THE VALORIZATION OF THE TUNISIAN RADIO ARCHIVE IN THE ARTIFICIAL INTELLIGENCE ERA

Sami Meddeb

*Digital Cooperation
Association Tunisia
Tunisia
s.meddeb@s2t.tn*

Randi Cecchine

*Independent Researcher
The Netherlands
Randi.Cecchine@gmail.com*

Abstract – Radio Elyssa's sound archives face challenges in the post-revolution Tunisian context: preserving a large volume of digital content with limited resources while preserving Tunisia's cultural heritage. The Digital Cooperation Association Tunisia and Radio Elyssa are collaborating to test the potential of Artificial Intelligence tools to automate archival tasks. Before any automation, it is necessary to understand the regulatory procedures for digital archiving: identifying, classifying, migrating, and storing data according to best practices. Long-term preservation faces challenges due to limited resources and increasing digitization. The combination of human expertise and AI will enable Radio Elyssa to use AI responsibly to fulfill its mission.

Keywords – artificial intelligence, image, music, Audiovisual, chatbot.

Conference Topics – immersive information, We're All in this Together

I. INTRODUCTION

The period since the 2011 revolution in Tunisia has presented multiple challenges in the capacity to preserve and make accessible Tunisia's rich audiovisual cultural heritage. In response to the various challenges facing Tunisian institutions as well as the new potentials of digital preservation, the Digital Cooperation Association Tunisia ("DCAT") was formed in 2019 by members of the audiovisual archives community. DCAT supports digital archival efforts through partnerships, research, and trainings (such as Webinar Series "Digitisation and Restauration of Audio-visual Objects" organised by Landesarchiv Baden-Württemberg) aimed at developing archival expertise and building a collaborative community. This article describes a partnership between DCAT and a community radio station called Radio Elyssa that focuses on researching and testing the potential of artificial intelligence tools to support digital preservation strategies and audience engagement. Radio Elyssa was created in 2012 to present events and educational programs from the city of Gabes, with a focus on civil society and sustainable development activities of the municipality. The project tests how appropriate use of artificial intelligence tools can help to make archives more accessible, better organized, and preserved, thus highlighting and realizing their cultural value.

II. INTEGRATING AI INTO RADIO ELYSSA'S DIGITAL PRESERVATION STRATEGY

A significant portion of Tunisia's radio archives have been lost due to financial pressures resulting in the closure of many stations, and lacking resources many of the remaining collections are not being properly maintained. Radio Elyssa's sound archives are of great value in documenting Tunisian history and culture across the southern region. Unfortunately, Radio Elyssa faces new challenges that put their collections at risk: economic difficulties, gaps in cultural preservation capacity, and huge amounts of digital content to manage. The station broadcasts 24 hours a day, seven days a week, with one-hour programs recorded in an MP3 format at 128 kbps, totaling 1.2 GB of content per day of audio

iPRES 2023

recording. In the past, these recordings were made on physical media (CD) and many of these recordings were lost during multiple location moves between 2012 and 2014. Additionally, at some points the station was relying on YouTube as a backup format which is also not a sustainable archival medium. In 2020 they received a new radio license through the The Independent High Authority for Audiovisual Communication (HAICA) [1], and the law obliged them to adopt a preservation strategy [2]. This partnership explores how AI can help in the development of a sustainable and affordable preservation strategy.

To ensure the long-term preservation of cultural heritage, a reliable preservation strategy includes the creation of geo-redundant preservation of 2 or 3 master copies, the migration to new formats and media, awareness of obsolescence, controls of integrity, accurate metadata, transparent rights management, professional monitoring, and adaptation of standards. Radio Elyssa's archives face digital preservation challenges due to technical, financial, and human constraints, which influence the choice of storage formats. They aim for an optimal balance between storage space and quality and implement regular verification, migration, and cloud backup procedures to minimize data loss.

While Radio Elyssa's archive is primarily comprised of audio recordings, it also includes image and video content used for promotion and education. They use lossless formats like JPEG and FLAC [3] for images and audio. The MP4 format with X264 encoding is chosen for video, specifying a parameter (CRF) that adapts the bit rate according to the content. A value between 15 and 20 offers a compromise between quality and storage space.

Storage solutions include multiple SSDs for backup with a plan to migrate to higher quality storage media every five years. Data integrity is verified prior to migration. Initial investments have covered the purchase of storage media and verification procedures but the long-term plan is for an extensive cloud storage service to reduce the need for local storage.

Innovation in AI can improve archive management and has the potential to quickly analyze large data sets and automate archiving tasks. The Radio Elyssa case study focuses on the judicious use of targeted AI applications to optimize specific tasks while adhering to archiving best practices and increasing audience engagement. The goal of implementing AI is to reduce costs, including technical training, and to improve efficiency. The partnership between DCAT and Radio Elyssa tested the following AI tools to identify which ones would be most helpful for Radio Elyssa's long-term goals of preservation and audience engagement:

- Chatbots for video and sound migration

- AI for audience engagement through image enhancement

- AI for audio enhancement and music creation

- AI for transcription and subtitling of Tunisian Arabic

- AI for Analyzing and Correcting Video, Creating Subtitles, and Detecting Deepfakes

This article will explain how these tools were tested, and the benefits and challenges that arose. It is important to note that AI must be carefully implemented to complement human monitoring that determines appropriate digital preservation methods.

III. TESTING CHATBOTS FOR VIDEO AND AUDIO FILE MIGRATION

As part of long-term preservation and access, Radio Elyssa migrates its production-output audio and video files to higher quality formats. Audio MP3 files are converted to the lossless format FLAC, and video MP4 files with h264 codec are converted to a VP9 codec [4] (with a CRF of 18) which supports higher resolutions up to 8K. Chatbots [5] such as ChatGPT [6] can simplify this process of audiovisual content migration. For those unfamiliar with Python tools for audio-visual [7] tasks or FFmpeg [8], the use of chatbots can help guide the migration process. Chatbot technology can help break down the steps of all parts of the migration process, enabling real-time feedback, simplifying progress tracking, and making adjustments as needed.

The team from Radio Elyssa and DCAT tested four chatbots (Chat GPT, You.com, Caktus AI and writesonic.com) for use in automating migration tasks. They found that all the chatbots could help automate their tasks, although Caktus.AI offers more parameterization and customization of the conversion. Recognizing that automating large processes would be expensive with a paid solution,

they noted that Chat GPT and you.com's free services would be preferred for budget-conscious archives. They also noted that given limited technical knowledge on the part of archivists and the potential to make mistakes when using chatbots, a better solution may be the simple use of open-source app shutter encoder [9].

The chatbot tests raised many questions about the technical expertise, both of coding and of file formats and codecs, that is needed in archival management. Although using chatbots to automate tasks may seem accessible to staff with more programming experience, it still may be inaccessible to some staff, without significant investment in training. More research is needed to understand how to develop the human skills needed for archival tasks in a digital preservation strategy incorporating AI. On one hand, human oversight is needed when implementing AI tools, and on the other hand, staff must be properly trained to provide that oversight.
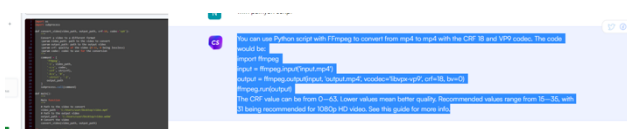

Fig 2: ChatGPT/ Youchat

Fig 3: Caktus AI / Writesonic

IV. AI FOR AUDIENCE ENGAGEMENT THROUGH IMAGE ENHANCEMENT

Radio Elyssa's photographic archives, featuring radio shows, guests, and special events, represent valuable resources to engage audiences, albeit with somewhat limited quantity. These images are an effective means of attracting audience attention before and after broadcast through social media platforms such as Intsagram. Unfortunately, many of these images have been shared and stored in low TIFF quality versions, reducing their effectiveness to inform audiences about radio programming. For long-term preservation these images converted to JPEG, and using AI tools can help with the improvement, enhancement and optimization of images, making them more legible and suitable for use on different platforms.

Due to limited expertise working with images in the team, they chose to test tools that could perform simple tasks such as object and background removal with remove.bg and automatic color correction and super-resolution [10] with Real-ESRGAN which performs Real-World Blind Super-Resolution training with pure synthetic data [11]. Super-resolution creates an increase of resolution in image processing and can be very helpful in making images usable, but the increase in storage space raises questions about the feasibility of long-term storage. The tests also raised significant questions about the authenticity of images and concerns of how tools such as super resolution could change, for example, facial features in a photograph. The tests raised the important point that the responsibility for preserving the authenticity of archives rests with humans.

V. AI FOR AUDIO ENHANCEMENT AND MUSIC CREATION

Making the Radio station's sound archive available for long-term preservation and re-use has a few challenges. Questions of copyright mean that not all music is accessible for re-use, and external recordings suffer from poor sound quality due to non-professional equipment and a lack of sound management expertise. To address these concerns, the team tested Artificial Intelligence tools for sound improvement, automatic mixing/mastering, and music creation.

The team used Krisp.ai and Adobe podcasts [12] to test how they were able to enhance and automatically attenuate noises in external interviews, in order to save time in the studio. They found that Adobe was able to reduce noises by 100%, while Krisp.ai was not able to reduce all the noises, despite the wide options that it offers. For automated mixing/mastering algorithms they tested Mixcord and Square and found that they improved consistency and productivity, mixing 100 times faster than manually. They tested Jukebox [13], MuseNet [14], AIVA, and beatoven.ai to generate customized music in order to expand Radio Elyssa's musical offerings.

These tests provided important insights into the potential benefits and challenges for using AI in a radio sound production environment and archive. The team found that while these AI tools helped to produce high-quality programs, optimize editing time, and saving on archiving costs human supervision is still essential. They found, for example,

that AI algorithms struggle with complex audio, requiring human adjustments. They noted that because sound design choices ultimately shape Radio Elyssa's programming character and impact, they need to be controlled by experienced professionals. Additionally, the use of AI-generated music raised questions about the need for human verification to ensure copyright compliance. Additionally, using AI generated music can be problematic because listeners are not accustomed to it.

In summary, the targeted, responsible AI use for specific audio tasks can optimize Radio Elyssa's post-production processes. But human expertise, judgment, and curation remain essential to ensuring the audio heritage's artistic quality and uniqueness. The tests revealed the important point that AI augments - rather than replaces - human capabilities.

VI.   AI FOR TRANSCRIPTION OF THE TUNISIAN ARABIC DIALECT

Transcription of speech is a powerful tool that many archives employ for increased access to their collections. Speech-to-text tools can produce transcripts for search and research purposes, and can help create subtitles for video content. Radio Elyssa and DCAT tested multiple speech-to-text tools including Kaptioned, Kapwing, Free subtile.ai and Subtitlebee and found that none of them could sufficiently recognize the Tunisian Arabic dialect. Despite the availability of parameters for the Tunisian dialect in different systems and programs, support remains limited, leading to unacceptable transcription errors.

One possible solution could be the development of speech recognition software or machine learning models specifically trained on Tunisian dialects in collaboration with archives. This would improve the accuracy of the transcription process and better support for the language and its nuances. Another approach could be to use local linguists and experts to manually transcribe and annotate audio recordings, to create a training dataset for machine learning models. This dataset could be used to improve existing automatic transcription systems or to develop new ones according to the specific needs of the dialect. A combination of technology and human expertise is likely to be required to effectively address the challenges posed by the Tunisian dialect.

This will ensure the accuracy and reliability of the text produced from these tools.

VII.   AI FOR CORRECTING VIDEO, CREATING SUBTITLES, AND DETECTING DEEPFAKES

Although the archives of Radio Elyssa contain only a limited number of videos (programs, interviews, news), AI offers the potential to help improve these images with tools such as motion detection, green screens, or background removal (runway ml). Text-to-video tools [15] such as Gen2 can delete objects or create video from text, opening up new potential for post-production or creative re-use of video from the archives.

AI tools offer a lot of potential also for creating subtitles and translations on video files, but the problems of automatic generation of subtitles remains a challenge for the Tunisian Arabic dialect, as explained in the section about transcription.

Finally, Radio Elyssa and DCAT have been testing tools to detect deepfakes [16], such as Deep AI's DeepFake-o-meter. The team understands that broadcasters and archives need to take careful steps to ensure the authenticity of content and to avoid accidentally sharing or storing deepfakes in the archive. Unfortunately, the development of deepfake detection tools helps to aid the development of deepfakes themselves, and the speed of evolution of deepfakes makes it impossible to create tools to detect them. The team is aware that deepfakes are a serious concern to the ethical responsibilities of broadcasters and archives, and that humans must play a role in carefully checking sources in order to verify authenticity.

VIII.   CONCLUSION

Radio Elyssa and Digital Cooperation Association Tunisia's partnership created a rich environment for exploring the potential of AI to assist the radio station's long-term digital preservation strategy. Given that the radio station's goal is production, it is helpful to partner with an outside organization that is oriented towards the technical and intellectual demands and challenges of preservation. Radio Elyssa is facing technical and financial difficulties, including a lack of resources and expertise and creative solutions and the use of AI have helped the station to reduce the costs of technology, equipment and training in order to fulfill the mission of preserving Tunisia's cultural heritage, while

respecting ethics and rights. However, challenges remain with regards to the accuracy of audio transcription, compliance with copyright for AI-generated content, and human responsibility for the ethical preservation of cultural heritage over the long term.

Continuing professional training of employees mixed with the development of strong digital preservation governance is essential to ensuring Radio Elyssa's digital sustainability. A balanced combination of AI software, open-source software, such as cup cat, and shutter encoder, and human know-how prevents over-dependence on either. Responsible use of AI means that it must be supervised and controlled by human experts at all stages. Humans must define policies, understand the limitations of AI, and make the final decisions. Preserving high quality audiovisual heritage depends on informed human decisions supported by tools used with discernment. By investing responsibly in infrastructure and procedures that balance constraints and best practices, Radio Elyssa's archives can be sustainability preserved. Through this partnership with DCAT, Radio Elyssa recognized that careful adoption of AI tools, with appropriate governance structures and human supervision, will be essential to ensure ethical [17] and sustainable cultural preservation.

1. REFERENCES

[1] "Présentation", HAICA. [Online]. Disponible: https://haica.tn/presentation/

[2] "Digital Preservation Planning", IASA - Technical Committee for Audiovisual Archives. [Online]. Disponible: https://www.iasa-web.org/tc04/digital-preservation-planning

[3] L. Katz, "How to get the most out of your FLAC files: What's so special about the free lossless audio codec?," SoundGuys, Jun. 8, 2023. [Online]. Available: https://www.soundguys.com/flac-audio-guide-28859

[4] "VP9 Codec: Google's Open Source Technology Explained," wowza.com, Mar. 2021. [Online]. Available: https://www.wowza.com/blog/vp9-codec-googles-open-source-technology-explained.

[5] D. Noever and K. Williams, "Chatbots as Fluent Polyglots: Revisiting Breakthrough Code Snippets," arXiv preprint arXiv:2301.03373, pp. 1-20, 2023.

[6] K. Lehnert, "AI Insights into Theoretical Physics and the Swampland Program: A Journey Through the Cosmos with ChatGPT," arXiv preprint arXiv:2301.08155, pp. 1-10, 2023.

[7] "AV Python Carpentry," Amia Open Source, 2021, [Online]. Available: https://amiaopensource.github.io/av-python-carpentry/index.html.

[8] H. Zeng, Z. Zhang, and L. Shi, "Research and Implementation of Video Codec Based on FFmpeg," 2016 International Conference on Network and Information Systems for Computers (ICNISC), Wuhan, China, pp. 184-188, 2016, doi: 10.1109/ICNISC.2016.049.

[9] Shutter Encoder, Documentation, available: https://www.shutterencoder.com/documentation.html.

[10] Y. Romano, J. Isidoro, and P. Milanfar, "RAISR: Rapid and Accurate Image Super Resolution," IEEE Transactions on Computational Imaging, vol. 3, no. 1, pp. 110-125, 2016.

[11] X. Wang, et al., "Real-ESRGAN: Training real-world blind super-resolution with pure synthetic data," in Proceedings of the IEEE/CVF International Conference on Computer Vision, 2021.

[12] V. Ayeni, "Why You Shouldn't Use Adobe's Enhanced Speech AI Tool for Voiceover Production," APVA, 01/10/2023. [En ligne]. Disponible: https://apva.africa/why-you-shouldnt-use-adobes-enhanced-speech-ai-tool-for-voiceover-production/.

[13] P. Dhariwal, et al., "Jukebox: A generative model for music," arXiv preprint arXiv:2005.00341, 2020.

[14] Pal, Abhilash, et al. "Musenet : Music Generation using Abstractive and Generative Methods"International Journal of Innovative Technology and Exploring Engineering, vol 9,iss 6 ,Apr 2020.

[15] P. Esser, J. Chiu, P. Atighehchian, J. Granskog, and A. Germanidis, "Structure and content-guided video synthesis with diffusion models," arXiv:2302.03011 [cs], Feb. 2023.

[16] K. Zhang, J. Yang, X. Tang and J. Luo, "Deep Learning for Deepfake Detection: A Comprehensive Review," arXiv:2202.06095 [cs.CV], Feb. 2022.

[17] UNESCO. (2021). Recommendation on the Ethics of Artificial Intelligence. SHS/BIO/PI/2021/1.