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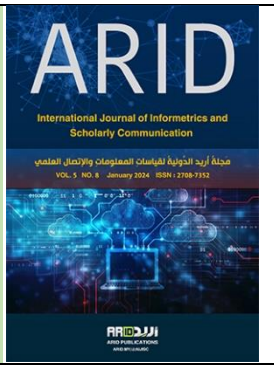

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Management of Audiovisual Archiving in the Context of Tunisia's National Artificial Intelligence Strategy

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إدارة الأرشفة السمعية البصرية في سياق استراتيجية تونس الوطنية للذكاء الاصطناعي

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ABSTRACT

This study aims to analytically highlight the efforts made by Tunisian national television to integrate artificial intelligence (AI) applications into its audiovisual production management policy, within the framework of implementing and overcoming the challenges associated with a national strategy for this innovative technology. The research is based on a qualitative methodology that includes both field observations and semi-structured interviews with experts working in the documentary management unit of the national television. Additionally, it involves a documentary analysis of all reports and strategic documents that reflect the process of implementing the national AI strategy and the various modernization projects of the national television. The results, informed by the experience of the French Audiovisual Institute (INA-France) in using AI applications for processing, analyzing, and enhancing audiovisual resources, demonstrate the vital need for Tunisian national television to adopt AI techniques within a coherent national context. Furthermore, there is a necessity for a complete digital transformation to fully play its role and remain competitive in the intelligent media landscape. By examining possible collaborations between the ambitions of Tunisian national television and the proven practices of major international channels, the study highlights the importance of strategic planning and proactive actions for AI integration. It also details the benefits and potential obstacles of this integration, emphasizing the need for a collective effort to incorporate AI into Tunisian media production, thereby positioning the country at the forefront of technological innovation.

Keywords: Knowledge Audiovisual Resources, Artificial Intelligence Techniques, Digital Preservation, Tunisian National Television Corporation, National Strategy for Artificial Intelligence.

الملخص

تهدف هذه الدراسة إلى تسليط الضوء بشكل تحليلي على الجهود التي بذلها التلفزيون الوطني التونسي لإدماج تطبيقات الذكاء الاصطناعي في سياسته لإدارة الإنتاج السمعي البصري، وذلك في إطار تنفيذ استراتيجية وطنية لهذه التكنولوجيا المبتكرة والتغلب على التحديات المرتبطة بها. يعتمد البحث على منهجية نوعية تتضمن الملاحظات الميدانية والمقابلات شبه المنظمة مع خبراء يعملون في وحدة إدارة الأفلام الوثائقية بالتلفزيون الوطني. بالإضافة إلى ذلك، يشمل التحليل الوثائقي جميع التقارير والوثائق الاستراتيجية التي تعكس عملية تنفيذ الاستراتيجية الوطنية للذكاء الاصطناعي ومشاريع التحديث المختلفة للتلفزيون الوطني. وتظهر النتائج، المستمدة من تجربة المعهد الفرنسي للسمعي البصري (INA-France) في استخدام تطبيقات الذكاء الاصطناعي لمعالجة الموارد السمعية والبصرية وتحليلها وتعزيزها، الحاجة الحيوية للتلفزيون الوطني التونسي لتبني تقنيات الذكاء الاصطناعي ضمن سياق وطني متماسك. علاوة على ذلك، هناك ضرورة للتحول الرقمي الكامل ليلعب دوره بشكل كامل ويظل قادرًا على المنافسة في المشهد الإعلامي الذكي. من خلال دراسة التعاون المحتمل بين طموحات التلفزيون الوطني التونسي والممارسات المثبتة للقنوات الدولية الكبرى، تسلط الدراسة الضوء على أهمية التخطيط الاستراتيجي والإجراءات الاستباقية لتكامل الذكاء الاصطناعي. كما توضح بالتفصيل الفوائد والعقبات المحتملة لهذا التكامل، مع التركيز على الحاجة إلى جهد جماعي لدمج الذكاء الاصطناعي في الإنتاج الإعلامي التونسي، من أجل وضع البلاد في طليعة الابتكار التكنولوجي.

الكلمات المفتاحية: الموارد السمعية البصرية، تقنيات الذكاء الاصطناعي، الحفظ الرقمي، مؤسسة التلفزة الوطنية التونسية، الاستراتيجية الوطنية للذكاء الاصطناعي.

Introduction

There's no denying that artificial intelligence, comprising a range of techniques and technologies designed to mimic and supplement human abilities in perception and cognition, has permeated every aspect of the digital era, particularly in libraries and information centers. Its impact is especially pronounced in the realm of audiovisual content management, encompassing television. Indeed, this technology has completely transformed operations and procedures within television entities, from the inception of audiovisual content to the amalgamation of recordings with metadata, alongside their reproduction and dissemination. Furthermore, artificial intelligence has become indispensable for revitalizing and enriching the assets and collections of information centers worldwide.

Arab television networks, cognizant of this technological advancement and determined not to lag behind, are actively integrating these innovations. They possess a wealth of rich and diverse audiovisual heritage, reflecting the cultures and histories of societies. Confronted with the proliferation of television productions, these organizations have formulated strategies and blueprints to refurbish, maintain, and digitize their collections. The progression of these endeavors underscores both the eagerness of audiovisual institutions to embrace and leverage AI technologies and the profound impact of national AI strategies on adoption across various sectors, including the audiovisual domain.

The Tunisian Television Society, akin to numerous other Arab television entities, boasts a storied legacy dating back to the colonial era. Its production capabilities have evolved, transitioning from early analog paradigms to contemporary digital orientations. Engaged in diverse maintenance and digitization initiatives for its collections, particularly on a Mediterranean regional scale, it has embarked on an ambitious modernization venture in collaboration with the Union of French

Television and Radio Institutions (France Media Monde). Entitled "Institutional Support for the Modernization of Tunisian Public Television" and funded by the European Union, this initiative seeks to comprehensively overhaul the institution, impacting the entirety of the television production process. This encompasses the establishment of a state-of-the-art archiving system, exemplified by the Dalet audiovisual material management platform, currently augmented by AI programs for metadata enrichment through facial recognition and automated transcription. Moreover, the utilization of machine learning in news creation, broadcasting, and other applications underscores the institution's steadfast commitment to artificial intelligence technology.

Study Objectives and Questions

The primary goal of this investigation is to illuminate the adoption and utilization processes of artificial intelligence techniques within the Tunisian Television Information Center, focusing on enhancing the management and appreciation of its audiovisual resources. Additionally, the study delves into collaborative approaches with emerging national institutions in the artificial intelligence sphere, aiming to foster the development of Arabic-based systems, inspired by the trailblazing expertise of France. Moreover, it endeavors to grasp the pivotal role played by the audiovisual sector in consolidating unified approaches, thus facilitating the formulation of a comprehensive and harmonized national strategy for artificial intelligence.

This research endeavors to address the following inquiries:

- To what extent is the Tunisian Television Company prepared to incorporate and harness artificial intelligence technology for processing, analyzing, and enhancing its audiovisual assets?

- Which primary artificial intelligence programs are prone to adoption by television information centers, leveraging French proficiency in this domain?
- What is the efficacy of artificial intelligence tools in handling the Arabic language?
- How extensive is the participation of the audiovisual sector within television organizations in national strategies concerning artificial intelligence?

Research Methodology

This study employs a qualitative methodology, which integrates a field visit and semi-structured interviews with the managers of the documentation unit within the Tunisian National Television Company. Furthermore, it conducts a thorough examination of the text outlining the modernization project of this institution, emphasizing the significance of the newly adopted system. Departing from a non-comparative standpoint, the research seeks to glean insights from pioneering endeavors, leveraging the expertise of the French Audiovisual Institute in processing, analyzing, and enhancing audiovisual recordings. INA-France utilizes a range of integrated artificial intelligence tools and systems, alongside other advancements originating from the institute. Furthermore, this study attempts to make an in-depth analysis of the main strategic texts of the functioning of Tunisian national television as well as the texts linked to the national strategy linked to artificial intelligence. Among these documents, we cite that of October 14, 2020, published by the United Nations Economic and Social Commission for Western Asia.

Literature Review and Studies on the Techniques of Artificial Intelligence and the Management of Audiovisual Resources

- **Artificial Intelligence: From Origins to Revolution**

Artificial intelligence, a field encompassing a multitude of disciplines including computer science, biology, psychology, linguistics, mathematics, and mechanical engineering, has its roots tracing back to 1943. It was during this time that the first mathematical model for constructing a neural network was introduced in a seminal scientific article titled "Logical Calculation of Fundamental Ideas in Neural Activity" (McCulloch & Pitts, 1943). As research progressed, the year 1950 saw the inception of the first computer equipped with a neural network, developed by Harvard University students Marvin Minsky and Dean Edmonds. Shortly thereafter, the Turing test emerged as a means of assessing artificial intelligence (Sansonetti, 2022). It wasn't until 1956 that the term "artificial intelligence" was formally coined and defined.

Since its origins, the field of artificial intelligence has steadily advanced, with landmark moments like IBM Deep Blue's historic victory over world chess champion Garry Kasparov in 1997. However, the rapid advancement of artificial intelligence owes much to the rise of big data. This vast reservoir of diverse, voluminous, and dynamic data has provided a robust foundation for enhancing learning processes, decision-making, and the generation of ideas and solutions. Moreover, artificial intelligence has reaped significant benefits from these developments, enhancing its analytical prowess in the process.

Artificial intelligence, often described as a realm encompassing the sciences and technologies aimed at replicating, extending, or enhancing human intelligence through machines, remains a subject of ongoing debate regarding its precise definition. Some argue that it represents a departure from traditional scientific disciplines, such as mathematics or computer science, towards a more

pragmatic and applied approach (Pallanca & Read, 2021). Its significance lies in its capacity to outperform the human mind in terms of speed in processing, assimilating, and interpreting data to make complex decisions. Today, its applications span a wide spectrum, from predicting consumer behavior in commercial settings to detecting fraudulent activities and enhancing customer service interactions online, particularly in contexts where decision-making processes are intricate.

These applications are underpinned by various technologies associated with intelligent machines, notably machine learning. We encounter manifestations of these technologies in our daily lives through social media algorithms, virtual assistants like Siri, or e-commerce chatbots. Consequently, artificial intelligence not only simplifies numerous tasks but also emerges as a valuable ally in knowledge management. Information and document institutions increasingly rely on artificial intelligence, particularly in the realm of digital content management, where it enables faster and more efficient processing. This article aims to delve into the realm of intelligent digital content management, with a particular focus on audiovisual content, which has traditionally posed unique challenges within the information sector (Global Digital Encounters, 2022).

- **Utilizing Artificial Intelligence for Audiovisual Content Management**

The advent of artificial intelligence (AI) technology has sparked a significant transformation in the realm of information and document management, offering innovative solutions for handling, analyzing, publishing, and researching stocks and collections of various kinds. This technology not only ensures a marked improvement in the quality and speed of information processing but also enhances security, while simultaneously opening up new avenues for professionals across diverse sectors. In particular, the integration of AI in managing audiovisual content and materials has witnessed myriad applications, driven by the diverse activities and professions within the

audiovisual sector, including media, audiovisual journalism, film production, and television broadcasting.

The content produced by television organizations and stations represents a treasure trove that AI can effectively retrieve, evaluate, and make accessible. Ranging from live broadcasts to recorded programs such as news bulletins, entertainment shows, educational programs, sports events, documentaries, interviews, and advertisements, these materials exist in both analog and digital formats, each carrying significant historical, documentary, and research value. Serving as the "living memory" of humanity, they offer invaluable insights into past events and provide unique testimonies (Mkadmi, 2021). Given that these contents are increasingly generated by smart devices, such as smartphones, smart TVs, and smart cameras, the management of these resources necessitates intelligent tools capable of sophisticated processing and analysis (ENC & Poupeau, 2020).

AI has ushered in profound transformations in the management of audiovisual content, revolutionizing the way it is organized, analyzed, utilized, and accessed. AI systems streamline the management of audiovisual stocks by automatically organizing files, proposing efficient sorting and archiving mechanisms, and identifying duplicates (Leclaire & Leroy-Terquem, 2021). Moreover, AI facilitates the automation of complex tasks like indexing, analyzing, and classifying audiovisual content, leveraging machine learning techniques such as artificial neural networks and supervised learning algorithms to train models capable of automatically indexing and categorizing content based on its characteristics (Dong et al., 2022).

Additionally, AI technology enables natural language processing, information extraction, sentiment analysis, and language translation (Prokhorov, 2019). It can enrich content by integrating augmented reality elements, explanations, and interactive features (Azzam, 2021).

Furthermore, AI systems enhance search engines by delivering more relevant and personalized results (Bellot, 2020), while also automating routine tasks such as responding to inquiries, scheduling appointments, and managing workflows, thereby freeing up time for IT professionals to focus on more complex, high-value-added tasks. Moreover, AI contributes to bolstering data security by thwarting cyber-attacks and safeguarding sensitive information (Al-Hadi, 2021).

Perhaps one of the most important experiences for the uses of artificial intelligence in this field is that of the French National Institute for Audiovisual - INA.

An Analytical Exploration of the French National Audiovisual Institute's Utilization of Artificial Intelligence Techniques for Audiovisual Collection Management

Established in 1974 by Law No. 696-74 of August 7, 1974, the French National Audiovisual Institute has been tasked with the preservation of radio and television productions for commercial, professional, and research purposes. Its mandate was further solidified with Legal Deposit No. 546-92 dated June 20, 1992, which expanded its scope to encompass the productions of both private and government radio and television channels. Subsequently, with the proliferation of digital media on the internet, the institute extended its legal deposit to include online content under the law of August 1, 2006, pertaining to "Copyright and Related Rights in the Information Society" (DADVSI).

As of 2022, the institute's collections, as outlined in its annual report for the year, comprised a staggering 25,833,868 hours of radio and television recordings. Among these, 391,764 hours were deposited for legal purposes, while 2,442,104 hours were archived for professional and commercial use. In addition to traditional media, the institute also amassed a substantial amount of digital content, with 17,569 websites and a total of 130 billion copies collected since 1996.

Furthermore, it has archived 16,302 Twitter accounts, totaling 3 billion tweets since 2014, and 11,134 video platforms with 36 million video clips since 2008 (INA, 2022a).

Figure 1: Preservation of the audiovisual archive at INA-France (Poupeau, 2021)

In response to the mounting challenges posed by the burgeoning size of its audiovisual heritage, the French National Audiovisual Institute is currently undergoing a technological transformation in its processing, preservation, and valorization efforts, leveraging modern solutions based on artificial intelligence (AI). Pierre Letessier, head of the "Artificial Intelligence Integration Cell," highlights the institute's ability to extract new metadata from its archives, thereby enhancing accessibility for all stakeholders (ibid.).

This study delves into the strategic approach adopted by the Data & Technologies Department, in collaboration with the Heritage Department, to develop and deploy AI-based systems for processing and analyzing its reserves. The French National Audiovisual Institute aims to expedite its development and bolster its digital, cultural, and heritage strategy while solidifying its position

as a preeminent global institution dedicated to preserving the memory of radio and television over the past 80 years (INA, 2022).

Situated within the "multi-functional pole" of the Institute, the Data and Technology Department houses units responsible for processing and valorizing audiovisual assets through a research and innovation policy grounded in modern technologies. These efforts draw upon the expertise of specialists in data and technology, spanning the audiovisual, documentary, and archival domains (Letessier, 2022). Under an integrated work policy, these units explore and employ various AI-based programs, both proprietary and open-source, encompassing tasks such as image and scene recognition, face analysis, optical character recognition, transcription, named entity extraction, and audio analysis (Dribault Dujardin, 2023).

The French National Audiovisual Institute currently employs AI tools to streamline the processing of recordings subject to legal deposit, facilitating their retrieval, availability, and valuation. While some programs have received approval, others are undergoing testing and evaluation. Notably, Places 365 stands out as a crucial AI tool employed by the Institute for audiovisual archive management, enabling viewer and location identification through a database comprising 1.8 million images across 365 scene categories. Additionally, the Trombinos system, developed in-house by the INA Institute, employs a built-in facial recognition model to automatically extract faces from television program content. This system boasts a vast database containing 62 million identified faces and a further 540 million unidentified faces, empowering users to search images, update data, and enrich metadata pertaining to various personalities (INA, 2022b).

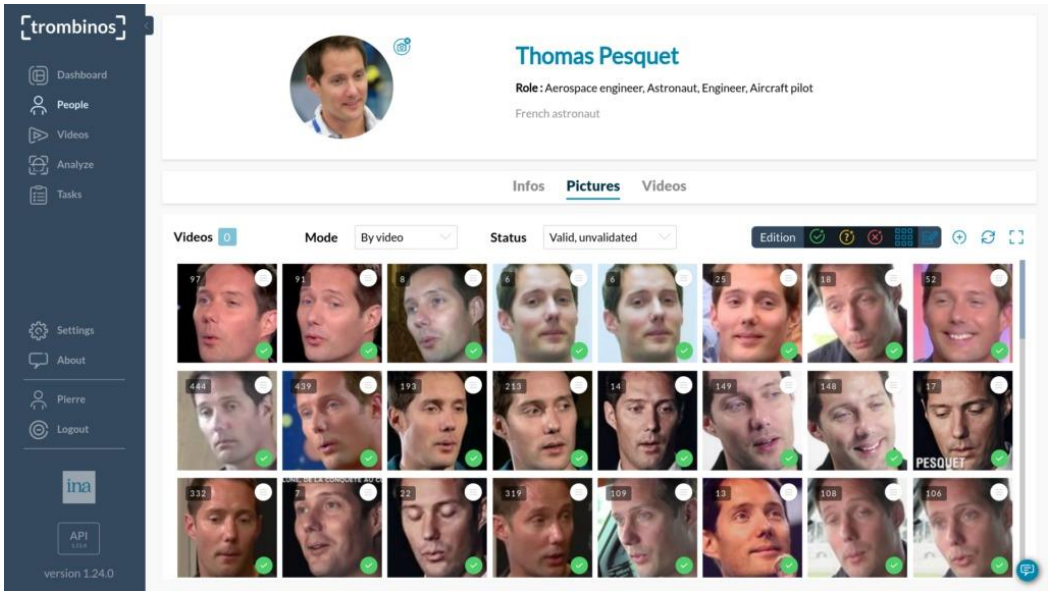

Figure 2: Trombinos facial recognition system https://inalelab.hypotheses.org/1249

While Trombinos is presently utilized by the INA Institute for facial recognition, its application in voice recognition is still undergoing study and experimentation. Efforts are underway to enrich the metadata of the database to establish connections between voice and image identification. In a Speech Segmenter is also employed to segment voice, determine speaker gender (male or female), and categorize audio signals into speech, music, noise, and silence segments. Additionally, the Vocapia system plays a role in processing speech across multiple languages, conducting audio analysis, and transcribing it into text, encompassing radio and television programs as well as podcasts. These systems are complemented by several others currently in use or undergoing testing (Poupeau, 2021).

Furthermore, the Media Scope tool (Hurst, 2021) warrants mentioning for its specialized capability in analyzing television news. It facilitates the processing of video clip images through optical character recognition (OCR) and optical layout recognition (OLR), converting textual content within images into usable text. This allows for the identification of journalists' data displayed on-

screen, including their names and the topics covered, as well as the recognition of visual objects through tools like DigInPix28, facial analysis, and image classification.

Moreover, MediaScope extends its functionality to analyze audio components, distinguishing speech, music, and ambient noise. This enables tasks such as speaker change detection, speech-to-text conversion, and audio classification based on characteristics like sound, music, or accompanying noise. Voice recognition capabilities are also integrated, comparing speaker voices to a predefined dictionary or audio database.

Additionally, Media Scope processes relevant metadata like title, director, actors, and genre for indexing purposes. This is achieved through automatic recognition of named objects in the text and linkage to external databases. Furthermore, automatic classification and creation of document collections are facilitated by statistical analysis of vocabulary and user interaction (Hurst, 2021).

According to insights gleaned from the French National Institute of Audiovisuals, the integration of artificial intelligence promises a significant leap forward, particularly in the indexing of audiovisual recordings. This is accomplished through the use of sophisticated algorithms for image recognition and natural language processing. Furthermore, AI facilitates more precise and contextual searches within audiovisual resources by leveraging language models to comprehend user queries and deliver relevant results. Additionally, AI technologies can automatically append annotations to audiovisual content by identifying various elements such as objects, scenes, and emotions depicted in videos. This streamlined tagging process enhances content organization, searchability, and evaluation.

Moreover, artificial intelligence enables the analysis of audience reactions to audiovisual content by scrutinizing comments, expressed sentiments, and social media interactions. This valuable feedback assists professionals in gauging audience reception, making necessary enhancements,

and ensuring compliance with copyright regulations through the automated identification of protected content. In essence, the integration of artificial intelligence in audiovisual resource management enhances accessibility, quality, and relevance. It empowers institutions and users alike to harness the vast array of audiovisual content available, thereby ushering in new possibilities in the realm of audiovisual archiving.

In light of these advancements, what is the current landscape of audiovisual resource management at the Tunisian Television Corporation amidst the era of artificial intelligence?

Results of the Study Related to the Reality of the Use of Artificial Intelligence Techniques in Tunisia

- **Artificial Intelligence Techniques for Managing Audiovisual Groups at the Tunisian Television Corporation**

The archives of Tunisian national television boast a rich collection of audiovisual content dating back to 1966, coinciding with the inception of government television broadcasting under the Tunisian Radio and Television Corporation - ETT, established by an order on April 25, 1957. In 2007, radio and television operations were separated, leading to the establishment of the Tunisian Television Corporation as an independent entity through Decree No. 1868 on July 23, 2007. Operating as a public audiovisual institution under the oversight of the Prime Minister, its mandate, as outlined in Chapter Three of the decree, encompasses delivering public television services, fostering media promotion, enriching the audiovisual landscape, providing national and regional information services, offering television-related services and products, producing dramas and television films, and leveraging advanced technologies for production while preserving and digitizing its visual inventory.

Presently, the Tunisian Television Corporation is engaged in revamping its overarching strategy, programming, and production processes to align with the digital transformation sweeping through media production pathways. Currently focusing on data engineering, the corporation aims to digitize, process, analyze, preserve, and enhance the value of television production. This pivotal phase lays the groundwork for adopting modern technologies, with a particular emphasis on implementing artificial intelligence systems and technologies that are revolutionizing the global media landscape.

Amidst the surge in media consumption via digital platforms and mobile applications, coupled with evolving economic models predominantly reliant on information and knowledge, the Tunisian Television Corporation has embarked on a twinning project with the French Public Media Union. Under the project "Institutional Support for the Modernization of Tunisian Public Television" TN 18 ENI TE 01 20-, funded by the European Union with a budget of one million euros, this initiative commenced in May 2021 and concluded in November 2023. Through this collaboration, the Tunisian Television Corporation aims to implement key reforms focusing on modernizing its organizational structure, bolstering its public service role, and transitioning into an integrated media system. The twinning project includes comprehensive training programs covering governance, organizational enhancements, programming support, and capacity building at the television training center, alongside the design and development of an integrated information system and a shared digital platform.

The DALET Media Asset Management system has been implemented to streamline the entire audiovisual production workflow, encompassing program preparation, production, management, archiving, and content distribution. At the core of the Dalet Galaxy software package are collaborative tools that ensure seamless integration across various workflows, including information production, program management, news production, and content management. This

system offers the flexibility to customize functions according to organizational requirements, such as scheduling, chat functionality, and notifications.

Upon the establishment of the DALET system, the content of programs from Tunisian television channels Al Wataniya 1 and Al Wataniya 2 was directly integrated to enrich the database of the new system. Additionally, digitizing the television archive has become imperative, with the Television Archive Unit tasked with digitizing programs and recordings from the audiovisual stock and integrating them into the DALET system database as per the requests of channel management, programming, and broadcasting departments.

The DALET system serves as the nexus connecting workflows across all production, broadcasting, and archival units of the National Television Corporation. This integration is in line with Order No. 99-1236 issued on June 4, 1999, pertaining to the organization of the Tunisian Radio and Television Corporation. Furthermore, a procedures manual has been developed to facilitate the utilization of the DALET system by various departments, including the General Administration of Television Channels, National Channel 1 Administration, National Channel 2 Administration, Television Archive Sub-Department, and Technical Television Administration.

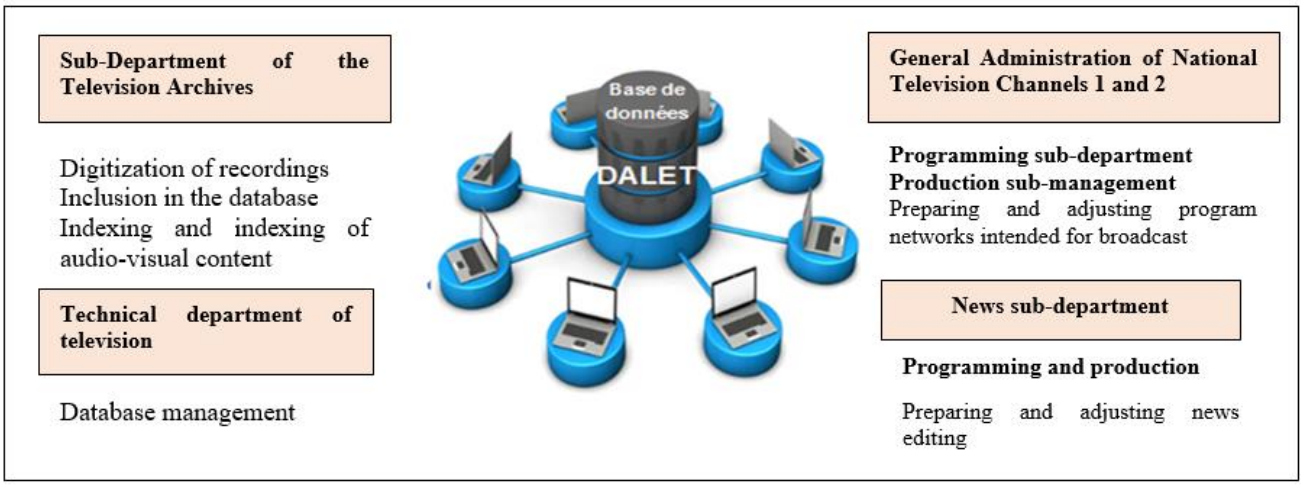

Figure 3: DALET is an integrated system for managing audiovisual contents

It's worth noting that the entity behind the DALET system is actively pursuing the integration of artificial intelligence technology into its specialized systems for processing broadcast programs and audiovisual media. This integration encompasses AI solutions aimed at enhancing audiovisual content with metadata through the use of facial recognition algorithms and speech-to-text transcription algorithms. Furthermore, artificial intelligence is leveraged within the DALET software to aid in editing processes, providing publishers with relevant content related to editorial topics, news formatting, and other solutions.

The Tunisian Television Company identified the analysis of the "8 p.m. news" using artificial intelligence as a key priority in its research endeavors. Consequently, it entered into a partnership in 2018 with a research laboratory at the National Engineering School of Monastir (ENIM) to develop dedicated software for this purpose. Today, the DALET system potentially enables the processing, analysis, and indexing of television news using a diverse array of artificial intelligence tools to extract metadata, including face recognition, event identification, personality recognition, and audio transcriptions.

Artificial intelligence technology has emerged as a crucial solution facilitating the reuse of content from the extensive inventory of the Tunisian National Television Company, which has long been confined to analog formats. This inventory comprises approximately 280,000 recordings stored across various mediums, such as Pelicule Film tubes (1966-1995), 02. Inch Quadruplex bearings (1970 - 1989), 4/3 Umatic cassettes (1980-1990), BNC bearings (1980-1994), VPR (1980-1994), VHS (1983-2010), BETACAM SP (1990-present), BETACAM digital (2000-present), as well as IMX and DVC PRO (2001-present).

To ensure the security and backup of this wealth of information, the Tunisian National Television Company has fortified the DALET integrated data system with a digital archiving server. This server, in collaboration with Xen Data (https://xendata.com/), employs cutting-edge technology, including the use of the modern Linear Type Open (LTO) loader.

It should be noted that 90% of the audiovisual content of the Tunisian Television Corporation's collections is in Arabic. Therefore, we raise the question of the effectiveness of artificial intelligence tools in processing the Arabic language.

- **Exploring the Intersection of Artificial Intelligence and the Arabic Language**

Despite the inherent complexities of computerizing the Arabic language due to its etymological intricacies, morphological richness, and diverse dialects, several artificial intelligence programs are actively engaged in understanding Arabic today. However, the challenge lies in developing linguistic models, primarily due to the scarcity of Arabic language resources on the Internet compared to other languages, despite its widespread use. Enhancing models and tools to achieve greater accuracy and effectiveness with Arabic remains a pressing goal. It's possible that the effective adaptation of these technologies to Arabic may require the active involvement of Arabic-speaking communities in the development of AI programs tailored to their language (Bobbs, 2023).

Big data, characterized by vast sets of unstructured data, fuels artificial intelligence algorithms, with the quality of AI directly linked to the quality of the data it operates on. Hence, the Arab region is actively working on developing big data infrastructure and establishing more data centers to support its AI strategies. However, it's noted that substantial amounts of big data in the Arab region are predominantly in languages other than Arabic, often stored outside the region. There's a growing call to localize technologies in the Arab context, considering its cultural, political, and

social nuances, and to create Arabic datasets to empower startups and AI programmers to develop applications and train machines effectively in this language (United Nations - ESCWA, 2020).

At the national level, Tunisia has seen the emergence of several promising companies in the artificial intelligence sector. Notably, Insta Deep, founded in 2014, has risen to prominence as a leader in Europe, the Middle East, and Africa. The company is actively engaged in various global AI programs, including Google's DeepMind, Intel's AI Builders, and Nvidia's Deep Learning initiatives. Additionally, companies like Enova Robotics, established in 2014, have made significant strides, with Enova Robotics being recognized among the top 17 robot manufacturers globally. During the Covid-19 pandemic, their Pearl Guard robot patrolled the streets to ensure adherence to quarantine measures, while the e Touch-Bot served as a nurse and home assistant for the elderly. The Veasense robot supported medical staff by assisting in patient care (Mejri, 2020).

One of Tunisia's pivotal institutions driving language development is iCompass, specializing in natural language processing. Since 2020, iCompass has seen significant growth, particularly in the realm of North African, African, and sub-Saharan dialects, alongside various Arabic dialects. This specialization has fostered collaboration between iCompass and Enova Robotics since July 2020. Beyond its primary focus, iCompass has also ventured into robotics, developing the "Aziza 3ziza" chat robot. This innovative creation is adept at understanding the Tunisian dialect and engaging in sustained conversations, owing to its deep learning algorithms and extensive knowledge base. Furthermore, its second iteration boasts the capability to detect emotional tension in individuals.

Tunisia hosts a burgeoning landscape of emerging institutions in artificial intelligence, spanning diverse specializations including machine learning, deep learning, computer vision, natural language processing (NLP), and predictive analysis. Notable among these are Tunisian startups such as Data performers, Majest EYE, ARTMIND, Koios Intelligence, YOBITRUST, Super Viz,

SWART, Epi Style, and Syslens Electronics, underscoring the nation's vibrant AI ecosystem (Mejri, 2020).

Given the proliferation of these emerging AI institutions, there's an opportunity to forge collaborative partnerships with national entities in the audiovisual sector. Moreover, nurturing a supportive ecosystem is imperative to formulate a comprehensive national policy for advancing Tunisia's AI strategy. Such initiatives promise to harness the synergies between technology and various sectors, driving innovation and economic growth.

- **National Artificial Intelligence Strategy**

The Economic and Social Commission for Western Asia (ESCWA) has crafted a national guide titled "Developing a Strategy for Artificial Intelligence" (October 14, 2020), as part of the United Nations' endeavor to align the Arab region with the objectives outlined in the 2030 Plan for digital transformation. This guide underscores that AI is a product of collaborative efforts across government, private sector, and NGOs, emphasizing its inseparability from key considerations such as security, data protection, privacy, and integrity. Furthermore, it highlights the ethical dimension of AI and stresses the importance of responsible programming, which should be integral components of national strategies.

The guide advocates for comprehensive national strategies that encompass a broad spectrum of elements, including legislation to foster innovation, investment in human resources, and the development of requisite infrastructure for AI deployment. It also underscores the importance of updating educational curricula to cultivate skills such as critical thinking, collaboration, teamwork, social interaction, and emotional intelligence, which are essential for navigating the AI-driven future.

In the global landscape of national strategies supporting the digital economy, with a focus on the adoption of modern technologies like AI, countries worldwide, including those in the Arab region, are categorized into three levels. Tunisia, positioned at the second level of "anticipated strategies," is recognized as a country with burgeoning digital capabilities. However, its strategy is noted as being incomplete, signifying the need for further development and refinement in aligning with the evolving digital landscape.

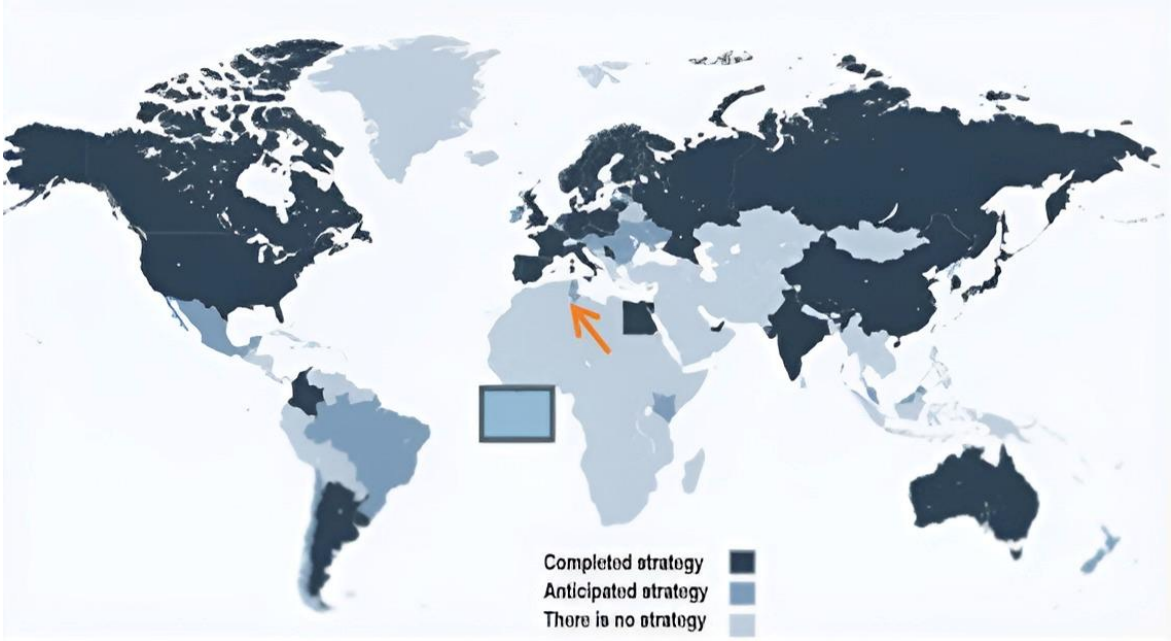

Figure 4: Digital economy strategies (Arab Federation for the Digital Economy, 2018)

The Economic and Social Commission for Western Asia (ESCWA) Handbook sets out the prerequisites and essential elements needed to develop a comprehensive artificial intelligence (AI) strategy. These prerequisites, as outlined, encompass a spectrum of vital factors. Firstly, there's an imperative for a ubiquitous, open, and secure internet infrastructure, followed by the cultivation of a dynamic startup ecosystem rich in capital, software expertise, government backing, innovative

academic institutions, cutting-edge technologies, and a populace conducive to entrepreneurial ventures. The third requisite underscores the importance of digital literacy, advocating for curriculum reforms embedding information and communication technologies (ICT) in educational programs from primary levels onwards. Lastly, the availability of substantial big data reserves, underpinned by a robust legal framework ensuring data privacy and security, is emphasized, recognizing big data as the cornerstone for training AI algorithms.

Delving into the components essential for a successful AI strategy, the ESCWA guide elucidates a multifaceted approach. Firstly, it underscores the necessity for legislation attuned to innovation's imperatives, ensuring accountability in AI algorithm deployment, effective risk management, and robust data protection measures. Secondly, it highlights the pivotal role of government as a facilitator of innovation, necessitating the establishment of research councils, universities, and the attraction of foreign investment to bolster the AI ecosystem. Additionally, governments are urged to stimulate demand for AI applications, foster collaboration in scientific research and development, and streamline technology adoption. Talent acquisition, through attracting skilled professionals in software engineering and data science, is deemed crucial, alongside fostering public-private partnerships and standardization efforts in ICT. Heightened awareness among the populace regarding AI technology's advancements is emphasized, alongside sector-specific delineation of AI applications, spanning healthcare, transportation, logistics, and commerce. Moreover, the imperative to generate employment opportunities in the AI era and establish governance frameworks, with designated administrative units overseeing AI strategy implementation under the purview of the Ministry of Technology or Digital Economy, is underscored.

In Tunisia, the Ministry of Communication Technologies and the Digital Economy is responsible for creating strategic plans to promote the digital knowledge economy. This includes developing

strategies for advanced technologies like the Internet of Things and artificial intelligence, as well as other areas related to information and communications technology. To achieve its goals, the efforts of several departments and operational units affiliated with the Ministry combine with the efforts of effective public institutions, as shown in the following figure:

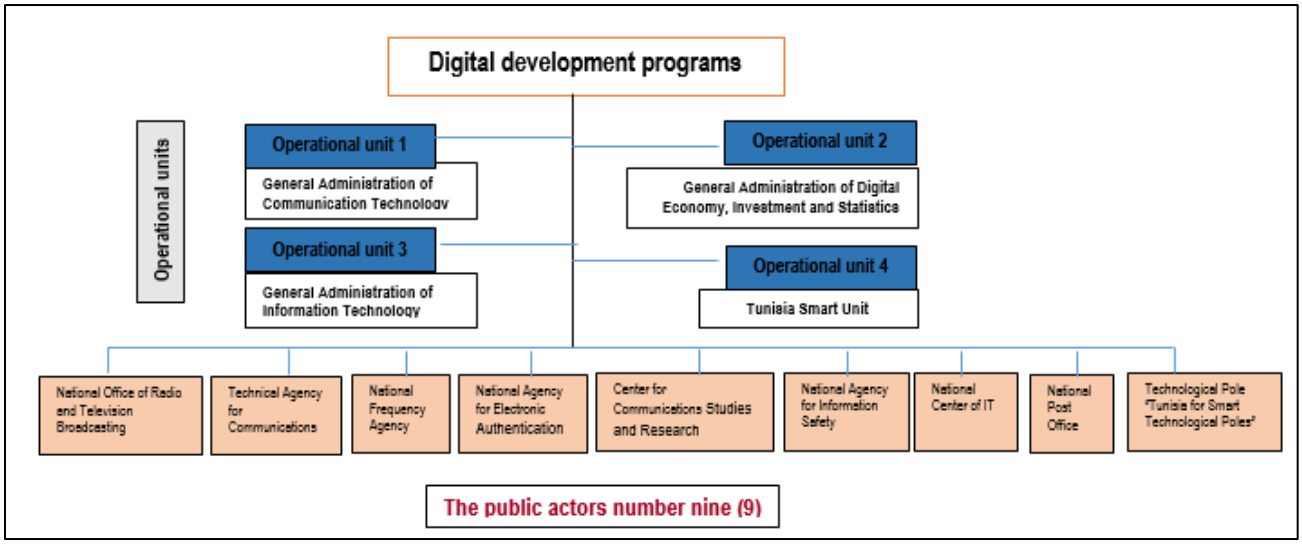

Figure 5: Operational units and public institutions active in the digital development program (Ministry of Communication Technologies, 2020)

Tunisia has embarked on a legislative journey to fortify its digital transformation strategy, enacting a series of laws and decrees to underpin pivotal projects and initiatives. For instance, the inception of the "Smart Tunisia" project, catalyzed by Decree No. 6 of 2014, aims to bolster research and development services alongside data processing and software application development. Similarly, Law No. 18 of 2010 fosters innovation in information and communication technology, while Law No. 13 of 2007 lays the groundwork for establishing a digital economy. Furthermore, Government Order No. 1062 of 2019 heralds the establishment of the "Tunis International Center for the Digital

Cultural Economy," further advancing Tunisia's digital agenda. Law No. 20 of 2018, pertaining to emerging enterprises, underscores the nation's commitment to nurturing innovative ventures through modern technologies.

In cultivating digital competencies essential for a thriving digital knowledge economy, Tunisia has devised a comprehensive plan to empower its youth progressively, starting from the educational realm. Through a cognitive and educational transformation, facilitated by an integrated educational and training framework, Tunisia endeavors to equip its youth with the requisite knowledge and skills to navigate modern technological landscapes. Notably, since March 11, 2023, Tunisia has embarked on a landmark endeavor—the "EDUNET10" project—marking the most extensive digital infrastructure development initiative in the country. Spearheaded by a collaboration between the Ministry of Communication Technologies, the Ministry of Education, and the Ministry of Economy and Planning, and bolstered by support from the International Bank for Reconstruction and Development and the African Development Bank, EDUNET10 aims to provide high-speed fiber optic connectivity to 3,307 educational institutions, encompassing primary schools, middle schools, and institutes. This initiative seeks to furnish these educational establishments with digital educational services and content, enriching learning experiences and fostering digital literacy among Tunisia's youth (Ministry of Technologies and Communication, 2023).

Tunisia is steadfast in forging a new digital landscape driven by innovation and empowered by artificial intelligence (AI) and machine learning capabilities, all while prioritizing heightened security measures. To achieve this vision, the nation is orchestrating various strategies, notably the "Internet of Things Strategy" developed by the Tunisian Institute for Strategic Studies in 2018, within the broader framework of the "Sectors with the Future" program. Furthermore, the formulation of the "National Cybersecurity Strategy 2020-2025" stands as a testament to Tunisia's

commitment to ensuring robust cybersecurity measures in the face of escalating digital interactions among citizens and public and private entities (Ministry of Communication Technologies, 2019).

Tunisia has undertaken various initiatives to develop a comprehensive national strategy in the field of artificial intelligence. Firstly, the Ministry of Higher Education and Scientific Research, supported by the National Agency for the Promotion of Scientific Research (ANPR), spearheaded efforts since April 2018, laying down a meticulous work methodology and assembling 10 specialized task forces. Despite initial challenges, progress has been evident, with an emphasis on bolstering university-level training in AI through the introduction of research and professional master's programs across governmental and private institutions. The research landscape in AI has flourished, with universities like the University of Sfax, Tunis, Sousse, Monastir, and the University of Carthage actively contributing to its advancement (Mejri, 2020).

Another significant initiative, spearheaded by the Ministry of Industry in April 2019, revolves around the development of an "AI Roadmap" as part of Tunisia's transition towards smart industry 4.0. This endeavor delves into critical issues concerning Tunisia's adoption of AI technology, identifies sectors ripe for AI integration, and delineates key national stakeholders poised to drive this transformative change (Leaders, 2019). Notably, this initiative has prioritized educating government employees on the nuances of AI through tailored training and awareness programs, aiming to train 5,000 employees over a three-year period under the AI4Leaders 2020 program. Additionally, collaboration agreements have been inked between the Ministry of Industry and the National Institute of Administration, paving the way for joint conferences, support for scientific research, and the development of AI-focused research projects under the National Program for Research and Innovation (PNRI) (Mejri, 2020).

Complementing these endeavors, various ministries and institutions are actively shaping national policy to foster the development of an AI strategy. Noteworthy among these efforts is the establishment of the Tunisian Artificial Intelligence Association (ATIA) in 2005, followed by the launch of the Tunisian Foundation for Artificial Intelligence in May 2023, spearheaded by the Tunisian Association Reconnect based in France. These initiatives aim to consolidate efforts and propagate a culture of AI excellence, leveraging the expertise of Tunisian researchers both domestically and globally (Watt, 2023).

Summary of Results and Suggestions

- **Policy and Regulatory Frameworks Related to Artificial Intelligence Are in the Process of Being Finalized**

As the International Telecommunication Union declares, the policy and regulatory frameworks related to artificial intelligence "are still in the initial stage of formation" in Tunisia, and they concern the approved technologies and techniques, the data sets used to train them, the development of machine learning models, and defining the purposes for which they will be used. Developing a strong enabling environment to drive innovation and use of technologies, and establishing responsibility and accountability for the use of AI models are critical steps (ITU, 2023).

- **Unifying Options to Develop a Unified Strategy for Artificial Intelligence**

The failure to develop an artificial intelligence strategy in Tunisia is due first to the dispersion of initiatives that each ministry took separately on a special path, and then to the absence of a national institution working to supervise, coordinate, and embody public policy in the field. Therefore, "it

is time to bring together a comprehensive view of AI" with the involvement of government first, researchers, AI developers, beneficiary companies, and civil society. According to the National Guide to developing an artificial intelligence strategy, supporting components must be put in place, including "innovation-friendly legislation," "the government's enabling role in ensuring infrastructure," "modernizing school curricula," "focusing on the ethical dimension of artificial intelligence," and "spreading awareness among the population about the benefits and challenges of AI," "promoting AI-based industry," and "identifying key AI sectors" (ESCWA, 2020).

- **Television Production and Archiving Are Among the Main Sectors of Artificial Intelligence**

This is also confirmed by a special report on "Artificial intelligence systems for program production and exchange" in the television broadcasting service, in which the International Telecommunication Union (2019) notes the importance of artificial intelligence in "increasing productivity and creative opportunities" for television production, mainly by automated content creation and adoption of "legacy archives" and "metadata generation" while reducing costs. This report considers that "artificial intelligence will be an integral part of the future broadcast program and the course of television production." The report includes the most important artificial intelligence systems approved by radio and television organizations at the global level. This is what we call for achieving through this article, especially for the Tunisian Television Corporation.

- **Digital Transformation of the Tunisian Television Corporation**

The twinning program between the Tunisian Television Corporation and France Media Monde concluded on November 24, 2023. Within two years, this project enabled the use of experts from France Télévisions, French Radio, and the National Institute of Audiovisuals under the supervision of “France Media Monde.” The basic objectives of the program were achieved, including the establishment of an ecosystem and a new regulatory system that would create dynamism between the various production, programming, archiving, and broadcasting functions, through a unified digital information system (DALET) for managing television production and archives. This step is considered the pillar of support for the institution's digital transformation, especially in light of the global shift to free access or through paid subscriptions to videos over the Internet. Through the DALET system, the institution's analog archive will continue to be digitized and then enhanced through artificial intelligence technology, as well as keeping pace with the global market for developing video-on-demand (VOD) or SVOD subscription platforms.

- **Artificial Intelligence Is an Absolute Necessity for the Tunisian Television Corporation**

There is no media today without artificial intelligence. Artificial intelligence is today creating the revolution in the media industry and enhancing methods of production and creativity by television media institutions that have chosen the approach of global competition and keeping pace with reality by adopting artificial intelligence techniques. If the Tunisian Television Corporation lags behind, it will be difficult to reach this level later. News bulletins, for example, have recorded a clear development of artificial intelligence, starting with their editing until they are presented by

the robotic journalist. This field requires partnerships, for example, with emerging Tunisian institutions in the field of artificial intelligence, robotics, and natural language processing.

- **An Unprecedented Transformation of Information Centers, Especially Audiovisual Ones**

The “beating role” of information centers and archive centers is supported by television organizations, which still preserve, process, and make available the stock of analogue television productions, and then have been working for decades to process them electronically, digitize them, and make them available in various digital formats. Today, it has also become part of the information specialist’s responsibility to keep up with modern technologies, including artificial intelligence, to facilitate the process of analyzing content that has remained locked in pop-ups for decades, and to discover images, audio, and videos using various artificial intelligence tools. This requires financial and technical requirements, as well as the rehabilitation and training of documentation specialists.

Conclusion

In summary, the integration of artificial intelligence (AI) technology within audiovisual information centers is intricately tied to national strategies governing this burgeoning field. Consequently, it falls upon the state to establish a dedicated committee within the Ministry of Communication Technologies and the Digital Economy, or potentially directly under the auspices of the government's leadership, tasked with formulating a comprehensive policy framework. This entails not only revising legislative frameworks to accommodate the evolving digital landscape

but also allocating resources for scientific research, fostering an enabling ecosystem, and encouraging international collaboration.

However, audiovisual information centers within television organizations encounter several hurdles on their path to embracing AI technology. Chief among these challenges is securing adequate financial resources to procure AI systems, alongside the scarcity of dedicated research units and innovation specialists adept at crafting intelligent applications. Moreover, there is a pressing need to enhance awareness among document specialists while providing them with requisite training to harness smart technologies effectively. Additionally, information security emerges as a critical concern necessitating a review and potential amendment of existing legislative frameworks to suit the dynamic digital milieu within audiovisual information centers.

In response to these challenges, the Center for the Audiovisual Archive of the Tunisian Television Corporation remains steadfast in its commitment to digital transformation, striving to align itself with the global shift towards intelligent media practices. Through relentless efforts and proactive measures, the center endeavors to navigate the complexities of AI integration, ensuring its continued relevance and efficacy in an increasingly digitized world.

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