

Artificial Intelligence and Archival practice: Transforming Management, Preservation, and Access in the Digital Age

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Abstract

The unprecedented growth of digital information and the increasing complexity of archival collections have compelled archival institutions worldwide to explore innovative technological solutions for records management, preservation, and access. Among these emerging technologies, artificial intelligence (AI) has attracted significant attention due to its capacity to automate processes, improve efficiency, and enhance access to archival materials. This paper critically examines the role of artificial intelligence in transforming archival management, preservation, and access within contemporary archival environments. Drawing upon current literature from archival science, information studies, digital humanities, and computer science, the study investigates the opportunities, challenges, and implications of AI adoption in archives. The paper reveals that AI technologies, including machine learning, natural language processing, computer vision, and optical character recognition, are increasingly employed to support archival appraisal, automated classification, metadata generation, digital preservation, and intelligent information retrieval. These technologies have demonstrated considerable potential in reducing processing backlogs, improving discoverability, enhancing user engagement, and facilitating large-scale digitization projects. Furthermore, AI-driven analytical tools are enabling new forms of archival research by uncovering hidden patterns and relationships within archival collections. Despite these benefits, the integration of AI into archival practice raises important ethical, legal, and professional concerns. Issues relating to algorithmic bias, transparency, accountability, privacy, authenticity, and contextual integrity challenge traditional archival principles and require careful consideration. The paper argues that while AI presents

transformative opportunities for archives, its implementation must be guided by robust governance frameworks, ethical standards, and professional oversight. The study concludes that AI should be regarded as a complementary technology that augments rather than replaces the expertise of archivists.

Future archival practice will depend on the successful integration of technological innovation with the enduring values of archival science, including authenticity, reliability, provenance, accountability, and equitable access.

Keywords: Artificial intelligence, archival management, digital preservation, archives, machine learning, information retrieval, digital humanities.

Introduction

Archives have long served as custodians of society's documentary heritage, preserving records that provide evidence of human activities, institutional functions, cultural practices, and historical developments. These records constitute invaluable sources of information for governments, researchers, historians, legal professionals, and the general public. Through their role in preserving documentary evidence, archives contribute significantly to accountability, transparency, collective memory, cultural identity, and knowledge production (Duranti & Franks, 2021). Historically, archival management has been characterized by labour intensive processes involving appraisal, acquisition, arrangement, description, preservation, and access. Archivists have traditionally relied on professional expertise and manual procedures to organize and manage collections. However, the emergence of digital technologies and the proliferation of born-digital records have fundamentally altered the archival landscape. It was based on these that Yeo (2018), argues that the volume, variety, and velocity of digital information now being generated pose unprecedented challenges for archival institutions worldwide.

Contemporary archives are confronted with rapidly expanding digital collections consisting of emails, websites, social media content, audiovisual materials, digitized manuscripts, electronic records, and other forms of digital documentation. Managing these collections requires new approaches that extend beyond traditional archival practices. The increasing scale of digital information has created significant processing backlogs, resource constraints, preservation challenges, and difficulties in providing timely access to archival materials (Gilliland, 2024). In response to these challenges, artificial intelligence has emerged as a promising technological solution. Artificial intelligence broadly refers to the ability of computer systems to perform tasks that typically require human intelligence, including learning, reasoning, decision-making, pattern recognition, and language processing. Recent

advances in machine learning, deep learning, natural language processing (NLP), computer vision, and data analytics have expanded the capabilities of AI systems and enabled their application across diverse professional domains, including healthcare, education, finance, law, and information management (Russell & Norvig, 2021).

Within archival environments, AI technologies are increasingly being employed to automate and enhance core archival functions. Machine learning algorithms can classify records, identify patterns within large datasets, and support appraisal decisions. Natural language processing technologies facilitate metadata extraction, automated description, and semantic indexing. Computer vision systems support image recognition and document analysis, while optical character recognition (OCR) technologies enable the conversion of scanned documents into searchable digital text. According to Colavizza et al., (2021), these innovations offer new opportunities for improving archival efficiency, reducing manual workloads, and enhancing access to archival collections. The growing interest in AI within archival science reflects broader transformations occurring across the information professions. Libraries, archives, museums, and records management institutions are increasingly adopting intelligent technologies to improve service delivery and address the challenges associated with digital transformation. The integration of AI into archival practice has the potential to revolutionize how records are organized, preserved, discovered, and interpreted. By automating repetitive tasks and enabling advanced analytical capabilities, AI can support archivists in managing complex collections that would otherwise be difficult to process using conventional methods.

Nevertheless, the adoption of AI in archives is not without controversy. While AI promises increased efficiency and improved access, it also raises significant ethical, legal, and professional concerns. Scholars have expressed concerns regarding algorithmic bias, transparency, explainability, accountability, privacy protection, and the preservation of archival context (Bunn, 2020). AI systems are trained on existing datasets that may contain historical biases and inequalities. Consequently, automated systems may unintentionally reproduce or amplify these biases, thereby affecting archival description, classification, and retrieval outcomes. Furthermore, archival theory has traditionally emphasized principles such as provenance, original order, authenticity, and contextual integrity. The increasing reliance on automated decision-making systems raises important questions about the extent to which these principles can be preserved within AI-mediated archival environments. Concerns have also been raised regarding the "black box" nature of many machine learning systems, which often make decisions in ways that are difficult to explain or interpret (Moss et al., 2020).

The implications of AI adoption extend beyond technical considerations to encompass broader questions regarding the future role of archivists and archival institutions. As AI increasingly assumes responsibility for tasks traditionally performed by professionals, archivists must develop new competencies in data analytics, machine learning, digital preservation, and information governance. Archival education programmes are therefore being challenged to integrate technological skills while maintaining commitment to foundational archival principles (Gilliland, 2024). Against this backdrop, a critical examination of AI's role in archival management has become increasingly important. While numerous studies have explored AI applications in libraries, records management, and digital humanities, there remains a need for comprehensive analysis of its implications for archival theory and practice. Understanding both the opportunities and challenges associated with AI adoption is essential for ensuring that technological innovation supports rather than undermines the fundamental mission of archives.

Objectives of the study

This paper therefore critically examines the role of artificial intelligence in transforming archival management, preservation, and access. Specifically, it seeks to:

1. Examine the application of artificial intelligence technologies in archival management.
2. Explore the opportunities presented by AI for archival preservation, description, and access.
3. Analyze the ethical, legal, and professional challenges associated with AI adoption in archives.
4. Assess the implications of AI for archival education and professional practice.
5. Identify future directions for research and innovation in AI-enabled archival environments.

Theoretical Foundations

The theoretical framework for this study is grounded on Socio-Technical Systems Theory and Records Continuum Theory, both of which provide valuable perspectives for understanding the integration of artificial intelligence technologies within archival management and recordkeeping processes.

Socio-Technical Systems Theory

This study is partly anchored on Socio-Technical Systems Theory, which emphasizes the interaction between technological systems and social structures. Originally developed by Trist and Bamforth (1951), the theory posits that organizational effectiveness depends on the successful integration of technological and human components. Within archival environments, AI technologies do not operate independently but interact with archivists, institutional policies, legal frameworks, and user communities.

The socio-technical perspective is particularly relevant because AI implementation in archives requires balancing technological efficiency with professional judgment, ethical considerations, and organizational goals. The theory suggests that successful AI adoption depends not only on technical performance but also on human acceptance, institutional readiness, and regulatory compliance.

Records Continuum Theory

The Records Continuum Theory developed by Upward (1996) provides another useful framework for understanding AI in archival management. Unlike traditional lifecycle models, the Records Continuum views records as existing within an ongoing process of creation, capture, organization, and pluralization. Records are continuously managed and reinterpreted across time and contexts. AI technologies support this continuum by facilitating the continuous processing, classification, preservation, and accessibility of digital records throughout their existence. Machine learning systems can contribute to recordkeeping processes by enhancing metadata creation, retrieval, and preservation activities.

Information Governance Theory

Information Governance Theory emphasizes the strategic management of information resources throughout their lifecycle to ensure compliance, accountability, transparency, and value creation. As AI becomes increasingly integrated into archival systems, information governance frameworks provide mechanisms for addressing ethical concerns relating to privacy, data security, algorithmic accountability, and regulatory compliance. The application of information governance principles ensures that AI-driven archival systems operate within acceptable legal and ethical boundaries while supporting institutional objectives and public trust. The combination of these theoretical perspectives provides a comprehensive framework for understanding the opportunities and challenges associated with artificial intelligence in archival management.

Literature Review

The reviews cover the existing literature on artificial intelligence and archival management, examining the conceptual foundations of AI, the transformation of archives in the digital era, theoretical perspectives, practical applications, and emerging global trends shaping the future of archival practice.

Artificial Intelligence: Conceptual Perspectives and Evolution

Artificial Intelligence (AI) refers to the capability of computer systems to perform tasks that traditionally require human intelligence, including learning, reasoning, problem-solving, language understanding, pattern recognition, and decision-making. Although the concept of AI emerged formally during the Dartmouth Conference in 1956, contemporary developments in machine learning, deep learning, natural language processing (NLP), and computer vision have significantly expanded its practical applications across various sectors (Russell & Norvig, 2021). The rapid growth of digital technologies has accelerated AI adoption in information-intensive environments such as libraries, archives, museums, and records management institutions. According to Dwivedi et al. (2023), advances in computing power, big data analytics, and cloud technologies have transformed AI from an experimental discipline into a practical tool capable of supporting complex organizational functions. Consequently, AI is increasingly being integrated into information management systems to improve efficiency, automate routine tasks, and enhance decision-making processes.

Within the information profession, AI technologies are now being employed to facilitate information organization, retrieval, preservation, and dissemination. Libraries use AI-powered recommendation systems and chatbots, while archives increasingly deploy machine learning algorithms for metadata generation, document classification, and digital preservation. As Cox (2022) argues, the growing complexity of digital information ecosystems necessitates innovative approaches capable of supporting sustainable information management practices. The application of AI in archives represents a significant shift from traditional archival processes toward data-driven and automated systems. This transformation reflects broader developments associated with digital transformation, open government initiatives, and the increasing demand for immediate access to information resources. As archival collections continue to expand, AI is becoming an indispensable tool for managing information at scales that exceed human processing capabilities.

Archives in the Digital Era

Archives have historically served as repositories of evidence, memory, accountability, and cultural heritage. Their primary function is to preserve records of enduring value and make them accessible to current and future generations. Traditional archival management was largely concerned with physical records, including manuscripts, correspondence, photographs, maps, and institutional documents. However, the emergence of digital technologies has fundamentally transformed the nature of archival collections.

Contemporary archives increasingly manage born-digital records such as emails, websites, social media content, electronic documents, databases, and multimedia files. According to Gilliland (2024), the digital transformation of archives has introduced unprecedented challenges relating to volume, complexity, authenticity, preservation, and access. The scale of digital information generated daily far exceeds the processing capacities of many archival institutions.

UNESCO (2023) estimates that global digital data production continues to increase exponentially, creating significant implications for long-term preservation and accessibility. Archivists are now required to manage massive datasets while ensuring that records remain authentic, reliable, usable, and accessible over time. These challenges have prompted the exploration of advanced technologies capable of supporting digital archival management.

The digital era has also transformed user expectations. Researchers increasingly expect online access to archival materials, sophisticated search functionalities, and immediate retrieval of information. Consequently, archival institutions are under pressure to modernize their services and adopt technologies that facilitate efficient information discovery and access. AI has emerged as one of the most promising solutions for addressing these demands.

Artificial Intelligence and Archival Theory

The integration of AI into archives raises important theoretical questions regarding the nature of records, archival authority, and professional responsibility. Traditional archival theory emphasizes concepts such as provenance, original order, authenticity, reliability, and contextual integrity. According to Duranti & Franks (2021), these principles have guided archival practice for decades and continue to underpin professional standards worldwide. The principle of provenance requires records to be maintained according to their origins and relationships, while original order emphasizes preserving the arrangement established by record creators. AI-

driven systems that automatically reorganize, classify, or interpret records may challenge these foundational principles if not carefully managed.

Yeo (2018) argues that the increasing use of algorithmic systems in archives necessitates rethinking traditional archival concepts within digital environments. While AI can enhance efficiency and accessibility, archivists must ensure that automated processes do not compromise contextual relationships that are essential for understanding records. Similarly, Bunn (2020) contends that AI technologies should be viewed as tools that support rather than replace archival judgment. Professional expertise remains critical for evaluating records, interpreting context, and making ethical decisions regarding preservation and access. Consequently, the relationship between AI and archival theory should be understood as complementary rather than adversarial. Recent scholarship has increasingly focused on the development of "human-centered AI" approaches that prioritize transparency, accountability, and ethical oversight. Such approaches recognize that while AI can assist archival processes, ultimate responsibility for archival decisions should remain with qualified professionals.

Applications of Artificial Intelligence in Archival Management

Automated Classification and Arrangement

One of the most significant applications of AI in archives is the automated classification and arrangement of records. Machine learning algorithms can analyze large datasets and identify patterns that facilitate the organization of records according to subject matter, creator, format, or administrative function. Traditionally, archival classification required extensive manual effort. Archivists reviewed records individually and assigned descriptive categories based on professional judgment. While effective, this process is often time-consuming and resource-intensive. AI systems can substantially reduce processing times by automating routine classification tasks.

According to Colavizza et al. (2021), machine learning models have demonstrated remarkable effectiveness in classifying digital records and identifying relationships among archival materials. These systems enable archivists to process large collections more efficiently while maintaining acceptable levels of accuracy. Automated classification is particularly valuable for managing born-digital records, where the volume of information often exceeds available staffing resources. Through predictive analytics and pattern recognition, AI systems can support appraisal and arrangement decisions while reducing processing backlogs.

Metadata Generation and Archival Description

Metadata creation is central to archival access and discovery. Metadata provides descriptive information that enables users to identify, locate, and understand archival materials. However, generating metadata manually can be labour intensive and costly. Artificial intelligence has significantly improved metadata generation processes through natural language processing and machine learning technologies. AI systems can automatically extract names, dates, locations, subjects, and keywords from textual documents and incorporate them into descriptive records.

Research by Carter, Huvila, and Anderson (2022) indicates that AI-generated metadata can substantially improve resource discoverability while reducing descriptive backlogs. Automated metadata extraction also enhances consistency and scalability, particularly in large digitization projects. Optical Character Recognition (OCR) technologies further contribute to metadata creation by converting scanned images into searchable text. Combined with NLP tools, OCR systems enable archives to provide advanced search capabilities and improve access to digitized collections.

Digital Preservation and Conservation

Digital preservation represents one of the most challenging responsibilities facing contemporary archives. The rapid obsolescence of hardware, software, and file formats threatens the long-term accessibility of digital records. AI technologies support digital preservation through predictive analytics, anomaly detection, and automated monitoring systems. These tools can identify potential preservation risks before data loss occurs and recommend corrective actions.

Moss, Endicott-Popovsky, and Dupuis (2020) note that AI-based preservation systems can monitor digital repositories continuously and detect integrity issues that might otherwise remain unnoticed. Such capabilities improve preservation planning and contribute to the sustainability of digital collections. Machine learning models can also support format migration strategies by predicting technological obsolescence and identifying suitable preservation interventions. Consequently, AI is becoming an increasingly important component of digital preservation infrastructures.

Information Retrieval and Discovery

Access is a fundamental objective of archival management. Archives preserve records not merely for storage but for use by researchers, policymakers, students, and the public. Effective retrieval systems are therefore essential. AI has transformed

archival information retrieval through semantic search, recommendation systems, multilingual processing, and contextual discovery tools. Unlike traditional keyword-based searches, AI-powered systems can interpret user intent and identify conceptually related materials.

According to Levy (2021), intelligent retrieval systems improve user experiences by facilitating more accurate and meaningful access to information. Recommendation algorithms can also suggest related records, thereby supporting exploratory research and knowledge discovery. These innovations are particularly important in large-scale digital archives, where conventional retrieval methods may struggle to locate relevant information efficiently.

Global Experiences and Emerging Trends

The integration of artificial intelligence (AI) into archival institutions is no longer a theoretical possibility but an emerging reality across many national archives, libraries, museums, and cultural heritage organizations worldwide. Leading archival institutions have increasingly adopted AI technologies to address challenges associated with the management of large-scale digital collections, improve access to archival materials, and enhance preservation strategies. These developments demonstrate the growing recognition of AI as a strategic tool for supporting archival functions in the digital age.

In the United States, the National Archives and Records Administration (NARA) has explored the application of machine learning and artificial intelligence in managing massive volumes of federal electronic records. NARA's Digital Records Management initiatives have investigated the use of automated classification, email categorization, and metadata extraction tools to improve the management and preservation of born-digital records. The increasing volume of government emails and electronic documents has necessitated the adoption of intelligent technologies capable of supporting appraisal, retention scheduling, and long-term preservation processes (National Archives and Records Administration, 2023).

Similarly, the National Archives has undertaken several AI-driven projects aimed at improving archival accessibility and cataloguing. Through its digital transformation programmes, the institution has experimented with machine learning algorithms to enhance metadata creation, automate transcription processes, and improve the discoverability of archival collections. The National Archives has also collaborated with academic researchers to investigate the potential of AI for improving archival

description and facilitating public engagement with historical records (The National Archives, 2023).

Across Europe, numerous archival and cultural heritage institutions have participated in collaborative digital heritage initiatives that employ AI technologies to support digitization, transcription, and information retrieval. Projects funded through the European Commission have increasingly incorporated machine learning, computer vision, and natural language processing technologies to improve access to historical collections and cultural heritage resources. According to Colavizza et al. (2021), AI applications within European archives have demonstrated significant potential for enhancing the management of large-scale digital collections while supporting innovative forms of historical research and knowledge discovery.

The integration of AI within archives, libraries, and museums has also contributed to improved accessibility and user engagement. Automated transcription tools, multilingual retrieval systems, and intelligent search platforms enable broader audiences to access archival resources regardless of linguistic, geographical, or physical barriers. Huvila (2022) argues that AI-driven information organization systems have significantly improved the discoverability of cultural heritage collections and facilitated more inclusive access to information resources.

Several emerging trends are shaping the future of AI in archival management. One notable development is the growing emphasis on explainable artificial intelligence (XAI), which seeks to make algorithmic decision-making processes transparent and understandable to users. Explainable AI is particularly important in archives because decisions regarding classification, appraisal, and access require accountability and professional oversight (Dwivedi et al., 2023).

Another important trend is the development of ethical AI governance frameworks. As concerns regarding algorithmic bias, privacy protection, and accountability continue to grow, archival institutions are increasingly adopting policies designed to ensure responsible AI implementation. Scholars have emphasized that AI systems should operate within frameworks that uphold archival values such as authenticity, provenance, transparency, and social responsibility (Bunn, 2020; Gilliland, 2024).

Emerging technologies are also transforming digital preservation practices. Intelligent preservation systems capable of monitoring repository integrity, detecting preservation risks, and recommending corrective actions are becoming increasingly sophisticated. These technologies enable archival institutions to manage digital preservation proactively rather than reactively, thereby improving the long-term sustainability of digital collections (Hedstrom, 2021).

Furthermore, advances in multilingual natural language processing are facilitating multilingual archival access, enabling users to discover and retrieve archival materials across linguistic boundaries. AI-assisted historical analysis is similarly creating new opportunities for researchers by enabling the identification of patterns, relationships, and trends within extensive archival datasets that would be difficult to detect through conventional research methods (Levy, 2021).

These developments suggest that artificial intelligence will continue to play an increasingly important role in archival management over the coming decades. Nevertheless, scholars caution that technological innovation alone cannot guarantee effective archival practice. The successful integration of AI depends upon the ability of institutions to balance efficiency with accountability, transparency, authenticity, and public trust. As Moss et al. (2020) observe, the future of archival management lies not in replacing archivists with machines but in developing collaborative relationships between human expertise and intelligent technologies that support the enduring mission of archives.

Opportunities Presented by Artificial Intelligence in Archival Management

The growing adoption of artificial intelligence (AI) in archival institutions has generated considerable interest among archivists, information professionals, and researchers due to its potential to transform archival operations and service delivery. Recent studies indicate that AI technologies, including machine learning, natural language processing, and computer vision, can automate labor-intensive archival functions such as classification, metadata generation, appraisal, and information retrieval, thereby improving efficiency and reducing processing backlogs (Colavizza et al., 2021; Moss et al., 2020). Furthermore, AI-driven tools enhance access to archival resources by enabling advanced search capabilities, automated description, and improved discoverability of digital collections (Huvila, 2022). Scholars have also emphasized the role of AI in supporting digital preservation through predictive analytics, automated monitoring, and the identification of preservation risks in large-scale digital repositories (Duranti & Franks, 2021; Hedstrom, 2021). As archival collections continue to grow in volume, diversity, and complexity, AI is increasingly viewed as a strategic technology capable of addressing many of the operational challenges associated with managing and preserving digital records while facilitating new forms of knowledge discovery and user engagement (Gilliland, 2024; Colavizza et al., 2021).

Enhanced Efficiency and Productivity

One of the most significant benefits of AI in archival management is its ability to automate repetitive and time-consuming tasks. Traditional archival activities such as classification, indexing, metadata creation, and document description often require substantial human labour and financial resources. Machine learning algorithms can perform these functions at a scale and speed that would be difficult to achieve through manual methods. According to Colavizza et al. (2021), AI-assisted processing significantly reduces archival backlogs and improves workflow efficiency. Automated systems can analyze thousands of records within minutes, thereby enabling archivists to focus on more complex activities requiring professional judgment and contextual interpretation. This increased efficiency contributes to improved service delivery and more effective utilization of institutional resources.

Improved Discoverability and Access

Access remains one of the primary objectives of archival institutions. AI technologies have enhanced archival accessibility by enabling more sophisticated search and retrieval capabilities. Through natural language processing, semantic indexing, and intelligent recommendation systems, AI can improve users' ability to locate relevant information within large collections.

Gilliland (2024)

Conclusion

Artificial intelligence is reshaping archival management by introducing innovative approaches to preservation, description, access, and interpretation. AI technologies provide significant opportunities for improving efficiency, enhancing discoverability, and expanding access to archival collections. However, their adoption also raises important ethical, professional, and technical concerns relating to bias, transparency, privacy, authenticity, and accountability.

The future of archival management should not be viewed as a choice between human expertise and artificial intelligence. Rather, AI should be understood as a complementary technology that enhances archival functions while preserving the professional values that underpin archival practice. Effective integration of AI requires robust governance frameworks, interdisciplinary collaboration, and continued commitment to the principles of authenticity, reliability, inclusivity, and public trust.

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