

Archaeological Relevance in the Era of Globalization and Artificial Intelligence

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Abstract

This work explores the significance of archaeology in the modern era, characterized by rapid globalization and technological advancements, particularly artificial intelligence. It addresses the challenges and opportunities arising from the intersection of archaeology, globalization, and artificial intelligence. It highlights archaeology's contributions to understanding human history, cultural identity, and sustainable development, while showcasing the field's adaptability to new technologies. The study employs a qualitative research approach, focusing on exploring and understanding the significance of archaeology in the modern era. The findings reveal that archaeology remains crucial for understanding human history, cultural identity, and sustainable development, while artificial intelligence and digital technologies enhance archaeological research and preservation. It further recommends that archaeologists prioritize digital literacy, collaborative research, and community involvement to ensure the field's continued relevance and impact. Ultimately, the research demonstrates the continued relevance and importance of archaeology in the 21st century, offering valuable insights into the human past and its implications for the present and future. It also provides insights for archaeologists, policymakers, and stakeholders seeking to harness the potential of archaeology in the digital age.

Keyword: Archaeology, Globalization, Artificial Intelligence

Introduction

The study of human history via excavation and research is known as archaeology. It is the study of the past through its tangible remnants, employing them as proof to arrange, characterize, and elucidate the hidden meaning. It entails finding, retrieving, preserving, and analyzing the artifacts that make up the archeological record. Archaeology is also a creative and imaginative endeavor. Renfrew and Bahn (1996) provide the following useful explanation of archaeology:

It is working with living linuit in Alaska's snows and toiling in the sun on an excavation in the Iraqi desert. It involves exploring Roman York's sewers and diving down to Spanish wrecks off the coast of Florida. However, it also involves the laborious process of interpretation in order to comprehend the significance of these items for the human tale (11).

The material remnants may not immediately reveal anything about the past since they are frequently incomplete, broken, and changed by the decaying process. Therefore, the process of reconstructing the past involves inference. The archaeological data serve as both the foundation for inference and the raw material for archaeological research. According to Ashmore and Sharer:

The acquisition of archaeological data occurs when an archaeologist recognizes the significance of material remains from past human activity as evidence and gathers and records them. This includes everything from the most massive architectural construction to the microscopic debris created by chipping stone tools (30).

Artifacts are the first element of archaeological data that are preserved parts of human tools, weapons, and containers. Man-made and excavated structures, such as houses, monuments, and simple trash cisterns, are also regarded as artifacts. The third primary category of the artifacts, as provided by Whitehouse and Wilkins (181), is the burial sites, which provide the first-hand information about the physical appearance of the people who lived in that culture in the past, along with a clue about their religion.

Globalization can also be used as a concept in development studies that promotes modification of interpersonal interactions and society in general. According to Shelly (1995:482), globalization may mean something to various individuals.

Thornhill (2007) defines globalization as a concept worldwide, which can be classified into three categories such as single world society, worldwide society, and world economy with cosmopolitan culture and international social movements. The inter-state dependency and the global interdependence are different, and he uses a large space on the former. Both Harrison and Orji cast their eyes. They argue that globalization propagates the notion that the globe is a single frame of reference and one that implies the increasing cultural consciousness of global connectivity. It also brings together the different economies of the world in addition to enabling the free flow of capital, labor, technology, products, and services that are all fundamental constituents of globalization. Uzuegbunam defines globalization as a process of expanding regions, societies, economies, cultures and politics through a global system of trade, communication and transport. Globalization is no longer viewed as an interrelated and integrative process which is faster, more affordable and deeper than it used to be before.

Globalization has brought about immense and radical transformation in the global political, economic, social and cultural transformation. The world is apparently becoming a global village as scientific and technological growth has removed the boundary and transformed the world over the past 20 years. This was facilitated by the symbolic fading away in the division of the world into communist and capitalist halves, the Berlin wall fell down in 1989, and the Soviet Union was disintegrated in 1991. This situation and advancement in communications led to free and unrestricted transfer of individuals and commodities all over the world to explore other cultures.

Archeology of the Globalization Age

Historically, archaeology relies on physical remains of the past, which are artifacts and sites. Nonetheless, it is the multicultural expansion of intellectual knowledge that can allow mankind to adjust itself to the future that makes archaeology a necessity. Simply, it examines human perception and flexibility with concrete cultural impressions to offer a basis for predicting human behavior by capturing thinking patterns. Due to this fact, future archaeology, unlike the past one, should be considered in modern civilization, which is rapidly developing. Modern technology innovation has brought significant transformations to the life of a human being in a manner that has never been imagined before. Although the digital revolution is less than a hundred years old, the ubiquitous artificial intelligence will one day take control over human life and will be assumed to be operating at a far different plane than it has been in the whole history of humanity. The examples of the digital technologies that take the stage during this era, often called the Fourth Industrial Revolution, are AI, robots, machine learning, nanotechnology, 3D printing, and life sciences. These technologies offer new combinations which are creative and shape new types of culture.

Effects of Globalization on Archaeological Practices

Globalization influences archeological activities and findings by encouraging collaboration on an international level, increasing access to capital and technology, and standard practices. It can also lead to the commercialization of cultural property and objects, which can bring disproportionate power relations and interpretations that lose their local context.

More tourism leads to the degradation of ancient sites, but globalization brings in more funding and international collaboration to conserve the sites. Protective laws can also be promoted by global activism and awareness, and technology dissemination enhances the efforts on documentation and preservation across the world.

Globalization affects the interpretation of archeological data by stimulating the diversity of perspectives, introducing foreign technology, and enhancing access to information. It facilitates cross-cultural collaboration at the expense of homogenizing opinion and hiding local narratives with dominant global ideologies.

Globalization facilitates the exchange of archaeological research as a result of international collaboration, the promotion of scholarship, and the digital sharing of resources to reach a broader audience. It enables the exchange of results and methodology across borders through internet platforms and international conferences and increases the level of public awareness and participation.

Archaeological research is enhanced by globalization-related technological innovations, which enhance international cooperation, widen access to global databases, and allow the use of high-tech remote sensing, digital mapping, and data analysis instruments. Those tools make archaeological work a more efficient and broad research due to the ability to find and pinpoint sites better and analyze the collected data more accurately.

One of the examples of how globalization altered the practice of archaeology is the Global Nature Project, whereby the information about ancient DNA is documented and shared, but the capturing was done by scholars around the globe. One of the major effects on archaeology brought about by globalization is the motivation to unrestricted access to knowledge. There is increased interdisciplinary cooperation and involvement by society because many researchers can publish their discoveries freely. Nevertheless, to protect confidential cultural data, strict data management and ethics are necessary. The concept of a shared heritage is gaining greater attention among archaeologists as a result of globalization, so as to highlight the common past and cultural connections that bind different regions and communities together.

Artificial Intelligence in Archaeology

The term Artificial Intelligence (AI) was first used in the 1955 article by McCarthy to describe an interdisciplinary field that started with the theories of Alan Turing. Between 70 years, AI has experienced both of these phases of growth, such as the present one, which was marked by a huge investment and a significant degree of confidence in achieving the goals, and decline, called an AI winter, which is marked by skepticism caused by disappointing technological progress and a decline in funding. Artificial intelligence (AI) tends to require research and development of systems and technologies that can imitate specific human capabilities such as reasoning, senses, learning, natural language processing, and pattern recognition to automate challenging jobs and make independent decisions. These procedures usually require large amounts of data (Big Data), large computing units, and specialized hardware such as graphics processing units (GPUs) and tensor processing units (TPUs). The field of artificial intelligence (AI) contains Artificial Neural

Networks (ANNs), Deep Learning (DL), Generative AI (Gen AI), and Machine Learning (ML), which are the most inclusive.

AI uses in Archaeology

The process of finding potential archeological sites with the help of satellite photography and machine learning algorithms is called site detection.

Artifact analysis is the use of AI-based technologies to analyze artifacts, such as coins, ceramics, and other archaeological finds.

Predicting the location of archeological sites and cultural resources with the help of AI is referred to as predictive modeling.

Advantages in Archaeology of AI

AI has assisted archaeology in some aspects, such as performing specialized and time-intensive tasks and processing massive data. The overall effectiveness of AI in this business sector is, however, restricted due to its high rates of inaccuracy and the fact that a significant part of the complicated task will still be human-centered. Nevertheless, it is not that difficult to foresee that non-domain experts would use generative models such as Chat GPT, Claude, DALL-E, and Gemini, Midjourney, and Stable Diffusion more actively as well. So far, AI has been primarily applied in classification and identification tasks in the analysis of texts, objects, landscapes, and, more recently, robots. As an example, the identification of ancient sites has been proposed to be done by Random Forest models and CNNs on satellite data, LiDAR data with transfer learning, or historical mapping using LiDAR data. Although the method of Casini et al. (2023), which applied a transformer to semantically segment GPR anomalies and test the potential of a collaborative workflow involving both humans and AI, involved expert-annotated images (human-in-the-loop) and did not involve transfer learning, there are also applications of CNNs to the semantic segmentation of GPR anomalies. This approach will enable the archaeologists to enhance subsequent research and surveys by refining the predictions of the AI.

The models were preliminarily developed with the aid of satellite pictures and site notations, with considerable support of subject matter experts who assisted in the formation of the dataset and also to determine the predictions, and it achieved an accuracy of approximately 80%. Examples of GANs can be provided to the virtual restoration of coins and ceramics on the artifact level, and Tsigkas et al. (2020) were using a pre-trained CNN to automatically identify rock art and Gualandi et al. (2021) CNNs with transfer learning to identify ceramics, developing two machine-learning tools publicly available as desktop and mobile applications: a system with a novel deep-learning architecture to recognize shapes and an alternative system with classical image-classification algorithms to recognize decorations, and with instead accuracy rates of 83%.

The method described by Zachariou et al. (2020) focuses on two significant applications: improving the accuracy of the automatic image-based algorithms of coin type recognition, affected by the condition of the coin, and providing a perspective of coins that is closer to their original production. That algorithm that was trained on 100,000 images of the historical coins can identify the differences in the sphere of art and reconstruct the damaged areas, preserving the semantic meaning of the artwork as well as the creative style despite the alterations in the coin designs. Pierdicca et al. have examined how to categorically take sections of architectural features using 3D models with the help of a Dynamic Graph CNN. (2020) Various types of

CNNs have been studied to detect butchery and cut marks on animal osteological remains, including CNNs with transfer learning, CNNs and SVMs, and different kinds of CNNs, some with a pre-trained version. Conversely, Resler et al. (2021) developed a CNN to detect the artifacts of Palaeolithic to the late Islamic times, and Grove and Blinkhorn (2020) used ANN to show lithic industries. NLP applications have also benefited a great deal in archaeology; an example is CNNs being applied to translate or reconstruct ostraca fragments and cuneiform tablets, though Greek epigraphs have been reconstituted and geographically assigned, and dated with the help of a transformer. This method is able to approximate inscriptions as far as a 30-year window and place the inscriptions in their original location with an accuracy rate of 71% accuracy. The most interesting point here is that the algorithm can be used to recover broken texts with 62 percent accuracy on its own, but with the involvement of a person, the accuracy of the algorithm becomes 72 percent.

Even though robotics is a relatively recent area of research, the recent AUTOMATA project, which will attempt to develop a robotic AI-assisted work cell to enhance the digitization of ceramics and lithic, and the newer Re PAIR projects, which will seek to find solutions to puzzles in Roman frescoes by a robotic AI-assisted system, indicate that it will be a new field of applied research. The use of Gen AI is seemingly restricted to the simulation of the landscape in immersion, the palaeo environment on the basis of pollen or entomological and environmental records.

The Relevance of Archeology in the Digital Age

Understanding the Past: Archaeology provides a unique perspective on human history, allowing us to understand the complexities of past societies and cultures.

Cultural Heritage: Archaeological sites and artifacts are an important part of our cultural heritage, providing a tangible connection to the past.

Digital technology: Archaeology is changing and becoming more accessible to a larger audience due to the use of digital technology like 3D scanning, virtual reality, and internet databases.

Public Engagement: Archaeology has the power to captivate the public imagination, inspiring interest in history, culture, and the past.

Informing the Present: Archaeology provides valuable insights into the human past, which can inform our understanding of contemporary social, economic, and environmental issues.

Cultural Preservation: Archaeology plays a critical role in preserving cultural heritage, which is essential for maintaining cultural identity and promoting cultural diversity.

Education and Outreach: Archaeology has the potential to educate and engage the public, promoting a greater understanding and appreciation of cultural heritage.

Challenges and Opportunities for Archaeology in the Era of Globalization and AI

Challenges

Cultural Heritage Destruction: Globalization and conflict have led to the destruction and looting of cultural heritage sites, threatening the loss of irreplaceable artifacts and historical records.

Looting and Illicit Trade: The illicit trade in antiquities and cultural artifacts poses a significant challenge to archaeology, as it can lead to the loss of context and the destruction of sites.

Climate Change: Climate change is threatening cultural heritage sites and artifacts, particularly those in coastal or vulnerable areas.

Digital Challenges: The increasing use of digital technologies in archaeology raises concerns about data management, preservation, and accessibility.

Opportunities

Global Collaboration: Globalization has facilitated international collaboration and knowledge-sharing among archaeologists, enabling researchers to work together on a global scale.

Digital Technologies: Artificial intelligence and other digital technologies are providing new tools for archaeological research, including site detection, artifact analysis, and predictive modeling.

Public Engagement: Digital technologies are also enabling archaeologists to engage with the public and promote a greater understanding of cultural heritage.

Community-Based Archaeology: There is a growing recognition of the importance of community-based archaeology, which involves local communities in the research and preservation of cultural heritage.

Recommendations

1. Archaeologists should leverage digital technologies, such as AI, machine learning, and data analytics, to enhance research, preservation, and public engagement.
2. International collaboration and knowledge-sharing among archaeologists, policymakers, and local communities should be encouraged to address global challenges and promote cultural heritage preservation.
3. Governments, policymakers, and the public should prioritize cultural heritage preservation, recognizing its importance for understanding human history and promoting cultural diversity.

4. Community-based archaeology initiatives should be developed and supported, involving local communities in the research and preservation of cultural heritage.
5. Archaeologists, policymakers, and the public should work together to address ethical and legal issues related to cultural heritage, including looting, illicit trade, and repatriation.
6. Archaeological research and education should be supported, recognizing the importance of archaeology in understanding human history and promoting cultural diversity.
7. Interdisciplinary research collaborations between archaeology and other fields, such as AI, data science, and environmental studies, should be encouraged to address complex research questions.

Conclusion

This work has demonstrated the continued relevance of archaeology in the era of globalization and artificial intelligence. Archaeology provides a unique perspective on human history and cultural diversity, offering insights into the complexities of globalization and the significance of protecting cultural heritage.

Archaeology has changed as a result of the incorporation of digital technologies like artificial intelligence (AI) and machine learning, which allow academics to examine massive databases, spot trends, and forecast future events. Additionally, these technologies have made it easier for local communities, policymakers, and archaeologists to collaborate globally and share knowledge.

But in the age of globalization and artificial intelligence, archaeology also faces formidable obstacles, such as looting, illegal trading, and the destruction of cultural heritage sites. The profession is also seriously threatened by climate change and technology issues like data management and preservation.

Despite these challenges, archaeology remains an essential discipline for understanding human history and cultural diversity. By prioritizing cultural heritage preservation, community engagement, and interdisciplinary research, archaeology can continue to thrive in the era of globalization and AI.

Ultimately, this research argues that archaeology is not only relevant but also essential for understanding the complexities of the modern world. By studying the past, we can gain insights into the present and future, and develop more effective strategies for addressing the challenges that we face.

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