

Developing smart archives in society 5.0: Leveraging artificial intelligence for managing audiovisual archives in Africa

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Abstract

In the age of Society 5.0, marked by the profound integration of digital technologies and human society, the preservation and management of audiovisual archives in Africa face substantial challenges. The application of artificial intelligence plays a pivotal role in the establishment of digital archives in the society 5.0. The exponential growth of digital content, combined with the continent's diverse cultural landscape, presents complex obstacles to conventional archival practices. Without the effective implementation of artificial intelligence technologies, crucial aspects such as curation, accessibility and sustainable management of audiovisual archives in Africa remain hindered. Thus, the overarching problem under scrutiny pertains to how the establishment of intelligent archives, facilitated by AI, can offer innovative solutions for preserving and managing audiovisual archives in Africa, within the overarching framework of Society 5.0. This approach has the potential to significantly contribute to safeguarding Africa's rich cultural heritage and advancing research, education and cultural exchange. The purpose of this paper will be to focus on the challenges encountered by selected African countries, such as the ESARBICA countries and those that undertake environmental conservation projects, in managing their audiovisual collections and what can be done to facilitate AI. It resulted in the formulation of a framework for implementing smart archives using AI in African contexts, emphasizing practical strategies and best practices. A qualitative approach enabled a nuanced understanding of complex dynamics at play. Through the observation of AI integration processes, by means of desktop analyses of websites of African national archives and online interest groups showcasing nature conservation projects and initiatives, this article aims to capture a comprehensive picture of the current landscape and future possibilities.

Keywords

artificial intelligence, audiovisual archives, nature conservation, postmodernism, society 50

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Introduction

In the emerging concept of Society 5.0, a human-centric society that integrates cyberspace and physical space, the management of data, particularly audiovisual archives, is undergoing a significant transformation (National Archives of Japan, 2019; Rojas et al., 2021). Africa, with its rich cultural heritage and history, encapsulated in vast collections of audiovisual archives, stands at the brink of a digital revolution. Leveraging Artificial Intelligence (AI) in managing

these archives presents an unprecedented opportunity to preserve, access, and utilize this heritage in ways previously unimaginable (Barlindhaug, 2022).

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Society 5.0 envisions a scenario where technologies like AI, the Internet of Things (IoT), and big data are integrated into every aspect of life, aiming for a balance between economic advancement and the resolution of social problems through a system that highly values human needs. In the context of archive management, this implies creating intelligent systems that not only preserve and organize data but also make it easily accessible and usable for individuals and communities, aligning with the human-centric focus of Society 5.0 (National Archives of Japan, 2019; Deguchi et al., 2020).

AI technologies, including machine learning and natural language processing, offer innovative solutions for the challenges faced by archives. These technologies can automate the categorization, transcription, and tagging of audiovisual content, making it searchable and more accessible (Khurana et al., 2022). Globally, there are case studies, such as the British Library's (2019) use of AI for sound archive enhancement, that demonstrate the potential of these technologies in archive management. Implementing AI in the management of archives in Africa is not without its challenges. Technical and infrastructural limitations, lack of skilled personnel and financial constraints are significant hurdles. However, strategies such as capacity building, fostering international collaborations and leveraging mobile technology, which has widespread use in Africa, offer viable pathways to overcoming these obstacles.

Background

The significance of audiovisual archives in Africa

Historically, archives in Africa, as elsewhere, have been predominantly physical, encompassing paper documents, photographs, and analogue audiovisual materials. The digital age has ushered in a paradigm shift toward digital archives, yet this transition faces numerous challenges including digital preservation, accessibility and the digital divide, particularly acute in various African contexts. Audiovisual archives in Africa serve as a cornerstone for preserving the continent's rich cultural and historical heritage. They play a critical role not only in education but also in the overall societal development, enabling future generations to access and learn from the past. This discussion highlights the importance of these archives in South Africa, Botswana, Kenya, and Namibia, (all members of the Eastern and Southern African International Council on Archives (ESARBICA)) underscoring

their contribution to culture, history and education. Audiovisual archives play a pivotal role in nature conservation across Africa, serving as a vital tool for documenting biodiversity, conservation efforts, and environmental changes. In countries like South Africa, Botswana, Kenya and Namibia, these archives not only preserve the rich natural heritage but also support scientific research, education, and awareness, contributing significantly to conservation strategies.

These archives are instrumental in cataloguing the diverse flora and fauna characteristic of Africa's ecosystems. From the unique biodiversity of the Cape Floral Kingdom in South Africa to the varied habitats of the Okavango Delta in Botswana, audiovisual materials help in capturing the essence of these ecosystems. They provide valuable data for biodiversity assessments, aiding in the identification of endangered species and the formulation of conservation strategies.

Conservation efforts and awareness

Morrar et al. (2017) contend that audiovisual archives document the evolution of conservation strategies and their impacts over time. They are crucial for educating the public about the importance of conservation, showcasing the beauty of natural habitats, and highlighting the challenges faced by conservationists. These archives serve as a bridge between scientific communities and the public, fostering a deeper understanding and appreciation of nature conservation (Morrar et al. 2017). The archives also preserve the knowledge of traditional conservation practices, offering insights into how indigenous communities have lived in harmony with nature. They document historical changes in landscapes, providing evidence of human impact on ecosystems and guiding future conservation efforts.

Challenges in preservation and accessibility

Maintaining these archives poses significant challenges, from environmental degradation affecting physical materials to the complexities of digital archiving. Ensuring the longevity and accessibility of these archives is crucial for ongoing and future conservation efforts. Audiovisual archives relating to nature conservation in Africa are indispensable resources for documenting biodiversity, educating the public and informing conservation strategies. They capture the beauty and fragility of natural ecosystems, serving as a call to action for conservationists,

policymakers, and the public. The continued preservation and accessibility of these archives are essential for the sustainable management of Africa's natural heritage. Audiovisual archives in South Africa, Botswana, Kenya and Namibia are indispensable for preserving the cultural, historical, and educational heritage of these countries. They not only serve as a bridge to the past but also as a foundation for future learning and understanding, highlighting the importance of continued investment and innovation in archival practices.

Problem statement

In the era of Society 5.0, characterized by the deep integration of digital technologies and human society, the management and preservation of audiovisual archives in Africa confront formidable challenges. Focus has been directed toward East and South African countries that are part of ESARBICA and who undertake recognized nature conservation projects. The exponential growth of digital content and the diverse cultural tapestry across the continent present intricate obstacles for conventional archival practices (Brown, 2020). In the absence of effective implementation of AI technologies, critical aspects such as curation, accessibility and sustainable management of audiovisual archives in Africa remain impeded. Consequently, the overarching problem at hand is to investigate how the establishment of smart archives, facilitated by AI, can furnish innovative solutions for the preservation and management of audiovisual archives in Africa within the overarching framework of Society 5.0. Such an approach holds the potential to significantly contribute to the safeguarding of Africa's rich cultural heritage and the advancement of research, education and cultural exchange (Clough, 2013; Carrive, 2019).

Research objectives

1. Assess the current state of audiovisual archives in specific African countries, in particular South Africa, with a focus on the challenges and opportunities they face in the era of Society 5.0.
2. Investigate the potential applications of artificial intelligence (AI) in the management of audiovisual archives.
3. Identify the specific AI technologies and tools that can be leveraged to enhance the organization,

preservation and accessibility of audiovisual archives.

4. Develop a framework or model for implementing smart archives using AI in African contexts, emphasizing practical strategies and best practices.

Literature review themes

State of audiovisual archives in Africa

Many African countries have encountered obstacles in allocating adequate resources for the preservation and digitization of audiovisual materials. Insufficient funding has often led to subpar infrastructure and understaffed archival institutions (Masenya, 2018). Moreover, outdated equipment and technology have plagued some archives, hindering access to and preservation of older audiovisual materials. The modernization of equipment and workflows has posed a significant challenge for many institutions (Mulauzi et al., 2022).

Climate and environmental conditions in certain regions have also presented preservation challenges for audiovisual materials like film reels and magnetic tapes. Without proper storage facilities and climate control measures, these materials are at risk of deterioration (Netshakhuma, 2016). Furthermore, many archives have faced a shortage of trained staff with expertise in audiovisual preservation and digitization techniques, impeding effective efforts to digitize and archive materials.

Copyright and intellectual property rights have emerged as significant hurdles for archives aiming to digitize and provide access to audiovisual materials. Unclear ownership and licensing issues often complicate efforts to make materials available online (Eze Asogwa, 2011).

Despite these challenges, there have been collaborative initiatives and partnerships aimed at improving the state of audiovisual archives in Africa. Organizations like UNESCO and the International Federation of Film Archives (FIAP) have collaborated with local institutions to provide training, resources, and technical assistance (Awinja, 2022). Some African countries have made strides in digitizing audiovisual materials and making them accessible online. Digital platforms and repositories are being developed to showcase cultural heritage and historical materials to a global audience (Masenya and Ngulube, 2020).

Overall, while significant challenges persist for audiovisual archives in Africa, efforts are underway

to address these issues and improve access to and preservation of cultural heritage materials. However, progress varies widely across different countries and regions on the continent (Eze Asogwa, 2011).

Potential applications of artificial intelligence (AI) in the management of audiovisual archives

Artificial intelligence (AI) holds significant potential for the management of audiovisual archives, offering various applications that can streamline processes, enhance accessibility, and improve preservation efforts. AI can perform automated metadata generation in audiovisual archives. AI algorithms can analyze audiovisual content to automatically generate descriptive metadata, including scene recognition, object identification, speech-to-text transcription and sentiment analysis. This metadata enhances searchability and retrieval of archival materials, enabling users to find relevant content more efficiently (Munster et al., 2024).

AI can also perform content analysis and classification of audiovisual archives. AI can analyze audiovisual content to classify materials based on various criteria, such as genre, topic, time, or visual elements. This automated classification facilitates organization and management of archival collections, enabling archivists to categorize and label materials accurately. AI can provide quality assessment and restoration of audiovisual archives. AI algorithms can assess the quality of audiovisual materials by detecting and correcting defects such as noise, scratches, or color distortion. Additionally, AI-based restoration techniques can enhance the visual and audio quality of deteriorated or damaged archival footage, preserving historical content for future generations (Anantrasirichai and Bull, 2022).

AI can also provide content recommendation and personalization of audiovisual archives. AI-powered recommendation systems can analyze user preferences and behavior to suggest relevant audiovisual content from archival collections. By leveraging machine learning algorithms, archives can personalize recommendations based on individual interests and viewing habits, enhancing user engagement and satisfaction (Jaillant and Caputo, 2022). AI can perform copyright detection and rights management of audiovisual archives. AI technologies can assist in copyright detection and rights management by analyzing audiovisual content to identify copyrighted material and determine usage rights. This helps archives

comply with copyright regulations and licensing agreements when digitizing and distributing archival materials online (Jaillant, 2022).

AI can provide semantic analysis and linked data of audiovisual archives. AI-driven semantic analysis can extract meaningful information from audiovisual content, enabling the creation of linked data structures that connect related concepts, events, and individuals across archival collections. This semantic enrichment enhances the contextual understanding of archival materials and supports interdisciplinary research and exploration (Colavizza et al., 2021). AI algorithms can recognize faces and detect specific objects within audiovisual content, enabling automatic indexing and annotation of individuals, locations, and events depicted in archival footage. This capability facilitates content retrieval and enhances the accessibility of historical materials for researchers and scholars (Anantrasirichai and Bull, 2022).

NLP techniques can be applied to analyze textual documents, transcripts and metadata associated with audiovisual archives. This enables advanced search functionalities, sentiment analysis and language translation, enhancing the accessibility and usability of archival collections for diverse audiences. Overall, the integration of AI technologies in the management of audiovisual archives has the potential to revolutionize how these materials are organized, preserved, and made accessible to audiences worldwide. However, it's essential to address ethical considerations, privacy concerns, and biases in AI algorithms to ensure responsible and inclusive archival practices (Munster et al. 2024).

AI technologies and tools to manage audiovisual archives

Computer visions. Computer vision plays a crucial role in managing audiovisual archives by enabling automated analysis, organization, and retrieval of multimedia content. Computer vision algorithms can analyze the visual content of audiovisual files, including images and videos, to extract valuable information such as objects, scenes, faces, text, and activities depicted in the media. This analysis helps in cataloging and indexing the content, making it easier to search and retrieve specific assets (Sahoo and Choudhury, 2024). By automatically recognizing and extracting visual features from audiovisual content, computer vision systems can generate rich metadata tags. These metadata tags provide detailed descriptions of the content, including the presence of

specific objects, people, locations, actions, and emotions depicted in the media. Such metadata enhances the discoverability and organization of the archives (Anantrasirichai and Bull, 2022).

Computer vision techniques can categorize audiovisual content into predefined classes or categories based on visual characteristics. For instance, videos can be classified by genre, scene type, or content theme, while images can be categorized by subject matter or visual style. This classification aids in organizing the archives and facilitating targeted retrieval of relevant assets (Zheng, 2022). Computer vision algorithms can enhance the quality of audiovisual content by performing tasks such as image restoration, video stabilization, noise reduction, and resolution enhancement. These enhancements improve the overall viewing experience and ensure the preservation of archival material for future generations.

Computer vision enables the recognition of specific visual patterns or signatures within audiovisual content. This capability facilitates tasks such as identifying copyrighted material, detecting duplicate or similar assets, and conducting content-based searches across the archive repository (Sahoo and Choudhury, 2024). Computer vision systems can automatically annotate audiovisual content with descriptive labels, keywords, or annotations based on the visual elements present in the media. This automated annotation streamlines the archival workflow, reducing the manual effort required for metadata tagging and annotation tasks (Jaillant, 2022). By leveraging the visual features extracted from audiovisual content, computer vision enables advanced search and recommendation systems for archival collections. Users can search for relevant assets using visual queries or receive personalized recommendations based on their viewing preferences and historical interactions with the archive (Khurana et al. 2022).

Computer vision plays a vital role in managing audiovisual archives by automating content analysis, metadata generation, content classification, enhancement, recognition, annotation, retrieval, and recommendation tasks. These capabilities not only streamline archival workflows but also improve the accessibility, organization, and usability of multimedia archives for various stakeholders, including researchers, historians, educators, and the public (Jaillant and Caputo, 2022).

Machine learning in audiovisual archives. Machine learning is integral to managing audiovisual archives

due to its ability to automate and optimize various tasks involved in archival management. Machine learning algorithms can analyze audiovisual content to automatically generate descriptive metadata tags. These tags can include information about objects, scenes, locations, people, emotions, and actions depicted in the media. This automated tagging process speeds up the archival workflow and ensures consistent and accurate metadata generation across a large volume of assets (Zheng, 2022).

Machine learning models can be trained to recognize and classify audiovisual content into different categories or genres. For example, videos can be categorized by genre (e.g., drama, comedy, documentary), while images can be classified based on subject matter (e.g., landscapes, portraits, events). This classification enables efficient organization and retrieval of archival assets (Jaillant, 2022). Machine learning techniques such as image and video processing algorithms can enhance the quality of archival content by removing noise, stabilizing shaky footage, restoring damaged or degraded media, and improving resolution. These enhancements help preserve the integrity of archival material and enhance the viewing experience for users (Anantrasirichai and Bull, 2022).

Machine learning algorithms can analyze user interactions with archival content to provide personalized recommendations. By understanding user preferences and viewing behavior, recommendation systems can suggest relevant audiovisual assets, increasing engagement and exploration of the archival collection (Rebound, 2022). Machine learning enables advanced content analysis capabilities, such as object detection, scene recognition, and text extraction from images and videos. These analyses make archival content more searchable and discoverable, allowing users to find specific assets or topics of interest within the archive more efficiently (Barlindhaug, 2022).

Machine learning models can automatically transcribe spoken words from audiovisual content and translate them into different languages. This functionality improves accessibility and enables cross-cultural exploration of archival material, benefiting users with diverse linguistic backgrounds (Jaillant and Caputo, 2022). Machine learning algorithms can identify duplicate or similar audiovisual assets within the archive, helping to detect plagiarism and ensure the integrity of the collection. By automatically flagging redundant content, these systems streamline the curation and management of the archive (Valente et al., 2023).

Machine learning can assist in the preservation and longevity of audiovisual archives by predicting and mitigating risks associated with deterioration, degradation, or obsolescence of media formats. By analyzing historical preservation data and patterns, machine learning models can recommend optimal preservation strategies to prolong the lifespan of archival material (Sahoo and Choudhury, 2024). Machine learning plays a crucial role in managing audiovisual archives by automating tasks related to metadata generation, content recognition, enhancement, recommendation, analysis, searchability, duplication detection, preservation, and longevity. These capabilities not only streamline archival workflows but also improve the accessibility, organization, and usability of multimedia archives for various stakeholders (Unal et al., 2023).

Automated classification algorithm for audiovisual archives. Audiovisual archives often contain vast amounts of diverse content. Automated classification enables efficient organization of this content by categorizing it into meaningful groups based on various criteria such as genre, topic, time and content type. This organization makes it easier for users to navigate and discover relevant assets within the archive (Rebound, 2022). Automated classification enhances search and retrieval capabilities within audiovisual archives. By categorizing content into predefined classes or tags, users can quickly locate specific assets without having to manually browse through large volumes of material. This improves the overall usability and accessibility of the archive (Zheng, 2022).

Automated classification helps ensure consistent metadata generation across the archive. By applying standardized classification schemes or rules, metadata tags can be automatically assigned to audiovisual content, providing descriptive information about the content's attributes, context, and relevance. Consistent metadata enhances the archive's usability and facilitates interoperability with other systems (Jaillant, 2022). Automated classification enables personalized content recommendation systems within audiovisual archives. By analyzing users' interactions with archived content and their preferences, recommendation algorithms can suggest relevant assets based on their classification and similarity to previously viewed items. This enhances user engagement and promotes exploration of the archive (Anantrasirichai and Bull, 2022).

Automated classification aids in the preservation of audiovisual archives by facilitating the identification and prioritization of valuable or at-risk content. By classifying content based on factors such as historical significance, rarity, and condition, archivists can allocate resources more effectively to preserve and protect high-priority assets from degradation, loss, or obsolescence (Sahoo and Choudhury, 2024). Automated classification helps identify duplicate or redundant content within audiovisual archives. By comparing the visual and auditory features of media files, classification algorithms can detect similarities and variations between assets, enabling archivists to manage and deduplicate the archive more efficiently (Unal et al. 2023).

Automated classification supports analysis and research activities within audiovisual archives by providing structured access to content based on specific criteria or attributes. Researchers can use automated classification to identify trends, patterns, and correlations within the archive, facilitating scholarly inquiry and knowledge discovery (Rebound, 2022). Automated classification is essential for audiovisual archives as it enables efficient organization, improved search and retrieval, consistent metadata generation, personalized content recommendation, content preservation, detection of duplicate content, and facilitation of analysis and research. These benefits enhance the usability, accessibility, and long-term sustainability of audiovisual archives, ensuring their continued value to researchers, historians, educators, and the public (Jaillant, 2022).

Natural language processing in audiovisual archives

Natural Language Processing (NLP) techniques can extract valuable information from textual metadata associated with audiovisual content, such as titles, descriptions, and transcripts. By analyzing this textual data, NLP algorithms can extract entities, key phrases, and sentiments, enriching the metadata and improving the searchability and discoverability of the archive (Jaillant and Caputo, 2022). NLP algorithms can automatically transcribe spoken words from audiovisual content, generating accurate textual representations of dialogue and narration. These transcriptions can be used to create subtitles or closed captions, improving accessibility for viewers with hearing impairments and enhancing the overall user experience (Rebound, 2022).

NLP enables semantic analysis of textual content associated with audiovisual archives, allowing for a deeper understanding of the context and meaning conveyed in titles, descriptions, and transcripts. This analysis can help identify themes, topics, and relationships between different pieces of content, facilitating content organization and retrieval (Rebound, 2022). NLP techniques can summarize textual content associated with audiovisual archives, providing concise descriptions or abstracts that capture the essence of longer documents or transcripts. Summarization algorithms enable users to quickly grasp the main ideas and themes of archived content, aiding in content exploration and decision-making (Unal et al. 2023).

NLP facilitates language translation, enabling the automatic translation of textual metadata, transcripts, and subtitles associated with audiovisual content into different languages. Language translation enhances the accessibility and reach of audiovisual archives, making them accessible to users with diverse linguistic backgrounds (Valente et al. 2023). NLP algorithms can perform named entity recognition (NER) to identify and classify named entities such as people, organizations, locations, and dates mentioned in textual content. NER enhances the understanding of the context and content of audiovisual content, enabling more accurate indexing and retrieval of relevant assets (Munster et al. 2024).

NLP techniques can support question answering systems that allow users to pose natural language queries about audiovisual content and receive relevant answers based on the content's metadata, transcripts, or subtitles. Question answering systems improve the accessibility and usability of audiovisual archives, enabling users to find specific information quickly and easily (Unal et al. 2023). Natural language processing plays a vital role in audiovisual archives by enabling metadata enrichment, transcription and subtitling, semantic analysis, content summarization, sentiment analysis, language translation, named entity recognition, and question answering. These capabilities enhance the accessibility, searchability, and usability of audiovisual archives, making them more valuable resources for researchers, historians, educators, and the public (Khurana et al. 2022).

Robotic machine to manage audiovisual archives

A robotic machine can automate repetitive and time-consuming tasks involved in managing audiovisual archives, such as digitization, cataloging, metadata tagging, and quality control. This automation reduces the burden on human operators, increases efficiency,

and accelerates the archival workflow (Unal et al. 2023). High Precision and Accuracy: Robotic machines can perform tasks with high precision and accuracy, ensuring consistent quality in archival processes such as digitization, content analysis, and preservation. By minimizing human error, robotic systems help maintain the integrity and fidelity of archived material (Rebound, 2022).

Robotic machines can be equipped with specialized grippers, sensors, and handling mechanisms to delicately handle fragile or delicate audiovisual material, such as old film reels, magnetic tapes, and fragile documents. This capability minimizes the risk of damage during digitization and preservation processes (Valente et al. 2023). Unlike human operators, robotic machines can operate continuously without the need for breaks or rest, enabling round-the-clock archival management and processing. This constant availability ensures timely completion of tasks and improves the overall productivity of the archival facility.

Robotic systems can be easily scaled up or down to accommodate changes in archival workload and demand. Whether processing a small collection or a large-scale archival repository, robotic machines can adapt to varying requirements, ensuring scalability and flexibility in archival operations (Sahoo and Choudhury, 2024). Many robotic systems can be operated and monitored remotely, allowing archival facilities to manage and oversee operations from a centralized location. This remote accessibility enables efficient resource allocation, real-time monitoring of archival processes, and rapid response to any issues or emergencies (Colavizza et al. 2021). While the initial investment in robotic technology may be significant, the long-term cost savings can be substantial. By automating labor-intensive tasks and improving operational efficiency, robotic machines help reduce labor costs, minimize errors, and optimize resource utilization, ultimately lowering the overall cost of managing audiovisual archives (Anantrasirichai a Bull, 2022).

Society 5.0 and the need for smart archives

According to Darwina and Raharja (2022), Society 5.0, a concept originating from Japan, represents the next stage in the evolution of societal structures, integrating advanced digital technologies with every aspect of human life to achieve a balance between economic advancement and the resolution of social challenges. It emphasizes a human-centric approach where

technology serves to enhance individual capabilities and societal well-being. This societal blueprint is particularly relevant to the digital transformation of archives, advocating for a transition toward smart, interconnected archival systems that can serve diverse and dynamic societal needs (Darwina and Raharja, 2022). Archival practices have undergone significant transformation from physical document storage to digital archiving, driven by the advent of digital technology. This evolution reflects a broader shift in information management, necessitating archives that are not only repositories of historical data but also active resources for knowledge creation and dissemination. Smart archives involve the development of information technology, the managed archives information resources gradually take on the characteristics of wisdom. In the aspect of management means, it mainly means that through the new information technology, the smart archives can provide active and perceptible intelligent service (Luo, 2021).

Society 5.0's impact on archival practices. Aquilani et al. (2020) maintain that in the era of Society 5.0, the digital transformation of archives is not just an option but a necessity. Archives must adapt to become more than passive storage spaces; they need to be interactive, accessible, and intelligent systems capable of supporting a data-driven society. The integration of digital technologies in archival practices is exemplified by projects aimed at digitizing historical documents and making them accessible online, thereby democratizing access to historical knowledge (Aquilani et al. 2020). Smart archives refer to digital archives enhanced with Artificial Intelligence (AI) and other technologies to automate processing, enhance accessibility, and provide advanced services to users. AI plays a pivotal role in this transformation, employing techniques such as machine learning for pattern recognition in documents and natural language processing for indexing and summarizing textual content, significantly improving the efficiency and accessibility of archival materials (Fukuyama, 2018). Furthermore, AI bridges the gap between traditional and smart archives through applications that automate digitization processes, generate metadata and improve searchability and accessibility. For example, AI algorithms can transcribe handwritten documents into searchable text, making historical documents more accessible to researchers and the public. These technologies not only enhance the functionality of

archives but also help in preserving cultural heritage and facilitating research.

The transformation of archives in Society 5.0 presents both challenges and opportunities. Challenges include the need for significant investment in technology and training, concerns about digital preservation and data security and the risk of widening the digital divide. However, the opportunities, such as increased public access to archives, enhanced research capabilities, and the preservation of intangible cultural heritage, highlight the potential of AI to revolutionize archival practices (Msiza et al., 2020). The advent of Society 5.0 necessitates a reimagining of archival practices, where AI plays a critical role in transitioning archives into dynamic, intelligent platforms that support the needs of a data-driven society. While challenges remain, the potential for AI to enhance the accessibility, efficiency, and relevance of archives is clear, marking a significant step forward in the preservation and utilization of historical knowledge.

Challenges in managing audiovisual archives in Africa

Audiovisual archives serve as critical repositories of cultural, historical, and educational materials. In Africa, these archives face unique challenges that hinder their ability to preserve and provide access to their collections. This review explores the specific difficulties encountered, including linguistic diversity, limited resources and technological gaps, offering real-world examples to illustrate these issues (International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) (2020)). Africa's linguistic diversity, with over 2000 languages spoken across the continent, poses a significant challenge for audiovisual archives. This diversity complicates the cataloguing, preservation, and accessibility of archival materials (ICCROM, 2020). For example, the National Archives of Namibia (2023) struggles to provide adequate access to its diverse linguistic materials, reflecting a broader challenge across the continent in managing multilingual collections effectively.

Financial constraints significantly impact the preservation of audiovisual archives in Africa. Many institutions lack the necessary funding for proper archival storage conditions, leading to the degradation of valuable materials. The East African Film Archive, for example, faces challenges in preserving its film collections due to inadequate funding and resources, risking the loss of important historical and cultural films. The

digital divide exacerbates the challenges faced by audiovisual archives in Africa. Limited access to digital technologies hampers efforts to digitize and make collections accessible online. In Kenya, the lack of widespread technological infrastructure limits the Kenya National Archives' ability to digitize and provide online access to its audiovisual materials, restricting both preservation and public access.

In addition, worth noting that most African audiovisual archives – especially film collections – that due to many years of neglect through the application of substandard environments/ climate control for the preservation thereof many of the films are “lost” because of the devastating effects of vinegar syndrome that has taken over the collections, rendering many of the films past saving (Kotze, 2024).

Case studies. South Africa: Despite its relatively advanced infrastructure, South Africa's audiovisual archives, such as those managed by the South African History Archive (SAHA), encounter challenges in digitizing and preserving apartheid-era footage due to technological and financial constraints (SAHA, 2019). Meanwhile in Kenya, the Kenya National Archives faces difficulties in preserving and digitizing its vast collection of historical recordings, hindered by both limited resources and technological gaps (Kenya National Archives and Documentation Service (KNADS), 2022). Specifically relating to environmental research that has been captured on audiovisual archives several case studies illustrate project undertaken in South Africa, Botswana, Kenya and Namibia. In South Africa, the Table Mountain Archive contains valuable data on biodiversity conservation efforts, while the Kruger National Park's archives offer insights into wildlife management and conservation practices. Both of these archival collections have audiovisual material that needs to be preserved and made accessible to future generations. Meanwhile, in Botswana, the Okavango Delta Archives capture the dynamic ecosystem and its significance for both local wildlife and human communities. In Kenya, the Archives from the Maasai Mara and Amboseli National Park document the rich biodiversity and the challenges of managing human-wildlife conflict; and finally, in Namibia, The Namib Desert and Etosha National Park Archives offer a visual and audio record of some of the most unique ecosystems on the planet, emphasizing conservation needs and successes.

Strategies for overcoming challenges. Efforts to address these challenges include international partnerships, such as the collaboration between the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) and African archives, focusing on capacity building and resource sharing. Additionally, initiatives like UNESCO's Memory of the World Programme aim to enhance the preservation and accessibility of documentary heritage globally, including in Africa (United Nations Educational, Scientific and Cultural Organization (UNESCO) 2018). The management of audiovisual archives in Africa is fraught with challenges stemming from linguistic diversity, limited resources, and technological gaps. These issues complicate the preservation and accessibility of valuable cultural and historical records. However, ongoing efforts and international collaborations offer hope for overcoming these obstacles, highlighting the importance of sustained investment and support for the future of Africa's audiovisual heritage (UNESCO, 2018).

The role of AI in establishing smart archives

The evolution of smart archives, enabled by Artificial Intelligence (AI), marks a significant leap forward in the way archival materials are managed, preserved, and accessed. AI technologies offer the potential to transform archives from static repositories of information into dynamic, accessible, and interactive resources. This transformation is critical both globally and within the African continent, where unique challenges present opportunities for innovative AI applications. The advent of Artificial Intelligence (AI) has significantly impacted the field of archival science, leading to the development of smart archives. These advanced repositories utilize AI to manage, preserve, and provide access to a vast array of digital materials, including audiovisual archives. This literature review explores the role of AI in establishing smart archives globally, with a particular focus on its application and implications for audiovisual archives in Africa.

Global trends in AI for archives. Globally, AI is reshaping archives through automation, enhanced search capabilities, and improved accessibility. For instance, the British Library's “Living with Machines” project leverages machine learning to digitize and analyze vast collections of industrial revolution era documents,

demonstrating AI's potential to unlock historical insights from archival materials (British Library, 2019). Globally, AI technologies such as machine learning, natural language processing, and computer vision have been leveraged to automate the indexing, transcription, and annotation of archival materials. For instance, the British Library's "Unlocking Our Sound Heritage" project demonstrates how AI can be used to digitize and preserve rare and at-risk audio recordings, setting a precedent for archives worldwide (British Library, 2019).

AI in African archives. In Africa, the adoption of AI in archives faces specific challenges, including limited infrastructure and resources. However, initiatives like the South African National Archives' digitization project illustrate the growing interest in leveraging AI to overcome these barriers. AI technologies are being explored for their ability to automate the digitization process, enhance metadata creation, and improve the accessibility of archival collections. In Africa, the integration of AI into archival practices presents both opportunities and challenges. While there is a significant potential for AI to enhance the preservation of Africa's rich audiovisual heritage, challenges such as limited digital infrastructure, funding constraints, and the need for capacity building in AI technologies persist.

Technologies and applications. Key AI technologies applied in archival contexts include Machine Learning: For automatic document classification and indexing, making archival searches more efficient. Natural Language Processing (NLP): Used to analyze text for content analysis, sentiment analysis, and to generate descriptive metadata, enhancing the discoverability of archival materials. Image and Speech Recognition: Facilitates the digitization of visual and audio materials, enabling features like searchable transcripts of historical recordings. AI plays a crucial role in transforming audiovisual archives by automating the digitization process, enhancing metadata accuracy, and improving content discoverability. Technologies like speech-to-text algorithms enable the transcription of spoken words in videos and audio files, facilitating easier access and searchability. Global case studies of AI technologies include: The U.S. Library of Congress employs AI for the Newspaper Navigator project, which allows users to search and access historical newspaper images efficiently (US Library of Congress, 2021). Meanwhile in Africa,

Kenya and South Africa are also undertaking similar projects. Kenya's National Archives and Documentation Service is exploring AI to digitize and catalogue its extensive collection, aiming to make Kenya's rich history more accessible to the public and researchers alike (Kenya National Archives and Documentation Service (KNADS), 2022). Meanwhile, the South African National Archives' efforts to digitize apartheid-era documents using AI for better accessibility is a notable example within Africa. This initiative underscores the potential of AI to manage large-scale audiovisual archives efficiently (National Archives of South Africa, 2020).

Challenges and opportunities. Modiba (2021) suggests that implementing AI in archival systems presents challenges, including the need for substantial technical infrastructure, concerns about data privacy and the ethical implications of automated decision-making. However, the opportunities, particularly for African archives, are significant. AI can help overcome resource limitations, improve access to cultural and historical resources, and contribute to the preservation of Africa's heritage. Emerging AI trends, such as deep learning and advanced image recognition, promise to further revolutionize the field of smart archives (Modiba, 2021). These technologies could enable more sophisticated analysis and categorization of audiovisual content, making archives not just repositories of information but interactive platforms for education and research.

AI's role in establishing smart archives is transformative, offering new possibilities for managing, preserving and accessing archival materials. Despite the challenges, the potential benefits of AI for archives, especially in resource-constrained settings like many found in Africa, are immense. As technological advancements continue, the future of smart archives looks promising, with AI at the forefront of this evolution. AI's integration into archival practices represents a pivotal shift toward the creation of smart archives, with profound implications for the preservation and accessibility of audiovisual archives. Despite the challenges, particularly in the African context, the potential benefits of AI in enhancing archival management, accessibility, and preservation are immense. Continued investment in digital infrastructure and capacity building in AI technologies is essential to realize the full potential of smart archives in Africa and around the world.

Research methodology

In the era of Society 5.0, a postmodernist approach to developing smart archives emphasizes the integration of Artificial Intelligence (AI) to manage audiovisual archives, particularly in Africa. This approach underlines a shift from traditional, hierarchical methods of knowledge preservation to a more inclusive, decentralized digital infrastructure that values diverse narratives and multifaceted histories. Postmodernism, with its skepticism of grand narratives and emphasis on the plurality of experiences, provides a critical lens through which to examine the deployment of AI in society (Taylor, 2018). Society 5.0, characterized by its focus on technology-driven, human-centered advancement, aligns with postmodern values through its emphasis on diversity, inclusivity and the democratization of information (Taylor, 2018). AI stands at the intersection, offering tools for realizing these ideals in the management of audiovisual archives. The application of AI in audiovisual archives introduces a postmodernist framework by enabling decentralized information systems and challenging traditional, linear approaches to history and knowledge preservation. AI technologies such as machine learning, natural language processing, and computer vision facilitate the creation of dynamic, accessible archives that reflect the complex, multifaceted nature of human experience (Duff and Harris, 2002).

As noted by Rosenzweig (2003), the advent of Society 5.0 brings forth a new paradigm in which technology and human-centric values converge, offering unique opportunities for the management of audiovisual archives. In Africa, where cultural heritage is rich and diverse, leveraging Artificial Intelligence (AI) to enhance archival practices holds promise for improved accessibility, preservation, and dissemination of historical and cultural content. The primary objective of this research is to delve into the transformative potential of AI in audiovisual archives by applying observations within the African context, exploring how these technologies can be harmonized with the goals of Society 5.0 to foster a more connected, accessible, and sustainable archival ecosystem.

A qualitative approach enabled a nuanced understanding of the complex dynamics at play, including the technological, cultural and ethical dimensions. Through the observation of AI integration processes, by means of desktop analyses of websites of African

national archives and online interest groups showcasing nature conservation projects and initiatives, this article aims to capture a comprehensive picture of the current landscape and future possibilities. Case studies will provide concrete examples of AI's application in archival management, highlighting successes and challenges. These real-world insights grounded the research in practical outcomes and future potentials.

A qualitative research methodology was employed to capture the intricate dynamics involved in integrating AI into audiovisual archives. This approach facilitates a deep dive into the technological, cultural and ethical dimensions shaping this transformation. By observing the integration processes of AI in existing archival setups provides firsthand insights into how these technologies are being adopted and adapted. This method helps in understanding the operational, logistical and technical challenges and opportunities that arise from AI application in archives. The research includes a series of case studies from different African countries where AI technologies have been implemented in the management of audiovisual archives. These case studies will illustrate practical examples of AI's application, shedding light on successful strategies, encountered challenges, and the impact on accessibility, preservation, and engagement with archival materials. Engaging with key stakeholders through interviews offered valuable perspectives on the motivations, expectations and outcomes of AI integration in archival practices. Document analysis of project reports, policy documents and academic literature supplemented these insights, providing a broader understanding of the context and implications of these technological interventions.

Findings

Research design – case studies: AI-enhanced audiovisual archives in the world and Africa

The preservation of archival material on nature conservation is crucial for biodiversity research, environmental education, and policymaking. In recent years, Artificial Intelligence (AI) has played a transformative role in archiving practices, enhancing the management and accessibility of vast amounts of data, including audiovisual materials related to nature conservation. The integration of Artificial Intelligence (AI) into nature conservation efforts in Africa is revolutionizing the way audiovisual archives are utilized. These

archives, rich in biodiversity and natural heritage content, are invaluable for research, education and policymaking. AI technologies offer unprecedented opportunities for enhancing the accessibility, analysis, and management of these resources.

Globally, AI technologies such as machine learning, image and speech recognition, and natural language processing are increasingly used to automate the processing and indexing of conservation archives. For example, the Global Biodiversity Information Facility (GBIF) leverages AI to improve the accessibility and quality of biodiversity data worldwide, facilitating research and conservation efforts (GBIF, 2020).

AI applications specific to audiovisual archives include automated tagging and categorization of images and videos, speech-to-text transcription of documentaries, and enhanced search capabilities through natural language queries. These technologies significantly improve the efficiency of archiving practices, making it easier for researchers and the public to access and utilize conservation materials. The Wildlife Conservation Society's use of AI in cataloguing and analyzing camera trap footage is a prime example of how AI can aid in monitoring and preserving biodiversity (Wildlife Conservation Society, 2019).

Africa's rich biodiversity and significant conservation challenges make the continent a critical focus for smart archiving initiatives. However, implementing AI in conservation archives faces hurdles such as limited infrastructure, digital divide issues, and a lack of technical expertise. Despite these challenges, projects like the African Wildlife Foundation's use of digital archives for habitat conservation highlight the potential for AI to support conservation efforts in Africa (African Wildlife Foundation, 2021).

Notable success stories are the collaboration between the Serengeti Research Institute and Google AI to analyze vast amounts of data from the Snapshot Serengeti project. This partnership has enabled the efficient categorization of millions of camera trap images, aiding in the study and conservation of Serengeti wildlife (Snapshot Serengeti, 2020). The use of AI-powered camera traps in Kenya's national parks. These smart cameras analyze images in real-time to monitor wildlife populations, identify poaching activities, and track species migration patterns (Wildlife Conservation Society, 2019). The data collected is archived, creating a dynamic audiovisual database for long-term ecological studies. South Africa's project that employs AI to digitize and catalogue vast amounts of video and photographic data

from decades of ecological research (Wildlife Conservation Society, 2019). AI algorithms are used to tag and categorize content, making it easier for researchers to access specific data on various species and habitats. A collaboration between African conservationists and international AI researchers to develop systems that analyze satellite imagery and drone footage (Wildlife Conservation Society, 2019). This initiative aims to detect changes in landscape, such as deforestation or illegal mining, with the findings archived and made accessible for educational and policy-making purposes.

As contended by the African Wildlife Foundation (2021), the future of AI in conservation archiving is promising, with potential advancements in deep learning and computer vision expected to further revolutionize the field. These technologies could enable more sophisticated analysis of environmental changes and threats, contributing to proactive conservation strategies. The development of global digital archives, accessible to researchers and the public alike, could foster a greater understanding of and engagement with conservation issues. AI enables the efficient processing and analysis of large volumes of audiovisual data, facilitating easier access for researchers and conservationists. Through machine learning models, AI can predict potential threats to biodiversity, aiding in proactive conservation measures. AI-driven tools assist in the digital preservation of archives, ensuring the longevity of valuable ecological data (African Wildlife Foundation, 2021).

AI's role in establishing smart archives represents a significant advancement in the preservation and accessibility of archival material on nature conservation, particularly in Africa. Despite challenges, the integration of AI into archiving practices offers unparalleled opportunities for enhancing biodiversity research, environmental education, and policymaking. Continued investment in digital infrastructure and AI technologies is essential to realize the full potential of smart archives in supporting global conservation efforts. The future of AI in nature conservation through audiovisual archives in Africa holds great promise, with advancements in technology paving the way for more innovative and effective conservation strategies. Ongoing collaboration between conservationists, technologists, and policymakers will be crucial in harnessing the full potential of AI for environmental preservation. AI's implementation in African audiovisual archives represents a significant leap forward in nature conservation efforts. By enhancing

the management, accessibility, and analysis of ecological data, AI technologies are instrumental in promoting sustainable environmental practices. Continued investment in AI research and its application in conservation is essential for safeguarding Africa's natural heritage for future generations.

Recommendations for establishing smart archives in Africa

Included is a mind map for implementing smart archives for audiovisual archives in Africa (Figure 1).

The mind map diagram, which was generated using ChatGPT Diagrams for implementing smart archives for audiovisual archives, using AI in African contexts is structured around a central node labeled "Smart Archives Model." From this central node, seven primary branches extend, each representing a key component of the model. These components are:

Digitization: This branch focuses on the initial step of converting physical media into digital formats. It includes sub-nodes for "High-quality scanning" and "Format standardization," highlighting the importance of creating digital replicas that are of high quality and in formats that are widely accessible and preservable.

Metadata Generation: This component emphasizes the creation of descriptive data to make the archives searchable and manageable. It features "Automated tagging" for efficiency and "Cultural context annotation" to ensure the relevance and richness of metadata in representing African contexts.

Content Management: This branch outlines the strategies for storing, organizing and managing digital archives. It includes "AI-based categorization" for intelligent sorting and retrieval, and "Secure cloud storage" for the safekeeping of digital assets.

Accessibility: This part of the model focuses on making the archives easily accessible to various audiences. It incorporates "Multilingual search" to cater to the diverse linguistic landscape of Africa, and "Mobile accessibility" to address the widespread use of mobile devices on the continent.

Preservation: This branch deals with the long-term preservation of digital archives, ensuring they remain accessible for future generations. It includes strategies like "Climate-resilient storage" to protect against environmental threats and "Regular data integrity checks" to maintain the quality and reliability of the digital files.

Collaboration: Highlighting the importance of working together to enhance the archives, this component includes "Regional partnership networks" for sharing resources and expertise, and "Public access initiatives" to involve communities and make archives more widely available.

Training & Education: This branch underscores the need for capacity building and knowledge sharing, with "Local talent development" to foster expertise in digital archiving within Africa, and "Workshops on digital archiving" to educate stakeholders about best practices.

Each branch is designed to address both the technological and cultural aspects of building smart archives,

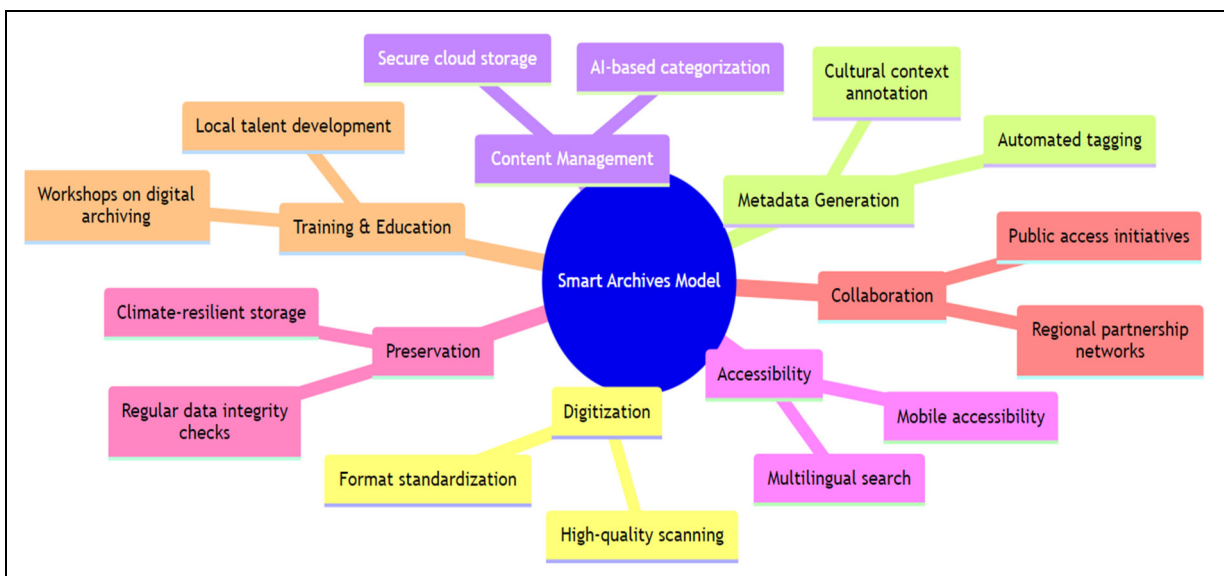


Figure 1. Image – smart archives model, Chat GPT diagrams.

ensuring that the model is both practical and sensitive to the unique needs and opportunities in African contexts.

As contended by Matlala et al. (2022) and the mind map, the Smart Archives Model (SAM) is an approach that incorporates modern technology and data analytics into the management of archival collections. This model focuses on enhancing the efficiency, accessibility, and preservation of archives through the integration of digital tools and smart technologies.

Conclusion

The development of smart archives leveraging Artificial Intelligence (AI) holds significant promise for addressing the multifaceted challenges in managing audiovisual archives within the African context amidst the transition to Society 5.0. By harnessing AI technologies, crucial aspects such as curation, accessibility, and sustainable management can be substantially enhanced, offering innovative solutions for preserving Africa's diverse cultural heritage. The formulation of a framework for implementing smart archives using AI in African contexts is imperative, emphasizing practical strategies and best practices to ensure the effective preservation and utilization of audiovisual materials for research, education and cultural exchange.

The prospects of developing smart archives in the context of Society 5.0 and leveraging Artificial Intelligence (AI) for managing audiovisual archives in Africa are promising and transformative. As digital technologies continue to evolve and become more integrated into society, the role of AI in archival practices is poised to revolutionize how audiovisual materials are preserved, accessed, and utilized. By harnessing AI technologies, archival institutions in Africa can overcome the substantial challenges posed by the exponential growth of digital content and the continent's diverse cultural landscape. AI offers opportunities for automating tasks such as metadata tagging, content analysis and search optimization, thereby improving the efficiency and effectiveness of archival processes.

Moreover, the establishment of intelligent archives facilitated by AI has the potential to democratize access to cultural heritage materials, making them more widely available to researchers, educators and the public. This accessibility can foster greater understanding, appreciation and preservation of Africa's rich cultural heritage while also facilitating cross-

cultural exchange and collaboration. However, realizing these prospects requires concerted efforts from stakeholders across various sectors, including archival institutions, governments, technology developers and local communities. Collaborative initiatives focused on capacity building, infrastructure development and policy support will be essential for ensuring the successful implementation of smart archives powered by AI in Africa.

In conclusion, the future of managing audiovisual archives in Africa lies in embracing AI technologies within the framework of Society 5.0. By doing so, African countries can not only overcome existing challenges but also unlock new opportunities for preserving cultural heritage, advancing research and education and promoting global cultural exchange in the digital age.

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References

- African Wildlife Foundation (2021) Digital archiving for habitat conservation. Available at: https://www.awf.org/sites/default/files/2021-10/2021_Conservation_Progress_Report.pdf (accessed 13 February 2024).
- Anantrasirichai N and Bull D (2022) Artificial intelligence in the creative industries: A review. *Artificial Intelligence Review* 55: 589–656. <https://link.springer.com/article/10.1007/s10462-021-10039-7> (accessed 18 February 2024).
- Aquilani B, Piccarozzi M, Abbate T, et al. (2020) The role of open innovation and value co-creation in the challenging transition from industry 4.0 to Society 5.0: Toward a theoretical framework. *Sustainability* 12(21): 8943.
- Awinja EJ (2022) *A Framework for Digital Archiving at Selected Public Universities in Kenya*. University of KwaZulu-Natal: South Africa.

- Barlindhaug G (2022) Artificial intelligence and the preservation of historic documents. *Proceedings from the Document Academy* 9(2): Article 9.
- British Library (2019) Living with Machines. <https://www.bl.uk/projects/living-with-machines> (accessed 15 February 2024).
- Brown K (Ed.) (2020) *The Routledge Companion to Digital Humanities and Art History*. New York: Routledge. <https://doi.org/10.4324/9780429505188>
- Carrive J (2019) Using artificial intelligence to preserve audiovisual archives: New horizons, more questions. In: Proceedings of the 27th ACM International Conference on Multimedia, pp. 1–2. <https://doi.org/10.1145/3343031.3349583> (accessed 18 February 2024).
- Clough GW (2013) *Best of Both Worlds: Museums, Libraries, and Archives in the Digital Age*. Smithsonian Institution. <https://doi.org/10.5479/si.9780981950013>
- Colavizza G, Blanke T, Jeurgens C, et al. (2021) Archives and AI: An overview of current debates and future perspectives. *Journal on Computing and Cultural Heritage* 15(1): 1–15.
- Darwina MW and Raharja TD (2022) The role of archivists in the Industrial Revolution 4.0 and Society 5.0. *International Journal of Social Relevance and Concern* 10(9): 16–23.
- Deguchi A, Hirai C, Matsuoka H, et al. (2020) What is society 5.0. *Society* 5(0): 1–24.
- Duff WM and Harris V (2002) Stories and names: Archival description as narrating records and constructing meanings. *Archival Science* 2(3–4): 263–285. <https://link.springer.com/article/10.1007/bf02435625> (accessed 13 February 2024).
- Eze Asogwa B (2011) Digitization of archival collections in Africa for scholarly communications: Issues, strategies and challenges. *Library Philosophy and Practice* 11: 651. <https://digitalcommons.unl.edu/libphilprac/651> (accessed 18 February 2024).
- Fukuyama M (2018) Society 5.0: “aiming for a new human-centered society.”. *Japan Spotlight* 27(5): 47–50. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwihn5Obk92FAxWASvEDHRPTC18QFnoECBMQAQ&url=https%3A%2F%2Fwww.jef.or.jp%2Fjournal%2Fpdf%2F220th_Special_Article_02.pdf&usg=AOvVaw1o7LEqKAua1dJhna8M_F55&opi=89978449 (accessed 15 February 2024).
- Global Biodiversity Information Facility (GBIF) (2020) Enhancing biodiversity data through AI. <https://www.gbif.org/what-is-gbif> (accessed 12 February 2024).
- International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) (2020) Audiovisual archives in Africa: Challenges and opportunities. <https://www.iccrom.org/> (accessed 15 February 2024).
- Jaillant L (2022) How can we make born-digital and digitised archives more accessible? Identifying obstacles and solutions. *Archival Science* 22: 417–436. <https://link.springer.com/article/10.1007/s10502-022-09390-7> (accessed 17 February 2024).
- Jaillant L and Caputo A (2022) Unlocking digital archives: Cross-disciplinary perspectives on AI and born-digital data. *AI and Society* 37(3): 823–835.
- Kenya National Archives and Documentation Service (KNADS) (2022) Innovations in archival practices: The role of AI. <https://www.archives.go.ke/digitization>
- Khurana D, Koli D, Khatter K, et al. (2022) Natural language processing: State of the art, current trends and challenges. *Multimedia Tools and Applications* 82: 3713–3744.
- Kotze B (2024) Interviews and discussions with retired audiovisual archivist in South Africa.
- Luo Y (2021) Design and Implementation of Smart Archives Information Service Architecture. In: ICISCAE’21: 2021 4th international conference on information systems and computer aided education, China. <https://doi.org/10.1145/3482632.3484063> (accessed 20 June 2024).
- Masanya TM (2018) *A Framework for Preservation of Digital Resources in Academic Libraries in South Africa*. Pretoria: University of South Africa. <https://core.ac.uk/download/pdf/477912909.pdf> (accessed 17 February 2024).
- Masanya TM and Ngulube P (2020) Factors that influence digital preservation sustainability in academic libraries in South Africa. *South Africa Journal of Libraries and Information Science* 86(1): 53–59.
- Matlala ME, Ncube TR and Parbanath S (2022) The state of digital records preservation in South Africa’s public sector in the 21st century: A literature review. *Records Management Journal* 32(2): 198–212.
- Modiba MT (2021) *Utilising artificial intelligence technology for the management of records at the Council for Scientific and Industrial Research in South Africa*. PhD thesis. University of South Africa. <https://uir.unisa.ac.za/handle/10500/28800> (accessed 19 January 2023).
- Morrar R, Arman H and Mousa S (2017) The fourth industrial revolution (industry 4.0): A social innovation perspective. *Technology Innovation Management Review* 7(11): 12–20.
- Msiza GM, Malatji KS and Mphahlele LK (2020) Implementation of an E-learning project in Tshwane south district: Towards a paperless classroom in South African secondary schools. *Electronic Journal of E-Learning* 18(4): 299–309.
- Mulauzi F, Bwalya P, Soko C, et al. (2021) Preservation of audio-visual archives in Zambia. *ESARBICA* 40: 43–59.
- Munster S, Maiwald F, di Lenardo I, et al. (2024) Artificial intelligence for digital heritage innovations: Setting up an R&D agenda for Europe. *Heritage* 7(2): 794–816.

- National Archives of Japan (2019) Towards the realization of society 5.0: The role of archives in a digital age. <https://www.nfaj.go.jp/english/2019/> (accessed 18 February 2024).
- National Archives of Namibia (2023) About the National Archives. <http://www.nationalarchives.na/> (accessed 18 February 2024).
- Netshakhuma NS (2016) *An Exploration of the Digitisation Strategies of the Liberation Archives of the African National Congress in South Africa*. Pretoria: University of South Africa. <https://core.ac.uk/reader/79171180> (accessed 18 February 2024).
- Rebound AA (2022) *Towards automatic understanding of narrative audiovisual content*. Sorbonne Université. <https://www.theses.fr/2022SORUS398> (accessed 20 February 2024).
- Rojas CA, Penafiel GAA, Buitrago DFL, et al. (2021) Society 5.0: A Japanese concept for superintelligent society. *Sustainability* 13(12): 1–16.
- Rosenzweig R (2003) Scarcity or abundance? Preserving the past in a digital era. *The American Historical Review* 108(3): 735–762.
- Sahoo SK and Choudhury BB (2024) Exploring the use of computer vision in assistive technologies for individuals with disabilities: A review. *Journal of Future Sustainability* 4: 133–148.
- Snapshot Serengeti (2020) Applying AI to conservation research. <https://www.zooniverse.org/projects/zooniverse/snapshot-serengeti> (accessed 12 February 2024).
- South African History Archives (SAHA) (2019) Challenges in preserving the apartheid archive. https://www.saha.org.za/news/history_heritage.htm (accessed 10 February 2024).
- South African National Archives (2020) Digitization strategy and implementation. <http://www.nationalarchives.gov.za/sites/default/files/u59/National%20Archives%20Digitisation%20Strategy%20-%20approved%20November%202013.pdf> (accessed 18 February 2024).
- Taylor A (2018) Postmodernism and archives: A dynamic duo? In: Wallace M and Buchanan SE (eds) *In Archives and New Modes of Feminist Research*. Toronto: University of Toronto Press, 95–113.
- Unal FZ, Guzel MS, Bostanci E, et al. (2023) Multilabel genre prediction using deep learning frameworks. *Applied Sciences* 13: 8665.
- United Nations Educational, Scientific and Cultural Organisation (UNESCO) (2018) Memory of the world: Safeguarding the documentary heritage of humanity. <https://www.unesco.org/en/memory-world> (accessed 10 February 2024).
- US Library of Congress (2021) Newspaper navigator: Exploring a treasure trove of historical newspapers with AI. <https://www.loc.gov/item/prn-21-028/> (accessed 15 February 2024).
- Valente J, António J, Mora C, et al. (2023) Developments in image processing using deep learning and reinforcement learning. *Journal of Imaging* 9(10): 1–22.
- Wildlife Conservation Society (2019) AI for wildlife conservation. <https://www.wcs.org/get-involved/updates/wcs-launches-groundbreaking-a-i-tool-for-our-oceans> (accessed 15 February 2024).
- Zheng Z (2022) The classification of music and art genres under the visual threshold of deep learning. *Computational Intelligence and Neuroscience* 2022: 1–8.

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