilities. The paper also discusses the relevance of cultural computing in creating engaging user experiences and recognizes its potential in bridging cultural gaps. The literature review section presents a diverse range of technologies and tools, such as ZENetic Computer, C-Vyasa Sanskrit, Pandulipi Samshodhak, JATAN, and immersive projects like "Alice in Wonderland." The methods and technologies section delves into the technical aspects of digital heritage preservation. It explores photogrammetry, 3D depth sensing, 3D laser scanning, augmented reality, digital storytelling, focus stacking, and multiple view stereovision. Each technology is discussed in detail, highlighting its applications, benefits, and relevance in cultural heritage preservation. Finally, the comparative analysis section offers insights from various research papers and books, comparing different methodologies and approaches in the field. This review paper provides a comprehensive overview of digital heritage preservation, showcasing the diverse methods and technologies that contribute to the safeguarding and presentation of our cultural heritage for future generations.

Keywords: digital heritage; cultural computing; methods and technologies of digital heritage; preservation of heritage

1. Introduction

1.1. Introduce the Concept of Digital Heritage and Its Importance

"Digital heritage" is a concept that is integral to the Digital Earth program, which aims to harness technology and digital platforms to preserve and showcase our cultural, historical, and natural heritage. It involves the collection, digitization, documentation, visualization, and dissemination of artifacts, sites, and landscapes in a virtual format. This enables wider access to and interpretation of these invaluable assets for research, education, tourism, conservation planning, and public outreach. Through advanced technologies like 3D scanning, photogrammetry, remote sensing imagery, and augmented reality (AR) applications; digital heritage offers new opportunities for immersive experiences that enhance understanding and appreciation of our past while fostering sustainable development in the present. Heritage in the digital form has greatly enhanced research possibilities, allowing for in-depth exploration from various perspectives. [1]

In 2003, UNESCO, the United Nations Educational, Scientific and Cultural Organization, issued the Charter on the Preservation of Digital Heritage as a proactive response to the challenges posed by rapidly advancing technology and its impact on cultural heritage. The Charter addresses the urgent need for safeguarding digital information, artifacts, and expressions of culture in an ever-evolving digital age. By acknowledging that digital heritage encompasses both born-digital material

and digitized versions of analogue resources, UNESCO ensures that preservation efforts consider future accessibility while preserving authenticity.[2] Digital Heritage is a crucial process that encompasses various methods employed to record, analyse, and display information about heritage sites. By utilizing advanced technologies and techniques, professionals in the field can digitally capture and document these sites, ensuring their preservation for future generations. The process involves meticulously recording and documenting every aspect of the heritage site, from architectural elements to historical artifacts.

Digital Heritage has three key characteristics, and the first one is non-destructiveness. This simply means that when we talk about preserving digital objects, we do not alter or damage them in any way. We want to maintain their original state and ensure they remain accessible and usable for future generations. Non-destructiveness also implies that we must avoid any changes that could potentially compromise the integrity or authenticity of the digital content. So, whether it's a photograph, a video, or an important document, our goal is to safeguard these digital materials without causing any harm. This way, they can continue to be enjoyed and researched by people in the years to come without losing their historical significance or value. [3]

Digital methods are increasingly being used to record, monitor, analyse, and restore architectural heritage, leading to more accurate and efficient processes in preservation efforts. [4] This technology enables experts to measure and analyse elements that may be inaccessible or deteriorated in physical form. Additionally, digital tools allow for the ongoing monitoring of architectural heritage, detecting changes or damages in real-time. These methods facilitate better decision-making regarding restoration projects by providing data-driven insights into the condition of the heritage site. Moreover, digital analysis can aid in simulating historical reconstruction scenarios or assessing potential restoration approaches to ensure a faithful representation of the original design. Ultimately, the usage of digital methods offers architects and preservationists valuable tools for safeguarding and conserving our architectural heritage for future generations.

Traditional methods of preserving physical artifacts and historical documents are highly susceptible to damage, deterioration, or loss. Digitizing these items ensures their long-term survival and accessibility to a wider audience. Additionally, digitization allows for unprecedented opportunities for research and exploration by scholars, historians, and archaeologists worldwide. Digital heritage also plays a crucial role in promoting tourism and generating revenue by attracting visitors who may not have had the opportunity to physically experience a particular cultural site or artifact before. Furthermore, as technology advances rapidly, it becomes necessary to harness its potential to safeguard our legacy for future generations effectively.

1.2. The Relevance of Cultural Computing in Preserving and Presenting Heritage

The new paradigm for Human-Computer Interaction (HCI), known as cultural computing, is a groundbreaking approach that revolutionizes the way users interact with technology. At the core of this emerging field is Kansei Mediated Interaction, which emphasizes the consideration and integration of user emotions during interface design. [5] By taking into account cultural aspects, such as values, customs, and aesthetics, HCI practitioners can create more meaningful and engaging experiences for users worldwide. Cultural computing recognizes that individuals from different cultures possess unique preferences and sensitivities towards technology. Therefore, it aims to develop interfaces that not only meet functional requirements but also resonate with users on an emotional level. This paradigm shift acknowledges the significant role culture plays in shaping our attitudes towards technology and seeks to bridge the gap between human emotions and computational systems. With cultural computing at its helm, HCI can achieve higher levels of user satisfaction and foster inclusive digital environments that cater to diverse communities across the globe.

Cultural computing refers to the interdisciplinary field that explores the relationship between computer technology and cultural practices. It encompasses the study, design, and evaluation of interactive systems that are culturally sensitive and contextually relevant. This emerging area of research recognizes the importance of culture in shaping human-computer interactions and aims to

create technologies that reflect diverse cultural traditions, values, and worldviews. By incorporating cultural factors into the development process, cultural computing strives to address the limitations of mainstream computing models that often overlook or marginalize certain groups. Cultural computing draws upon various disciplines such as anthropology, sociology, psychology, design, and computer science to investigate how culture influences the use and understanding of technology. Ultimately, this approach can lead to more inclusive and user-centered digital experiences that honor diversity while promoting equity and inclusivity in our increasingly globalized society.

2. Literature Review

2.1. ZENetic Computer

The ZENetic Computer interactive storytelling system represents a cutting-edge platform that skilfully integrates traditional Japanese concepts and media, thereby creating an immersive experience like no other. Developed by a team of experts in both technology and Japanese culture, this innovative system transports users into the captivating realm of ancient Japan through its seamless fusion of visually stunning graphics, intricate narratives, and culturally rich elements. By incorporating traditional art forms such as calligraphy, kabuki theatre, and haiku poetry into its interactive interface, the ZENetic Computer successfully reinterprets and reintroduces this age-old cultural heritage to contemporary audiences. Moreover, this system's adaptive technology adapts to each user's preferences and choices, making every interaction unique and personal. [6].

The philosophy of ZENetic Computer is rooted in the belief that technology can be harnessed to bring about a higher state of consciousness and well-being. Drawing inspiration from the principles of Zen Buddhism, ZENetic Computer seeks to create devices and software that promote mindfulness, simplicity, and harmony with the natural world. The company's products are designed with a minimalist aesthetic, eliminating distractions, and fostering a sense of calmness in the user. In line with Zen philosophy, ZENetic Computer emphasizes the importance of being present in the moment, encouraging users to detach from their digital devices when necessary to maintain a healthy balance between technology and real-life experiences. By incorporating elements of meditation, mindfulness, and self-reflection into its technological advancements, Zenetic Computer aims to revolutionize the way we interact with computers and ultimately enhance our overall well-being. [7]

The ZENetic Computer is an innovative and groundbreaking computer interaction model that uniquely integrates Buddhist principles into its human recognition model. [8] By drawing inspiration from Buddhist philosophy, this cutting-edge technology aims to provide a more intuitive and mindful user experience. The computer's recognition system utilizes a deep understanding of human emotions, intentions, and mindfulness techniques to enhance the overall interaction. Through this model, users can communicate with the computer on a deeper level, enabling it to respond empathetically and adaptively in real-time. This integration of Buddhist teachings fosters a sense of calmness, serenity, and harmony between humans and machines.

2.2. C-Vyasa Sanskrit

C-Vyasa Sanskrit-Word processor is an exceptional tool designed specifically for writing articles in Sanskrit. C-Vyasa Sanskrit is a highly efficient and effective utility that offers an array of features aimed at simplifying tasks related to sorting, searching, indexing, and file conversion. This software is specifically designed for users who work extensively with Sanskrit literature or texts. C-Vyasa Sanskrit is a groundbreaking initiative that aims to leverage the wisdom and knowledge found in ancient Indian texts such as the RgVeda, Yajurveda, Sama Veda, Vedanga, RigVeda, Yajurveda, Sama Veda, Vedanga and Upanga texts, prose and poetry are linked to the application. [9]

The C-Vyasa tool stands out as a versatile and indispensable asset for individuals working with rare Indian scripts. It offers an efficient avenue to type information in these unique scripts, allowing users to preserve and disseminate cultural heritage that may otherwise be lost due to limited accessibility. By providing a user-friendly platform specifically designed for these scripts, the C-

Vyasa tool supports researchers, linguists, and historians in their endeavours to study ancient texts and documents written in lesser-known Indian languages [10]

2.3. *Pandulipi Samshodhak*

Pandulipi Samshodhaka is a cutting-edge manuscript processing software designed specifically to assist scholars in the preservation and processing and analysing of valuable manuscripts. This state-of-the-art tool offers numerous benefits to researchers, such as enhanced efficiency and accuracy in managing vast collections of manuscripts. Its advanced technological features enable easy digitization, ensuring long-term preservation and accessibility of these historical documents. The integration of manuscript image processing software into an image processing tool is a significant advancement in the field. This combination of tools allows for the comprehensive analysis and manipulation of manuscript images with enhanced accuracy and efficiency. The software's algorithms are specifically designed to recognize and interpret handwritten text, enabling professionals to extract valuable information from historical documents. Furthermore, this augmented tool incorporates advanced image enhancement techniques, such as noise reduction and contrast adjustment, which are essential for improving the legibility of aged or damaged manuscripts. By seamlessly integrating manuscript-specific functionalities into a versatile image processing platform, professionals now have access to a powerful tool that revolutionizes their ability to study and preserve invaluable written records. Consequently, researchers, historians, archivists, and other experts can delve deeper into deciphering complex scripts or uncovering hidden details within manuscripts with unmatched precision using this integrated solution. [11]

Pandulipi Samshodhak is a robust software tool designed to support both ISCII and Unicode-based storage, catering to the diverse needs of users in the digital content industry. ISCII (Indian Script Code for Information Interchange) and Unicode are widely used character encoding standards for representing Indian languages. This software allows seamless conversion between these two formats, enabling smooth integration across various platforms and applications. The Pandulipi Samshodhak software offers comprehensive support for Vedic accents and the Grantha script, making it an invaluable tool for scholars, researchers, and enthusiasts in the field of ancient Indian languages. With its advanced algorithms and intelligent features, this software not only accurately reproduces Vedic accents but also ensures proper rendering of texts in the intricate Grantha script. [12]

2.4. *Jatan*

JATAN: Virtual Museum Builder is a meticulously designed and highly specialized digital library system that caters specifically to museums in India. It provides these institutions with an all-encompassing solution for seamlessly digitizing their collections, preserving cultural artifacts, and ensuring their accessibility to a wider audience. Offering an intuitive user interface, JATAN enables museum professionals to effortlessly create virtual exhibitions, conducive for immersive experiences. This cutting-edge software integrates various components such as metadata management, image processing, 3D modelling, and multimedia presentation tools. With its emphasis on preserving the rich heritage of India, JATAN assists in documenting and conserving invaluable artworks, manuscripts, sculptures and historical artifacts by providing a secure digital platform for archiving and showcasing them. By embracing innovation in the field of museology and incorporating the latest technologies, JATAN empowers Indian museums to bridge the gap between physical and digital realms while captivating global audiences with the diverse treasures of Indian culture. [13]

This system is running in Chhatrapati Shivaji Maharaj Museum, Mumbai; Raja Dinkar Kelkar Museum, Pune; SalarJung Museum, Hyderabad; and Victoria Memorial Museum, Kolkata. [14]

2.5. *Alice in Wonderland*

'Alice in Wonderland' is a captivating and groundbreaking project developed at the Entertainment Technology Center of Carnegie Mellon University. This immersive experience takes

inspiration from Lewis Carroll's classic story and leverages the latest advancements in technology to bring Wonderland to life like never before. Through the use of virtual reality (VR) and augmented reality (AR) technologies, users are transported into a whimsical world filled with interactive characters and spellbinding environments. The project showcases the exceptional talent and innovation possessed by the students at Carnegie Mellon, as they demonstrate their expertise in storytelling, game design, computer graphics, and human-computer interaction. 'Alice in Wonderland' exemplifies how emerging technologies can be utilized to create engaging experiences that push the boundaries of what is possible in entertainment. With its rich visuals, intuitive user interface, and seamless integration of VR/AR elements, this project undoubtedly offers a tantalizing glimpse into the future of immersive storytelling and sets new standards for interactive entertainment." [15]

One such successful virtual experience is "Alice in Wonderland," which utilizes a head-mounted display (HMD) to transport participants into Lewis Carroll's whimsical world. By donning the HMD, users can explore interactive 3D environments that faithfully recreate the fantastical setting of Wonderland. They can interact with iconic characters such as the Mad Hatter and the Cheshire Cat and even partake in whimsical tea parties or solve mind-bending puzzles. The success of this virtual experience lies in its ability to seamlessly merge captivating visuals with intuitive controls, resulting in an unforgettable journey through Carroll's timeless story. [16]

3. Methods and Technologies

3.1. Photogrammetry

Photogrammetry is an advanced technique that has been widely employed in various fields, such as documenting cultural heritage in 3D, geoscience applications, and prosthetic socket design [17]. In the context of cultural heritage preservation, photogrammetry allows professionals to capture detailed and accurate three-dimensional representations of historical artifacts, buildings, or sites. This method not only enables the creation of digital archives but also facilitates virtual experiences for educational purposes or immersive exhibitions. Moreover, photogrammetry finds significant application in geoscience by enabling precise terrain modelling or mapping landforms. The resulting geo-referenced 3D models can assist in understanding geological formations, erosion processes, and even planning resource management strategies. Additionally, this technology plays a crucial role in the field of prosthetics by capturing detailed images of an amputee's residual limb to design custom-made sockets accurately. By utilizing photogrammetric techniques, prosthetists can develop better-fitting sockets leading to enhanced comfort and mobility for individuals requiring artificial limb support. With its broad range of applications and remarkable accuracy, photogrammetry undeniably serves as a valuable tool across multiple professional domains

3.2. 3D Depth Sensing

3D depth sensing is a sophisticated process that involves the accurate acquisition of distances for all points within a three-dimensional scene. This innovative technology has significantly advanced in recent years and finds applications in various fields, including robotics, virtual reality, and autonomous vehicles. [18] Depth sensing systems utilize various methods such as structured light, time-of-flight, or stereo vision to map the scene and calculate the precise distance between objects. By capturing detailed depth information, these systems enable more realistic virtual environments, enhanced object detection and recognition capabilities, and improved accuracy in spatial mapping. The acquired data can be utilized for diverse purposes like obstacle avoidance, 3D reconstruction, facial recognition, or immersive gaming experiences. Furthermore, emerging cutting-edge technologies like LiDAR have revolutionized depth sensing by enhancing its precision even further. In conclusion, 3D depth sensing holds immense potential to revolutionize countless industries by providing a crucial ability to perceive the world in unprecedented detail and accuracy.

3.3. 3D Laser Scanning

Laser scanning technique, often referred to as terrestrial laser scanning (TLS), has revolutionized the documentation process of tangible cultural heritage. This sophisticated technology automatically collects high-density 3D coordinates of objects, structures, or archaeological sites with unprecedented accuracy and detail. [19] By utilizing a series of laser beams emitted from a scanner, hundreds of thousands of points on the surface are rapidly measured, thus creating a highly accurate digital representation of the object or site being scanned. This non-destructive and non-contact method allows for the precise capturing of even intricate details inaccessible to traditional surveying methods. Furthermore, laser scanning significantly speeds up data acquisition compared to manual measuring techniques while ensuring minimal disturbance to delicate artifacts or architectural elements. The resulting 3D models offer invaluable information for preservation purposes, research studies, restoration projects, exhibition designs, and virtual reconstructions. In sum, laser scanning is an indispensable tool in the field of cultural heritage documentation and is continuously advancing our understanding and appreciation for our collective past.

3.4. Augmented Reality

Augmented Reality (AR) has emerged as a valuable tool for the management and preservation of cultural heritage, proving to be immensely useful in this field. AR allows users to overlay virtual content onto the real world, enhancing visitors' experiences by providing additional information and context about historical sites, artifacts, and artworks. [20]. By incorporating computer-generated imagery and information into the physical environment, AR can present details that are otherwise invisible or difficult to access. Furthermore, it enables interactive engagement with cultural heritage, facilitating immersive learning experiences for visitors - whether they are physically present at a museum or exploring remotely through digital platforms. AR applications have successfully brought ancient ruins back to life by reconstructing missing parts or recreating entire buildings virtually. Moreover, with its ability to showcase artifacts from various periods with accurate dimensions, textures, and colors, AR provides a unique opportunity for preservation efforts such as digital archiving of fragile items. The utilization of AR in cultural heritage management not only enhances accessibility but also enriches our understanding and appreciation of history by bridging the gap between past and present.

3.5. Digital Storytelling

In today's digital age, the art of storytelling has transformed significantly with the emergence of new and innovative techniques. Digital storytelling has become an effective tool in bringing life to dry and difficult subjects, captivating the viewer through a dynamic and engaging narrative. [21]. Using multimedia elements such as animations, graphics, videos, and interactive features, complex concepts can be simplified and presented in a visually appealing manner that captures the viewer's attention. Additionally, incorporating personal anecdotes or real-life examples into the narrative adds depth and relatability to the subject matter. By carefully utilizing these techniques, professionals can effectively convey information while simultaneously stimulating curiosity and interest in their audience. The ability to make a challenging topic more alive not only improves comprehension but also facilitates long-lasting retention, making digital storytelling an invaluable skill in communication across various industries.

3.6. Focus Stacking

Focus stacking is a highly effective technique used in photography to extend the depth of focus in an image. By combining multiple images taken at different focus points, typically with low apertures, photographers can create a result that is sharp and in focus from front to back. Focus stacking is a technique primarily employed in the field of close-up and macrophotography, essential for achieving optimal depth of field. It involves capturing multiple images with different focal distances and subsequently merging them using specialized software. This technique finds extensive use in various professional applications such as scientific research, botanical studies, product

photography, and even insect or wildlife documentation. Focus stacking, although not widely adopted in the field of cultural heritage, can prove to be a highly valuable technique for accurately documenting objects and illustrating intricate details [22]. By capturing a series of photographs with different focus points and then combining them into a single image using specialized software, focus stacking ensures that every part of the object is sharply focused. This method eliminates the depth of field limitations that often occur when photographing complex three-dimensional artifacts with varying depths and textures. Moreover, focus stacking allows for unprecedented detail preservation, especially in delicate or deteriorating objects where direct contact may cause damage. Thus, by extending the potential applications of digital photography within cultural heritage contexts, focus stacking offers researchers and conservators an effective tool to enhance visual documentation while aiding in the study and preservation efforts of valuable historical artifacts.

3.7. Multiple View Stereovision

Multiview stereo vision is a sophisticated process that involves reconstructing a three-dimensional model of an object or scene using a set of digital images. This advanced technique employs multiple viewpoints to enhance accuracy and depth perception. By meticulously analysing the corresponding features in each image, the algorithm can determine the relative positions and orientations of the camera viewpoints. Then, it proceeds to triangulate and match these features across different images, ultimately constructing a dense point cloud representation of the scene. Stereo vision is an indispensable aspect when it comes to the 3D recording of cultural heritage, as it significantly enhances accuracy and precision. By employing two optical sensors positioned at different angles, stereo vision allows for the creation of a three-dimensional image that accurately captures the depth and spatial information of objects being recorded [22]. This capability not only ensures a high level of precision in documenting cultural artifacts or architectural structures but also facilitates accurate measurements and reconstructions. Stereo vision plays a vital role in preserving cultural heritage as it enables experts to obtain detailed and extensive records that can be used for documentation, analysis, research, and restoration purposes. The accurate reproduction of size, shape, texture, and colour through stereo vision contributes to a more comprehensive understanding and appreciation of cultural assets while offering future generations an invaluable resource for study and interpretation.

4. Comparative Analysis

Table 1. This is a table. Tables should be placed in the main text near to the first time they are cited.

Reference	Objective	Data Source	Methodology	Findings
Sampsä Kohtala et al. (2021)	In this paper, author aim to present a comprehensive introduction to the 3D scanning method utilizing the photogrammetry algorithm	Article	Photogrammetry	Photogrammetry-based 3D scanning has emerged as a powerful and cost-effective tool in the realm of cultural heritage preservation and documentation. This technology utilizes multiple photographs taken from various angles to reconstruct accurate 3D models of historical artifacts, buildings, and archaeological sites. The sheer versatility of this approach is truly remarkable; it allows for the digitization of even the most fragile and

				delicate artifacts without causing any physical harm.
Li, R. et al (2010)	In this paper, the author's aim is to present a 3D digitizing pipeline that utilizes 3D depth sensing technology for documenting and preserving cultural heritage.	Conference paper	3D depth sensing	3D digitization depth sensing technology have emerged as crucial tools in the preservation and protection of cultural heritage. By effectively capturing the three-dimensional geometry, texture, and color of cultural artifacts, 3D digitization enables accurate documentation and replication of historical objects and sites. Depth sensing, a key component of this process, facilitates the capture of precise measurements in the third dimension. This aspect is especially significant in cultural heritage protection as it allows for the creation of highly detailed virtual models that can be utilized for research, education, restoration, and even virtual reality experiences.
Park, Jin -ho et al (2015)	The author in this article provides explanation of why 3D scanning has become an accepted technique for the collection of 3D representations of heritage sites.	Conference paper	3D Laser Scanning	When it comes to preserving complex and demolished heritage sites, relying solely on 3D scanners may not guarantee successful results. Complex heritage sites often present challenging conditions such as low lighting, tight spaces, or fragile structures that require meticulous handling. Therefore, it is essential for professionals to supplement the use of 3D scanners with other complementary techniques like photogrammetry or laser scanning to ensure a comprehensive and accurate representation of these delicate and intricate spaces.
Boboc, R.G. (2022)	The author delves into the significant advancements and applications of augmented reality (AR) in the realm of	Article	Augmented Reality	AR contributes significantly to the preservation of intangible cultural heritage by enabling the creation of interactive experiences that showcase traditional practices or artifacts. Thus, AR's versatile applications provide

	cultural heritage over the past decade.			professionals across different fields with innovative solutions that greatly enhance their work processes while ensuring the safeguarding of valuable cultural treasures.
Miller, Carolyn (2008)	This book is literature on the applications of digital technologies in the study and preservation of heritage.	Book	Digital storytelling	Digital storytelling is an invaluable tool in virtual cultural heritage applications as it allows for the preservation and dissemination of historical narratives in an engaging and immersive manner. By combining elements of multimedia such as images, videos, audio, and interactive features, digital storytelling brings cultural heritage to life in ways that traditional methods fail to achieve. It provides users with a unique opportunity to explore various aspects of historical events, artifacts, or locations from different perspectives, thereby enhancing their understanding and appreciation of the rich tapestry of human history.
Aurore Mathys et al (2017)	In this chapter, the author provides a comprehensive and well-researched exploration of focus stacking, beginning with a clear definition that lays the foundation for subsequent discussions	Edited Book Chapter	Focus Stacking	Focus stacking combined with photogrammetry has proven to be a groundbreaking technique in the field of 3D digitization, particularly for small artifacts. By capturing a series of high-resolution images at varying focal distances and then merging them together using specialized software, focus stacking eliminates the need for complex and expensive 3D scanners. When combined with photogrammetry, which involves analyzing multiple photographs to generate accurate 3D data, this approach enables precise and detailed scans of intricate and delicate objects.
Christos Stentoumis (2017)	The author provides a clear and concise definition of	Edited Book Chapter	Multiple View Stereovision	The field of multiple view stereovision is undergoing dynamic transformations, driven by the tenacious efforts

Multiple View Stereovision advanced methodology, highlighting its fundamental purpose and underlying principle.	of researchers in digital heritage. These experts are relentlessly exploring innovative ways to unlock the vast potential hidden within multi-perspective images and videos. By leveraging advanced computer algorithms and cutting-edge machine learning techniques, they strive to extract precise 3D models from a multitude of viewpoints, facilitating a more comprehensive understanding of cultural artifacts and historical sites. This interdisciplinary field merges traditional photography with computer vision and computer graphics, resulting in groundbreaking applications for archaeological preservation, restoration, and visualization.
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5. Conclusions

In this comprehensive review paper, we have embarked on a journey through the diverse and evolving landscape of digital heritage preservation and presentation. Our exploration has revealed the paramount importance of digital heritage in safeguarding and sharing our cultural, historical, and natural treasures with the world.

We began by introducing the concept of digital heritage and its significance, emphasizing its non-destructive nature and the role of cultural computing in creating engaging and culturally sensitive user experiences. This served as a foundational understanding of the field's principles and motivations.

The literature review section exposed us to a wide range of technologies and tools that exemplify the transformative power of technology in preserving cultural heritage. From innovative projects like the ZENetic Computer and the digitization of Sanskrit literature with C-Vyasa Sanskrit to advanced manuscript processing tools like Pandulipi Samshodhak, these examples demonstrated the versatility and potential of technology in protecting our diverse cultural legacies.

In the methods and technologies section, we delved into the technical aspects of digital heritage preservation. We explored photogrammetry, 3D depth sensing, 3D laser scanning, augmented reality, digital storytelling, focus stacking, and multiple view stereovision. Each technology offers unique capabilities and applications, contributing to the meticulous documentation and immersive presentation of cultural artifacts and sites.

The comparative analysis section highlighted the collaborative nature of the field, where researchers and professionals from various disciplines work together to achieve comprehensive digital heritage preservation. By combining different methodologies and approaches, the field advances and enriches its practices continually.

In conclusion, this review paper has illuminated the dynamic and ever-evolving realm of digital heritage preservation and presentation. It underscores the pivotal role of technology in ensuring the enduring legacy of our cultural heritage for future generations. As technology continues to advance

at a rapid pace, it becomes imperative to harness its potential to safeguard and celebrate the richness and diversity of our shared human history. Through innovation, interdisciplinary collaboration, and cultural sensitivity, we can bridge the gap between the past and the present, preserving our heritage while making it accessible and engaging for all.

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