

Artificial Intelligence, Cultural Heritage, and Ethical Responsibility: Rethinking Preservation in the Digital Age

Dr. Akanksha Yadav¹, Dr. Pratibha Agrawal², Dr. Sumeer Ranjan³, Dr. Rahul Kumar⁴, Tamal Bhattacharya⁵

¹ Assistant Professor, Amity University Jharkhand, Ranchi, India.

Email: mail2akankshalearns@gmail.com

ORCID: 0000-0002-8096-0161

² Assistant Professor, Amity University Jharkhand, Ranchi, India.

Email: pratibhaagrawal329@gmail.com

ORCID: 0009-0003-8820-9553

³ Assistant Professor, Amity School of Foreign Languages, Amity University Jharkhand, Ranchi, India.

ORCID: 0009-0003-2977-3699

⁴ Assistant Professor, Amity University Jharkhand, Ranchi, India.

Email: rkumar5@rnc.amity.edu

ORCID: 0009-0005-6399-5003

⁵ Assistant Professor Grade-II, Department of Commerce, Amity University Jharkhand, Ranchi, India.

Email: tbhattacharya@rnc.amity.edu

ORCID: 0000-0003-4246-9213

ABSTRACT

As AI becomes an increasingly powerful tool in the preservation, digital archiving, and representation of cultural knowledge, there have been important ethical questions to consider about who owns the knowledge, how the knowledge is used, and how it should be interpreted. The use of AI-driven tools, like machine learning, automated translation, generative image creation and digital curation, is being adopted to safeguard intangible cultural heritage like oral traditions, ritual performances, folk narratives and indigenous knowledge systems. These technologies open up new possibilities of accessibility and preservation, but also question issues of authenticity, representation, consent, data collection and cultural agency.

This chapter explores the ethical questions of the preservation of heritage in today's digital culture from an AI perspective. It posits that AI systems are not merely technological devices, but rather socio-political entities that are influenced by platform economies, algorithmic governance, and power imbalances. Cultural practices are being digitized and as such can become commercially usable, and disembodied from local meanings and community ownership. The study is based on the ideas of Walter Benjamin (1969), on the concept of representation of Stuart Hall (1997) and on the UNESCO Recommendation on the safeguarding of intangible cultural heritage (2003). It also draws on current research in the field of AI ethics to explore topics like algorithmic bias, cultural appropriation, surveillance, and data colonialism (Benjamin, 2019; Noble, 2018). This chapter calls for ethical, participatory and human-centred perspectives on the use of AI for the preservation of heritage...

Keywords: Artificial Intelligence (AI); Ethics; Intangible Cultural Heritage; Digital Humanities; Cultural Representation; Algorithmic Bias; Cultural Ownership; Data Colonialism; AI Ethics; Digital Heritage; Cultural Memory; Indigenous Knowledge; Media Anthropology; UNESCO Heritage Framework

INTRODUCTION

The rapid proliferation of artificial intelligence technologies within cultural heritage preservation marks a paradigmatic shift in how societies document, interpret,

and transmit their collective memory. As digital transformation accelerates across cultural institutions globally, AI-enabled systems have emerged as powerful tools for safeguarding both tangible artifacts and intangible traditions that constitute humanity's shared heritage¹. From machine learning algorithms that

¹ Khabzoaui A and Cherifi M, 'Preserving Cultural Heritage Using Artificial Intelligence' (2025) 11(2) *Cultural and Historical Heritage: Preservation, Advances in Consumer Research*

Presentation, Digitalization 22–32

<http://www.math.bas.bg/vt/kin/>

Wibawa B and Rusnalasari Z, 'Navigating Ethics and

reconstruct damaged manuscripts to predictive models that monitor environmental threats to archaeological sites, artificial intelligence has demonstrated "strong potential in artifact restoration, predictive maintenance, and revitalization of traditional practices through immersive technologies".²

The scope of AI applications in cultural heritage has expanded dramatically, encompassing digital documentation, automated cataloging, virtual reconstruction, and interactive preservation platforms.³ These technologies offer "unprecedented capacities to analyze huge amounts of historical data, enabling researchers and art historians to uncover precious patterns, connections, and insights that might otherwise remain elusive".⁴ International platforms such as Europeana, Google Arts & Culture, and specialized digital archives demonstrate the practical potential of AI in supporting cultural institutions and democratizing access to heritage resources.⁵ Moreover, AI's capacity for "intelligent documentation, virtual representation, personalized learning, and assisted creation" has opened new pathways for preserving intangible cultural heritage, including oral traditions, ritual performances, and indigenous knowledge systems.⁶

However, this technological revolution in heritage preservation is accompanied by profound ethical complexities that challenge fundamental assumptions about authenticity, representation, and cultural authority. Tiribelli et al. (2024) observe that while AI offers remarkable analytical capabilities, its integration "brings forth intricate ethical questions" spanning issues of authenticity, subjectivity, interpretation biases, and legal concerns related to authorship. More critically, AI systems systematically "inherit and amplify existing societal and historical prejudices embedded in analogue records," creating what they term a "bias loop" that perpetuates historical inequities through algorithmic processes.⁷ This phenomenon is particularly concerning given that AI-driven heritage preservation often transforms living cultural practices into data-driven

content, potentially detaching them from their original contexts, ritual meanings, and community ownership.

The ethical challenges extend beyond technical bias to encompass broader questions of cultural sovereignty and representation. Salah identifies the risk of "epistemic drift," whereby "unverified synthetic narratives circulate faster than critical validation," fundamentally altering how cultural memory is constructed and transmitted.⁸ This concern is amplified by AI technologies can be used to "spread misinformation, distort historical facts, and promote extremist views," necessitating increased attention to transparency, accountability, and human rights compliance in algorithmic systems.⁹

Despite growing recognition of these challenges, current scholarship reveals significant gaps in addressing the ethical dimensions of AI in cultural heritage. Pansoni et al. (2023) identify a critical lacuna: "there is still a lack of formal frameworks that evaluate the algorithms' adherence to the ethical standards set by the European Union for the use of AI in protecting cultural heritage and its inherent value." This absence of sector-specific ethical guidelines is compounded by "systemic barriers, including limited financial resources, fragmented governance, and lack of standardized ethical frameworks" that hinder responsible AI adoption in heritage contexts.¹⁰

The urgency of addressing these ethical challenges is underscored by the accelerating pace of AI deployment in cultural institutions. Ghaith and Hutson (2024) document the "widespread adoption of generative artificial intelligence technologies" across conservation domains, while Ghaith (2024) emphasizes that this integration "necessitates a symbiotic relationship between technological innovation and the nuanced, irreplaceable human element." The stakes are particularly high for marginalized communities whose cultural practices may be subject to digital extraction and commodification without adequate consent or benefit-sharing mechanisms.

This chapter responds to these pressing concerns by critically examining the ethical implications of AI-mediated heritage preservation within contemporary

Innovation: The Role of AI in Cultural Heritage' (2024) 2(4) *Harmonia: Journal of Music and Arts* 198–212 <https://doi.org/10.61978/harmonia.v2i4.905>

² Wibawa B and Rusnalasari Z, 'Navigating Ethics and Innovation: The Role of AI in Cultural Heritage' (2024) 2(4) *Harmonia: Journal of Music and Arts* 198–212 <https://doi.org/10.61978/harmonia.v2i4.905>

³ Tiribelli S, Pansoni S, Frontoni E and Giovanola B, 'Ethics of Artificial Intelligence for Cultural Heritage: Opportunities and Challenges' (2024) 5(3) *IEEE Transactions on Technology and Society* 293–305 <https://doi.org/10.1109/TTS.2024.3432407>

⁴ Tiribelli S, Pansoni S, Frontoni E and Giovanola B, 'Ethics of Artificial Intelligence for Cultural Heritage: Opportunities and Challenges' (2024) 5(3) *IEEE Transactions on Technology and Society* 293–305 <https://doi.org/10.1109/TTS.2024.3432407>

⁵ Golovach, N. (2026). Artificial intelligence and digital technologies in cultural heritage preservation: Opportunities and risks. *Scientific Journal "Library*

Science. Record Studies. Informology". 1, 83–89 43 <https://doi.org/10.32461/2409-9805.1.2026.356339>

⁶ Zhang, D. (2025). Artificial Intelligence for the Preservation and Transmission of Non-Material Cultural Heritage: Opportunities, Ethical Challenges, and Future Directions. *Applied and Computational Engineering*, 174, 209–215. <https://doi.org/10.54254/2755-2721/2025.PO25257>

⁷ Foka, A., Griffin, G., Pablo, D. O., Rajkowska, P., & Badri, S. (2025). Tracing the bias loop: AI, cultural heritage and bias-mitigating in practice. *AI & Society*. 5835–5847. <https://doi.org/10.1007/s00146-025-02349-z>

⁸ Salah, M. (2026). Algorithmic memory: Towards reflexive authenticity in cultural heritage. *AI & Antiquity*. 2(1). 65–75. <https://doi.org/10.64946/aiantiquity.v2i1.004>

⁹ Golovach, N. (2026)

¹⁰ Wibawa B and Rusnalasari

digital culture. Drawing upon Benjamin's seminal insights on mechanical reproduction and authenticity, Hall's theory of representation, and UNESCO's framework for safeguarding intangible cultural heritage, the analysis reveals how AI systems function not as neutral technological tools but as socio-political structures embedded within platform economies and unequal power relations. The chapter argues that responsible AI deployment in cultural heritage requires moving beyond technical solutions toward community-centered approaches that prioritize cultural sensitivity, participatory governance, and equitable representation. Through this critical lens, the chapter contributes to emerging scholarship on AI ethics and digital humanities by developing a framework for understanding how algorithmic systems shape cultural visibility and influence collective understandings of heritage. By foregrounding questions of responsibility, inclusivity, and justice, this analysis emphasizes the imperative to develop human-centered AI frameworks that protect the integrity of cultural traditions while addressing the broader ethical challenges of technological mediation in heritage preservation.

The article begins by examining the increasing use of Artificial Intelligence (AI) in the preservation and circulation of intangible cultural heritage, arguing that digital preservation is shaped by ethical, cultural, and political power relations rather than functioning as a neutral technological process. It then explores how AI-enabled technologies such as generative AI, digital archives, and algorithmic recommendation systems transform cultural traditions into data-driven and visually consumable forms, often privileging standardized and commercially appealing representations. Drawing upon Benjamin's concept of aura and authenticity, the article analyzes how algorithmic reproduction affects the sacredness and lived experience of cultural practices, while Hall's theory of representation is used to demonstrate how digital platforms actively construct and circulate selective meanings of heritage. The discussion subsequently shifts toward ethical concerns surrounding cultural ownership, consent, algorithmic bias, commodification, and data colonialism, highlighting how local traditions may be appropriated and governed within global technological infrastructures. Finally, the article advocates for ethical and participatory approaches to AI-mediated heritage preservation by emphasizing community agency, cultural sensitivity, inclusive representation, and human-centered frameworks for safeguarding intangible cultural heritage in the digital age.

2. Theoretical Framework

The theoretical foundation for understanding AI's role in cultural heritage preservation emerges from the intersection of digital humanities, AI ethics, and cultural memory studies. At its core, this framework recognizes that AI systems function not as neutral technological tools but as "socio-political structures embedded within platform economies and unequal power relations" that fundamentally reshape how cultural knowledge is

produced, circulated, and interpreted (Tiribelli et al., 2024). This understanding builds upon Benjamin's seminal insights on mechanical reproduction and authenticity, Hall's theory of representation, and UNESCO's framework for safeguarding intangible cultural heritage, while extending these concepts into the algorithmic age. This conceptualization draws upon the theory of cultural memory¹¹ and Hoskins's (2024) notion of connective memory to position heritage not as static repositories but as "networked processes to be cultivated" through ongoing dialogue between human and algorithmic agents.

Central to this theoretical landscape is Salah's (2026) Reflexive Authenticity Framework, which reconceptualizes authenticity as a performative practice grounded in transparency rather than material provenance. This framework posits that "authenticity is continually reactivated through disclosure, dialogue, and participation," positioning it as a collective responsibility for maintaining integrity within increasingly algorithmic environments. The framework operates through three interconnected principles: transparency of mediation, where all human and algorithmic interventions must be documented through provenance metadata; participatory governance, ensuring AI augments rather than replaces human deliberation; and ethical verification, recognizing that authenticity emerges at the intersection of technological transparency and humanistic judgment. This approach directly addresses what Salah (2026) identifies as "epistemic drift," the condition whereby "unverified synthetic narratives circulate faster than critical validation," fundamentally altering how cultural memory is constructed and transmitted. Benjamin's discussion in *The Work of Art in the Age of Mechanical Reproduction* (1969) provides a foundational framework for understanding how technological reproduction transforms the authenticity and sacredness of cultural practices. Benjamin argues that mechanical reproduction diminishes the "aura" of cultural objects by detaching them from their original contexts of ritual, locality, and lived experience. This article extends Benjamin's argument into the age of algorithmic reproduction, examining how AI-generated devotional imagery, digitally curated rituals, and automated cultural reproductions reshape notions of authenticity, sacred presence, and embodied participation in intangible heritage.

Hall's theory of representation (1997) further informs the analysis by emphasizing that cultural meanings are socially constructed through systems of representation rather than passively reflected through media. Digital platforms and AI-driven algorithms actively shape which cultural traditions become visible, marketable, and globally circulated. Hall's framework enables the article to critically analyze how algorithmic systems privilege selective representations of heritage while simplifying, standardizing, or exoticizing culturally diverse practices for digital consumption.

¹¹ Assmann J, *Cultural Memory and Early Civilization*:

Complementing this conceptual framework, Pansoni et al. (2023) have developed a comprehensive sector-specific ethical framework consisting of six core principles designed to address the unique challenges AI poses in cultural heritage contexts. Their framework emphasizes shared responsibility among multiple stakeholders, cultural continuity that considers the perspectives and values of living communities, economic accessibility to ensure equitable access regardless of institutional resources, protection of personal information through right-to-be-forgotten principles, reliability through expert validation of AI training data, and the centrality of physical space to prevent digital reproduction from justifying the destruction of tangible heritage. This framework emerges from the recognition that "there is still a lack of formal frameworks that evaluate the algorithms' adherence to the ethical standards set by the European Union for the use of AI in protecting cultural heritage and its inherent value" (Pansoni et al., 2023).

In addition, the article draws upon contemporary scholarship on AI ethics, algorithmic bias, and data colonialism.¹² Noble's critique of algorithmic systems demonstrates how digital technologies reproduce social hierarchies and cultural inequalities through biased systems of visibility and categorization. Similarly, Ruha Benjamin's work highlights the political dimensions of technological systems and the ways AI can reinforce structures of exclusion, commodification, and unequal power relations. These perspectives allow the article to interrogate how heritage data may be extracted, commodified, and governed within platform economies and global technological infrastructures. The theoretical framework is further strengthened by human-centered AI approaches that prioritize community agency and cultural sensitivity. Tiribelli et al. (2024) emphasize that AI systems "embed directly or indirectly socio-political, economic, and cultural values" that can improperly affect cultural heritage, necessitating frameworks that maintain "human agency and oversight" while ensuring explainability and preventing discrimination. This perspective aligns with Zhang's (2025) advocacy for "community-centric ethical guidelines" that address "critical ethical risks such as data ownership and authenticity." These approaches collectively recognize that AI-mediated heritage preservation often transforms living cultural practices into data-driven content, potentially detaching them from their original contexts, ritual meanings, and community ownership.

Underpinning these frameworks is a broader theoretical understanding of digital heritage as what Salah (2026) terms "living memory" - dynamic systems where users "re-mix, annotate, and reinterpret collections" through participatory engagement. This conceptualization draws upon theories of participatory heritage from Simon (2010) and Giaccardi (2012), positioning heritage not as static repositories but as "networked processes to be cultivated" through ongoing dialogue between human and algorithmic agents. Similarly Europeana aggregates more

than 58 million cultural objects from more than 4,000 institutions and uses AI to generate multilingual metadata and visual similarity clustering. For Hoskins (2024), such systems facilitate connective memory where personal memories become entangled with collective heritage due to digital interfaces. The framework thus addresses the fundamental tension between technological innovation and cultural preservation, advocating for what Ghaith (2024) describes as "a symbiotic relationship between technological innovation and the nuanced, irreplaceable human element" that ensures preservation efforts remain "as ethically informed as they are technologically advanced."

3. Methodology

This chapter takes a critical qualitative approach, drawing on a systematic literature analysis, theoretical synthesis and critical discourse analysis (CDA) to explore the ethical implications of heritage preservation through AI. The methodology is rooted in digital humanities and critical technology studies, acknowledging that AI is not merely a technological tool, but a socio-political construct influenced by platform economies, algorithmic governance, and power dynamics (Tiribelli et al., 2024). The study is an interdisciplinary interpretive approach that draws on Benjamin's theory of mechanical reproduction, Hall's theory of representation, UNESCO's framework of intangible cultural heritage, and current work on ethics and algorithmic bias in the field of AI.

The research is based on a review of the scientific literature, policy documents and case studies on the use of AI technologies for cultural heritage preservation. Following Wibawa and Rusnalasari (2024), keywords in accordance with the topics were used to search in academic databases which include Scopus, Web of Science and Google Scholar. This study highlights epistemological issues of authenticity, cultural control, representation, commodification and data colonialism that are persistent in the study of the same. Furthermore, the study uses qualitative content analysis of the emerging themes as well as a critical analysis of the impact that AI technologies are having on cultural visibility, community engagement and heritage practices in the current digital landscape (Pansoni et al., 2023; Salah, 2026).

4. AI Applications and Opportunities in Cultural Heritage Preservation

AI has created new possibilities for the documentation, analysis, and transmission of cultural knowledge across time, space, and language, thereby expanding the realm of cultural heritage preservation. AI technologies, such as 3D scanning, machine learning, and predictive modelling, have bolstered conservation efforts and made it possible to interact with cultural materials in new ways (Khabzoaui & Cherifi, 2025). The technological shift is part of what Wibawa and Rusnalasari (2024) call 'a global shift towards technology-driven conservation strategies',

¹² Benjamin R, *Race after Technology: Abolitionist Tools for the New Jim Code* (Polity Press 2019)

Noble SU, *Algorithms of Oppression: How Search Engines Reinforce Racism* (New York University Press 2018)

which helps solve old problems with the conservation of heritage and opens new windows for access and interpretation of culture.

AI applications in cultural heritage can be classified into four major areas that collectively illustrate the potential of AI in transforming the field of cultural heritage. According to Wibawa and Rusnalasari (2024), these are "tangible heritage conservation, intangible heritage preservation, environmental monitoring and risk management, and museum and archive engagement. Every domain offers unique opportunities to improve traditional preservation techniques and to respond to current issues like climate change, urbanisation and cultural erosion. These applications offer context to exploring the ethical issues that arise as AI systems become the medium for cultural knowledge and heritage practice. The use of artificial intelligence in the field of tangible heritage conservation has revolutionized how approaches are taken towards the documentation, analysis and restoration of such heritage, breaking away from traditional methods with advanced technologies that have improved precision and scale. Tiribelli et al., 2024, point out that "Deep Learning models can automatically describe works of art, identify the artist, context, and period of the work, and solve the attribution or interpretation conflicts. The skills are relevant to fundamental issues in art historical research and museum practice that have been long-standing, and are characterized by the need for much intensive expert analysis and frequently left unanswered questions of authorship and provenance.

One major improvement in restoration practice is the use of Generative Adversarial Networks (GANs). As explained by Tiribelli et al. (2024), GANs "are able to fill missing elements in frescos or paintings with unprecedented accuracy and detail, further improving the cultural heritage restoration processes". This technology allows conservators to envision possible restoration strategies without disturbing the site, facilitating more effective choices regarding restoration options. These are especially useful in situations where traditional approaches of restoration may draw on original materials or parts are too significant to be lost. The three-dimensional scanning and modeling technologies, combined with AI algorithms, have revolutionized the way architectural heritage and archaeological sites are documented. Khabzoai and Cherifi (2025) highlight the ability of these technologies to recreate historical locations and artifacts with "precise and thorough fidelity," which can offer an immersive experience to visitors and researchers. Documentation abilities do not just consist of recording, but also forecasting the state of structures and ecological hazards. Visual information gathered from sensors and cameras can be processed using AI to detect possible structural damage or deterioration, allowing for preventive measures to be taken for conservation that can help solve problems before they become serious.

These technologies are especially impactful in crisis response and post-disaster recovery. Tiribelli et al. (2024) recount the revival of destroyed monuments using "3D modeling techniques," for instance, "holographic statues"

of Buddhas, which were destroyed in the Bamiyan Valley region of Afghanistan in 2001, and the UNESCO's "Revive the Spirit of Mosul" initiative, which employed "3D modeling to restore monuments that were destroyed during the numerous conflicts." Likewise, the fire and subsequent reconstruction of Notre Dame Cathedral in 2019 was an example of how "modern 3D scanning tools and AI algorithms were used to map the damage and plan the reconstruction of Notre Dame Cathedral.

Documentation, analysis and transmission of intangible cultural heritage are significant challenges that can be taken on by AI technologies in innovative ways. According to Zhang (2025), there are several promising future applications of AI, such as "Virtual representation", "Personalized learning" and "Assisted creation" and "Intelligent documentation", which together provide new opportunities for the preservation of living cultural traditions. Such applications are of special importance because intangible heritage is "in the face of great threats from modernization and the decline in its transmission, traditional conservation methods do not seem to be very effective at addressing these threats". Intelligent documentation systems are a fundamental step toward documenting intangible heritage practices' complexity and dynamism. While static recording techniques cannot provide analyses of patterns in oral traditions, variations in the way it is performed, or changes in the ways it is transmitted over time, AI-driven documentation can. These systems can handle huge amounts of cultural data to uncover "vital traditions, knowledge, and skills," which may be missed or poorly documented, according to Zhang (2025). The ability to 'see pattern' allows us to detect changes and new ideas within established ways of doing things, leading to a more complex understanding of the dynamics of cultural change, as well as the recognition of core aspects of cultural tradition.

With the help of AI and virtual representation technologies, new opportunities are created to experience and learn about intangible heritage practices. These systems can construct an immersive context that replicates the settings in which cultural practices have been traditionally enacted, allowing students to access elements of cultural transmission that they do not normally have access to. AI systems' ability to tailor learning experiences to individual needs, such as customization based on prior knowledge, cultural backgrounds, and learning preferences, can enhance cultural education beyond the scope of the community. AI's ability to facilitate the creation process is especially innovative in assisting modern-day practitioners of traditional arts and crafts. These systems can process conventional methods and patterns and give guidance to the learners, while also acknowledging the creative freedom of human practitioners. Applications such as these can help the "revitalization of traditional practices through immersive technologies" while preserving the human elements that are integral to cultural authenticity, according to Zhang (2025).

The introduction of AI technologies has opened up unparalleled possibilities for the democratization of cultural heritage, tackling longstanding limitations that have restricted access to cultural life. According to

Tiribelli et al. (2024), "Under their educational mission, museums have to ensure the accessibility of their spaces and collections to people with disabilities, as the UN Convention on the Rights of Persons with Disabilities states that persons with disabilities have the right to take part on an equal basis with others in cultural life. AI-driven accessibility solutions overcome not just physical barriers, but cognitive barriers to cultural participation, and bring new forms of engagement to diverse audiences. Artificial Intelligence (AI) technology powered augmented reality (AR) app is used to describe and share alternative sensory experiences for visitors who are unable to see the exhibits, addressing the "sight-centric design" of most cultural institutions. According to Tiribelli et al. (2024), the "mobile applications equipped with AR technologies that can give interactive descriptions of the artwork and 2D visual access" allow the independent exploration of cultural sites. They rely on "image sensing and tracking, location, and simultaneous mapping" to generate a "auditory virtual tag affixed to objects in museum space" that activates when you get close to the object but does not replace interaction with the actual object.

VR technologies are well suited to overcome the barrier created by physical disabilities by providing immersive cultural experiences that goes beyond geographical and physical boundaries. Virtual environments, as noted by Tiribelli et al. (2024), "enable the user to navigate through the space and interact with others from a different location," thereby enhancing the sense of being "there" or feeling "present" in a specific space for people with disabilities. These technologies are especially useful for the access to archaeological sites, historical buildings or cultural landscapes that are inaccessible or geographically remote. AI systems' personalization feature allows for the development of activities and content that can be tailored to various audiences, supporting the growth of visitor numbers and promotional objectives by creating "engaging cultural experiences that cater to diverse visitors" (Tiribelli et al., 2024). Personalized visit itineraries can be generated from automated planning systems, which take into account users' preferences, interests, and accessibility requirements, and speech recognition and interactive question-and-answer applications allow visitors to interact with virtual characters that offer culturally and historically appropriate interpretation.

AI's ability to process and analyze large amounts of cultural data has revolutionized the way one might traditionally approach digital documentation and the production of metadata, solving long-standing issues in cultural heritage management. Many, including the one called "Saint George on a Bike" by Tiribelli et al. (2024), illustrate the potential of AI to help cultural institutions and preserve cultural heritage, such as large-scale metadata enhancement, a collaboration between Europeana and Barcelona Supercomputing Center. The project is a prime example of the challenges of metadata quality and consistency that still face cultural heritage collections, and how AI can tackle them. The system can be trained on "tens of thousands of images and text descriptions," and then use "deep learning algorithms" to

automatically generate descriptions for hundreds of thousands of images from various cultural heritage archives that "show an understanding of culture, symbols, and historical context" (Tiribelli et al., 2024). This "enriched" metadata helps to make the collections searchable, discoverable within one another, and gives users a better experience, and minimizes the time-consuming and complex task of the detailed cataloging that is traditionally a requirement for comprehensive collection discovery.

Another major development in digital heritage practice is the use of AI technology for semantic enhancement, such as image analysis. According to Khabzoaui and Cherifi (2025), the purpose of these systems is to "analyze and interpret visual data through machine learning algorithms to enhance understanding and interpretation of historical artifacts and artworks. This is not only an ability to recognize objects, but also to understand the artistic style, iconographic details and cultural associations that give a insights into the historical and cultural context of heritage objects. AI systems' automated identification and classification have been especially useful in handling large-scale digitization initiatives. They can perform archaeological feature recognition based on the point cloud of the LiDAR scan, structural data analysis of historical documents, and archaeological artifact classification based on style and material. As reported by Khabzoaui and Cherifi (2025), such uses "help to organise and manage cultural heritage collections, making them more accessible and usable to researchers and the public.

AI has brought sophisticated solutions to predictive conservation, allowing for proactive, not reactive, solutions in heritage preservation. These systems determine value of environment, structure and past patterns and forecast potential threats in advance of causing irreparable damage. Khabzoaui and Cherifi (2025) highlight the value of "AI-powered visual inspection systems" that can be used to monitor the "structural health" of heritage sites by employing "machine learning algorithms to analyze visual data gathered from sensors and cameras to detect and identify any potential structural damage or degradation in a timely and accurate manner. The monitoring of the environment is a very special application because of the growing problems of climate change to cultural sites around the world. Advanced AI systems can analyze complex information from the environment to forecast hazards like flooding, temperature variations, and humidity shifts that impact tangible and intangible heritage. Tiribelli et al. (2024) give as an example "prediction of tides in the Venice Lagoon by AI algorithms" for which "The different ML algorithms (M5P Regression Tree, Random Forest and Multilayer Perceptron) can predict the tide level in the Venice Lagoon with a good accuracy." This predictive function can help heritage managers to take preventive action to safeguard vulnerable sites and collections.

AI has also made strides in the field of security and crime prevention for heritage protection. Khabzoaui and Cherifi (2025) state that AI can help with the 'historical property retrieval', which involves identifying and returning cultural property items that have been stolen or otherwise

illegally exchanged as well as with 'crime heritage detection on the internet' which will aid in identifying and fighting the illegal trade of cultural property items. The applications tackle the ongoing issue of heritage crime and help in the repatriation of cultural objects to their places of origin. In closing, the wide-ranging applications of AI in cultural heritage preservation underscore the technology's power to solve long-standing challenges and generate new potential ways of engaging with and transmitting culture. As will become evident in the following sections, however, these opportunities are met with serious ethical issues, and a proactive approach is needed to ensure that technological innovation works within the larger framework of cultural preservation and social justice.

5. Ethical Challenges and Risks in AI-Mediated Heritage Preservation

Artificial Intelligence (AI) can be seen as the greatest opportunity for the preservation of cultural heritage but also as the biggest challenge for cultural heritage practitioners, revealing phenomena of tension between technology and cultural responsibility. These ethical implications go beyond the technical to include issues of power, representation, authenticity and cultural sovereignty. AI technologies, as Tiribelli et al. (2024) note, are not neutral, as they always carry socio-political, economic and cultural values that influence heritage preservation and interpretation. Therefore, when it comes to culture and knowledge, AI systems are not just recording it—they are creating it and spreading it. This poses significant questions about who the histories are being made visible to, and how they are being interpreted, and which communities do or do not gain from digital preservation practices. Similarly, Foka et al. (2025) show how digital technologies can draw upon and compound societal and historical prejudices hidden within analogue records, resulting in “bias loops” that reproduce inequalities via algorithmic systems.

A major ethical issue with AI and heritage preservation is authenticity—whether the technology can accurately represent the past or remain faithful to it. Historical notions of originality, materiality, and continuity have been foundational to heritage preservation. Authenticity is a “hotly contested topic” in digital heritage discourse, especially as the use of AI systems is becoming more likely to reconstruct, reinterpret, and simulate cultural objects and practices,” write Tiribelli et al. (2024). The challenge goes beyond being correct and accurate, to the “aura” of cultural objects as described by Benjamin, the particularity of an object's existence in its historical, spatial and ritual context. Reconstructed images and/or symbolic representations of heritage, produced by artificial intelligence, can recreate iconic or symbolic aspects of heritage while simultaneously severing them from their physical context and embodied presence. As Tiribelli et al. (2024) point out, reproductions may not capture the “hic et nunc” (“here and now”) aspect of the authentic cultural encounter, leading to communicative and relational impoverishment.

When AI systems create seemingly authentic but historically unrecorded cultural stories, the dilemma of authenticity grows even more intricate. This has been defined by Salah (2026) as “epistemic drift,” or “unverified synthetic narratives circulate faster than critical validation. The public understanding of heritage may be therefore affected by AI-based interpretations without evidential support, such as through reconstruction, historical simulation and automated interpretation. These developments question established methods of scholarly authority, methods of curatorial expertise, which have been historically used to validate cultural interpretation. Tiribelli et al. (2024) also caution that automated planning systems that are personalized to individual preferences run the risk of replacing the educational and critical role of cultural institutions with the more popular and marketable.

An additional significant ethical issue in AI-driven heritage systems is algorithmic bias. The biases present within historical archives, datasets, and metadata models are passed down and replicated in AI systems, as stated by Foka et al. (2025). Such biases can manifest in various forms, such as in the process of data collection, data annotation, data categorisation and algorithmic interpretation. This leads to the frequent marginalization of alternative epistemologies and minority histories and the dominance of AI systems by the dominant culture. As the history of marginalized groups and races is increasingly dominated or ignored by the heritage interpretations generated by AI models and metadata systems that are “Western” in their perspective of history and culture” (Tiribelli et al., 2024).

Algorithmic bias can work in a very subtle way but it's also very systematic. Representative training data sets are often based on histories of collection and documentation that marginalized or excluded indigenous and marginalized communities and privileged elite or dominant groups. AI systems can thus reflect select conceptions of heritage and perpetuate cultural hierarchies based on these types of datasets. According to Tiribelli et al. (2024), “algorithmically mediated interpretation generally foregrounds the most dominant and accessible interpretations of cultural products and leaves out other, less visible but no less significant interpretations.” Pansoni et al. (2023) also caution that the use of AI can pose a threat to local cultures through the incorporation of indigenous knowledge within the context of conventional, western metadata systems that alter the original meanings and cultural contexts.

Data colonialism and cultural ownership is closely related to algorithmic bias. In many cases, the process of heritage digitisation includes the retrieval of cultural knowledge, as well as the encoding into encoded data formats that can be processed algorithmically. Tiribelli et al. (2024) point to specific dangers for indigenous peoples whose cultural norms are based on traditional norms of access which can be in tension with digital openness and technological access. As stated by Pansoni et al. (2023) some cultural assets are sacred, restricted or only for certain community members due to age, gender and/or ritual. Preservation and accessibility could then be seen as helping, but actually harming, very entrenched cultural values, through

the use of AI and digitization and the adoption of open-access systems. The use of AI and digitisation, and open-access systems, may then offend deeply entrenched cultural values while at the same time seeming to help preserve and be accessible.

This extraction of cultural data for AI training is frequently done without the informed consent and/or meaningful involvement of source communities, as Tiribelli et al (2024) refer to as "neo-colonial forms of cultural appropriation" in a digital context. Cultural traditions are turned into data resources under the control of institutions, corporations and technological infrastructure, not communities who maintain these traditions. This results in inequalities of ownership, representation and benefits. Pansoni et al. (2023) highlight that marginalized communities are frequently disadvantaged with respect to financial and technological means to be part of the digitization process equally, leading to exclusion in what is supposed to be a democratic digital heritage system.

These ethical issues are exacerbated by the commodification of cultural heritage in the digital platform economies, as it is sold as a commodity for monetary profit. With the rise of AI-mediated heritage, engagement metrics, visibility algorithms and market logics drive the circulation of AI heritage through commercial platforms. AI personalization tools could potentially reduce the importance of critical and transformative heritage if they favor content that meets audience interests and platform viability. AI customization tools could limit the critical and transformative role of heritage by prioritizing content that is more engaging to viewers and beneficial to the platforms. Heritage is therefore recodified into 'content' that is digestible for entertainment and engagement instead of critical thinking and cultural continuity. Pansoni et al. (2023) also point out that cultural institutions are facing more and more pressure to take entrepreneurial and business-oriented approaches, which include the charging of fees for access, cooperation with private corporations and a reliance on sponsorship structures that shape the nature of the cultural content that is digitized and promoted.

Ethical issues also come into the picture, like privacy and surveillance, in AI's role in protecting heritage. But there are also ethical concerns that arise, such as privacy and surveillance in the context of AI and heritage preservation. AI systems often gather, process and share vast amounts of cultural and personal information, such as ethnographic resources, oral histories, documentation of ritual practices, and community practices. Pansoni et al. (2023) emphasize the fact that many heritage archives hold intimate personal information and culturally sensitive knowledge that was never envisioned for free and easy digital dissemination. Digital reproductions and metadata can be easily shared, manipulated, and redistributed, leading to increased risks of privacy violations, cultural misuse, and unauthorized access. For the communities that are more vulnerable or more marginalized politically, their cultural practices are potentially monitored, suppressed, or exploited via digital infrastructures, making surveillance concerns of particular importance.

Lastly, the application of AI technologies towards heritage contexts can sometimes further reinforce unequal institutional power dynamics, and it can seem to be making access and participation more democratic. Pansoni et al. (2023) note that digitization projects are often implemented at a top-down level, with a focus on technological efficiency rather than involving local communities and empowering them to lead the process. Decisions about them are made by others and they are not involved in the process of representation and preservation. Often, the complexity of the AI systems hinders meaningful participation as they become more complex to understand and navigate. Thus, Zhang (2025) calls for "community-centric ethical guidelines" which focus on participative governance, cultural sovereignty, and co-governance in AI-based systems of heritage. In conclusion, the ethical issues highlight the need to reflect on AI's role in preservation beyond its technological aspects, as it also influences power dynamics, cultural heritage, and identity.

6. Toward Ethical and Participatory AI in Cultural Heritage: Frameworks for Responsible Innovation

The ethical dilemmas that are raised by AI in the preservation of heritage call for solutions that go beyond technical solutions and extend to the broader questions of power, representation, and cultural sovereignty. The responsible application of AI in cultural heritage settings requires the consideration of ethical risks like data ownership, authenticity, and representation in culturally and community-sensitive ways, as highlighted by Zhang (2025). In the same vein, Ghaith (2024) states that "technological innovation cannot be divorced from the subtleties and irreplaceable human element in preserving a work ethically" to maintain that preservation practices are still grounded in ethical considerations even as technological advances are introduced. AI systems are proliferating and impacting the documentation, interpretation and circulation of heritage in increasingly visible ways, so it is important that ethical frameworks acknowledge that digital preservation is not a neutral process, but one that is rooted in social, political and economic systems. Pansoni et al. (2023) also propose the use of "multidisciplinary and participatory" governance models for AI, which enable communities to have a direct voice in the process and in the impact of the digitisation of heritage.

Ethical implementation in the context of heritage continues to be a community centred approach. Traditional heritage institutions have tended to operate in custodial ways, giving primacy to institutional decision making over the participation of communities. Salah (2026), however, believes that participatory governance is key for ensuring that AI does not supplant, but supports, the human deliberation required in the protection of heritage. Such forms of governance view communities as the main stakeholders whose cultural understandings, lived experiences, and interpretive practices are important to consider when developing technologies. This is especially relevant given that intangible cultural heritage is about memories, rituals, and collective continuity that are embodied, rather than about lifeless information. So, the use of Mukurtu CMS is an example of this

participatory way of thinking, as it incorporates Indigenous cultural protocols into its metadata, enabling communities to control access, representation, and interpretation based on their epistemologies and cultural values. As Salah (2026) points out, these models illustrate how the "reflexive ethics" of technologically mediated participation can maintain epistemic plurality.

Consent and participation must also be viewed as a continuous process, not a static one, in community-based approaches. Pansoni et al. (2023) stress that the processes of implementing AI need to be continually monitored and adapted to keep technological systems relevant to different cultural contexts and community needs. This calls for institutional change within museums, archives and heritage organizations, as they need to cultivate new modes of expertise in collaborative governance, recognition of cultural protocols and ethical digital engagement. Tiribelli et al. (2024) point out that the need for interdisciplinary governance structures that combine technological expertise with cultural awareness and community engagement.

The principle of transparency and accountability is also crucial in ethical AI systems. Algorithmic technologies frequently work in a hidden way, obscuring the processes behind the selection, interpretation, categorization and circulation of cultural materials. This opacity is problematic in heritage contexts as it can contribute to an unequal visibility, algorithmic bias, cultural exclusion, and can seem technologically objective. Salah (2026) thus suggests the importance of 'transparency of mediation', through the use of provenance metadata, paradata, and auditable trails of process which capture human and algorithmic actions or interventions in curatorial practice. This openness allows communities, heritage practitioners, and researchers to review and critically assess the impact of AI systems on cultural representation and memory.

Social aspects of algorithmic accountability are also crucial. According to Tiribelli et al. (2024), explainability is a "pro-ethical condition" because it enables stakeholders to understand how an AI system reaches certain conclusions or interpretations. Pansoni et al. (2023) also call for "shared responsibility" approaches that consider the role of system designers, software developers, data providers, heritage institutions, and policy makers in cultural representation through AI. Mechanisms of accountability are particularly significant when algorithmic systems are used to reinforce stereotypes, exclude vulnerable communities, or profit from indigenous and folk knowledge. There is a need, then, for accessible ways to question, revise, or challenge problematic representations, as part of ethical AI governance, especially in communities that are impacted.

Technical interventions are also contributing to reduce algorithmic bias in the AI systems of heritages. Some of these strategies include data augmentation, adversarial debiasing, and ongoing monitoring, which can enhance the fairness and inclusiveness of AI-generated cultural representations (Foka et al., 2025). These methods aim to fill the gap of marginalized languages, views, cultural material in training datasets. Foka et al. (2025), however, also point out the need for interdisciplinary interaction and

cooperation between heritage professionals, cultural practitioners, anthropologists, and data scientists. The views of community on the concepts of sacredness, authenticity, or culturally appropriate representation may not correspond with technical definitions of fairness. Therefore, the cultural knowledge and local epistemologies should be considered as fundamental elements of ethical development of AI technologies in all its design and use.

Another significant ethical issue is the commercialization of cultural heritage in digital platform economies. With regard to cultural content, it is frequently produced by AI and circulated by means of social media and digital infrastructures, whose visibility, engagement economies and commercial profitability are the driving forces of their circulation. The approach to such systems favors engaging, attractive, and marketable depictions of heritage, and deems the less marketable cultural expressions less important. This process has the potential to commodify local practices, symbols and folk customs as digital aesthetics, lacking their local contexts and collective meanings. Golovach (2026) emphasizes the need for these policy frameworks to create transparency, accountability and safeguard from commercial exploitation in AI-driven cultural systems. Likewise, Wibawa and Rusnalasari (2024) have recognized that the lack of a coherent governance system and the lack of ethical guidance are key challenges for responsible AI use in heritage settings.

Changes to education and capacity development are also required to enable ethical consideration of AI in the heritage sectors. In Tiribelli et al. (2024), the authors call for a wider AI literacy, to ensure that digital technologies are not used by only a small or privileged minority. Increasingly, heritage professionals need to understand not only technical matters but also ethic, cultural sensitivity and community engagement matters as well. Professional development frameworks, then, should incorporate digital humanities into the training programs, along with AI ethics and participatory methods. Finally, Zhang (2025) highlights the need for interdisciplinary collaboration where technologists, heritage stakeholders, and community members collaborate to design AI systems for cultural preservation.

Ultimately, the future of AI in cultural heritage lies in collaborative and community-centric frameworks that ensure cultural diversity is safeguarded and community rights, agency, and cultural sovereignty are respected. Despite the advancements of AI technologies in making heritage more accessible and conservable, Ghaith (2024) emphasizes that human skills, ethical considerations, and lived cultural knowledge remain vital to the practice of heritage preservation. Ethical AI should thus be used as an enabler and reflective rather than a replacement for human interpretation or community memory. Heritage institutions and technological systems can strive towards more equitable and socially responsible approaches to digital preservation through an emphasis on participation, transparency, accountability, and cultural continuity. These strategies are necessary to ensure that AI is not a tool of digital colonialism and algorithm domination but

rather a tool of cultural empowerment and cultural protection.

7. Conclusion

The chapter has explored the ethical debate surrounding the use of AI in heritage preservation, revealing that AI is more than just a technological solution; it is a socio-political construct that significantly influences cultural representation, memory, and heritage practices. The use of AI technologies also raises significant ethical questions about authenticity, algorithmic bias, cultural ownership, commodification, and data colonialism, alongside opportunities for preserving and circulating cultural knowledge. This analysis indicates that digital preservation is not a purely neutral process, but is an active process of selection, organization, and representation of cultural traditions in platform-driven digital environments.

The chapter has drawn on the notions of authenticity in the work of Benjamin, the concept of representation as developed by Hall and UNESCO's guidelines on how to preserve intangible cultural heritage to emphasize the potential of AI-mediated reproductions to remove cultural practices from their context of living, ritual and community practices. The rise of information- and knowledge-based heritage content, and its ultimately commercial nature, may lead to a homogenization of local meanings and a consolidation of power dynamics within digital platforms. The latter can also function as a mechanism of reproducing visibility and control that is exclusive, while giving the impression of making culture more accessible, as seen in contemporary discussions about AI ethics.

The chapter states that the ethical and participatory way is critical for the culturally competent engagement with AI. Consensual, culturally sensitive, transparent and equitably represented community-based approaches offer viable alternatives to extractive and market-driven approaches to digital preservation. However, the future of AI in cultural heritage relies upon the creation of 'human-centred' and ethically informed practices and procedures, that help promote cultural diversity and respect the agency and the knowledge systems of the people who keep up these living traditions.

Future research must continue to develop both theoretical frameworks and practical tools for implementing ethical AI in heritage contexts while addressing the rapidly evolving nature of AI technologies and their applications. Particular attention is needed to the experiences and perspectives of marginalized communities whose heritage is most vulnerable to appropriation and misrepresentation through AI systems. Additionally, longitudinal studies of AI implementation in heritage contexts will be essential for understanding the long-term impacts of these technologies on cultural transmission and community well-being..

REFERENCES

1. Assmann, J. (2011). *Cultural memory and early civilization: Writing, remembrance, and political imagination*. Cambridge University Press.
2. Benjamin, R. (2019). *Race after technology: Abolitionist tools for the New Jim Code*. Wiley.
3. Benjamin, W. (1969). The work of art in the age of mechanical reproduction. In H. Arendt (Ed.), *Illuminations* (H. Zohn, Trans., pp. 217–251). Schocken Books. (Original work published 1935).
4. Foka, A., Griffin, G., Pablo, D. O., Rajkowska, P., & Badri, S. (2025). Tracing the bias loop: AI, cultural heritage and bias-mitigating in practice. *AI & Society*. 5835–5847. <https://doi.org/10.1007/s00146-025-02349-z>
5. Ghaith, K. (2024). AI integration in cultural heritage conservation – Ethical considerations and the human imperative. *International Journal of Emerging and Disruptive Innovation in Education: VISIONARIUM*. 2(1). 1-10. <https://doi.org/10.62608/2831-3550.1022>
6. Ghaith, K., & Hutson, J. (2024). A qualitative study on the integration of artificial intelligence in cultural heritage conservation. *Metaverse*. 5(2). 1-14. <https://doi.org/10.54517/m.v5i2.2654>
7. Giaccardi, E. (2012). *Heritage and social media: Understanding heritage in a participatory culture*. Routledge.
8. Golovach, N. (2026). Artificial intelligence and digital technologies in cultural heritage preservation: Opportunities and risks. *Scientific Journal "Library Science. Record Studies. Informology"*. 1, 83–89 <https://doi.org/10.32461/2409-9805.1.2026.356339>
9. Hall, S. (Ed.). (1997). *Representation: Cultural representations and signifying practices*. Sage Publications.
10. Hoskins, A. (2024). Media, memory, metaphor: Remembering and the connective turn. In L. Bond, S. Craps, & P. Vermeulen (Eds.), *Transcultural memory*. pp.19-31 . Routledge.
11. Khabzoaui, A., & Cherifi, M. (2025). Preserving cultural heritage using artificial intelligence. *Cultural and Historical Heritage: Preservation, Presentation, Digitalization*. 11(2). 22-32. <http://www.math.bas.bg/vt/kin/>
12. Noble, S. U. (2018). *Algorithms of oppression: How search engines reinforce racism*. New York University Press.
13. Pansoni, S., Tiribelli, S., Paolanti, M., Di Stefano, F., Frontoni, E., Malinverni, E., & Giovanola, B. (2023). Artificial intelligence and cultural heritage: Design and assessment of an ethical framework. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*. 48, 1149-1155 <https://u-pad.unimc.it/handle/11393/329690>
14. Salah, M. (2026). Algorithmic memory: Towards reflexive authenticity in cultural heritage. *AI & Antiquity*. 2(1). 65-75. <https://doi.org/10.64946/aiantiquity.v2i1.004>
15. Simon, N. (2010). **The participatory museum**. Museum 2.0.
16. Tiribelli, S., Pansoni, S., Frontoni, E., & Giovanola, B. (2024). *Ethics of artificial intelligence for*

cultural heritage: Opportunities and challenges. *IEEE Transactions on Technology and Society*. 5(3). 293 - 305. <https://doi.org/10.1109/TTS.2024.3432407>

17. Wibawa, B., & Rusnalasari, Z. (2024). Navigating ethics and innovation: The role of AI in cultural heritage. *Harmonia: Journal of Music and Arts*. 2(4). 198–212. <https://doi.org/10.61978/harmonia.v2i4.905>

18. Zhang,D. (2025). Artificial Intelligence for the Preservation and Transmission of Non-Material Cultural Heritage: Opportunities, Ethical Challenges, and Future Directions. *Applied and Computational*

Engineering,174,209-215. <https://doi.org/10.54254/2755-2721/2025.PO25257>

Other Sources

19. UNESCO. (2003). *Convention for the safeguarding of the intangible cultural heritage*. United Nations Educational, Scientific and Cultural Organization.

20. UNESCO. (2021). *Recommendation on the ethics of artificial intelligence*. United Nations Educational, Scientific and Cultural Organization.