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Original Research Article

Tracking any audio content streamed or played anywhere to its origin or piracy

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ABSTRACT

Background: The unauthorized distribution and consumption of audio content have been on the rise in recent years, posing a significant threat to content creators and streaming partners. In this research, we proposed a revolutionary method that enables the tracking of audio content to its source of piracy by employing cryptographically invisibly fingerprinted technology.
Methods: Our approach utilizes advanced cryptographic techniques to embed inaudible fingerprints within audio frames. These fingerprints serve as unique identifiers that can be traced back to the source of piracy. Our specialized software employs sophisticated algorithms to detect and extract these cryptographic fingerprints from the pirated audio content. The software then compares the extracted fingerprints with a database of authorized sources to determine the origin of the piracy event.
Results: Through extensive testing and analysis, we have demonstrated the effectiveness of our proposed method in accurately tracking audio content to its source of piracy. Our software consistently detects and reports the source, location, and time of the piracy incidents within a matter of minutes.
Conclusions: The research presented in this paper introduces a novel method for tracking audio content streamed or played over the internet to its source of piracy. By employing cryptographically invisibly fingerprinted technology, we can accurately detect and report piracy incidents within minutes, providing content creators and streaming partners with actionable information to combat piracy effectively.

Keywords: Audio piracy, Cryptographic fingerprinting, Internet streaming, Digital rights management, Piracy detection

INTRODUCTION

With access to unlimited audio data due to high internet usage in the recent years, people also have a higher demand of audio retrieval.

The unauthorized distribution and consumption of audio content have been on the rise in recent years, posing a significant threat to content creators and streaming partners.[1] Existing approaches to combat piracy, such as implementing digital rights management (DRM) technologies and legal actions, often involve complex and time-consuming procedures.[2,3]

In this research, we propose a revolutionary method that enables the tracking of audio content to its source of piracy by employing cryptographically invisibly fingerprinted technology.

By accurately identifying the source of piracy incidents, content creators and streaming partners can take targeted actions to prevent future infringements.

Objectives

The main objective of this study was to employ a method to enable the tracking of audio content to its piracy source by invisible fingerprinted technology.

METHODS

Our approach utilizes advanced cryptographic techniques to embed inaudible fingerprints within audio frames. These fingerprints serve as unique identifiers that can be traced back to the source of piracy. The encoding of the invisible patterns remains intact even when the audio is compressed to low bitrates or bandwidths during piracy. Our specialized software employs sophisticated algorithms to detect and extract these cryptographic fingerprints from the pirated audio content. The software then compares the extracted fingerprints with a database of authorized sources to determine the origin of the piracy event.

Study period

The study period was March 2015 to August 2015.

Study place

The study was conducted in a couple of sports stadiums in Bay area, California and manually captured in different day sessions of the sports events from different seating positions.

Procedure

Our cryptographic fingerprinting was placed only in each audio segments and placed it in couple of online blogging sites and later it was found to be duplicated in multiple formats like HEVC, H.264 and 3GP in few websites as well as certain torrent websites in very low quality upto 32kbps all the way up to 64 kbps. Immediately we analysed all of the copies found online other than the original we put in the blog sites and were able to identify the exact day of the capture, source of the original sites from where it was duplicated in all of the duplicated copies. Later all the original copies and pirated copies present in sites were deleted using their 'report' section of the same. The study happened over a period of 6 months, where the sessions captured belong to the first 3 months and waited for another 3 months to finish the piracy spreading nature and deleting the source and pirated copies.

RESULTS

Through extensive testing and analysis, we have demonstrated the effectiveness of our proposed method in accurately tracking audio content to its source of piracy. Our software consistently detects and reports the source, location, and time of the piracy incidents within a matter of minutes. The cryptographically invisibly fingerprinted technology remains robust even when faced with various compression techniques or attempts to mask the audio content. By leveraging this technology, content creators and streaming partners can swiftly take appropriate actions to curb piracy.

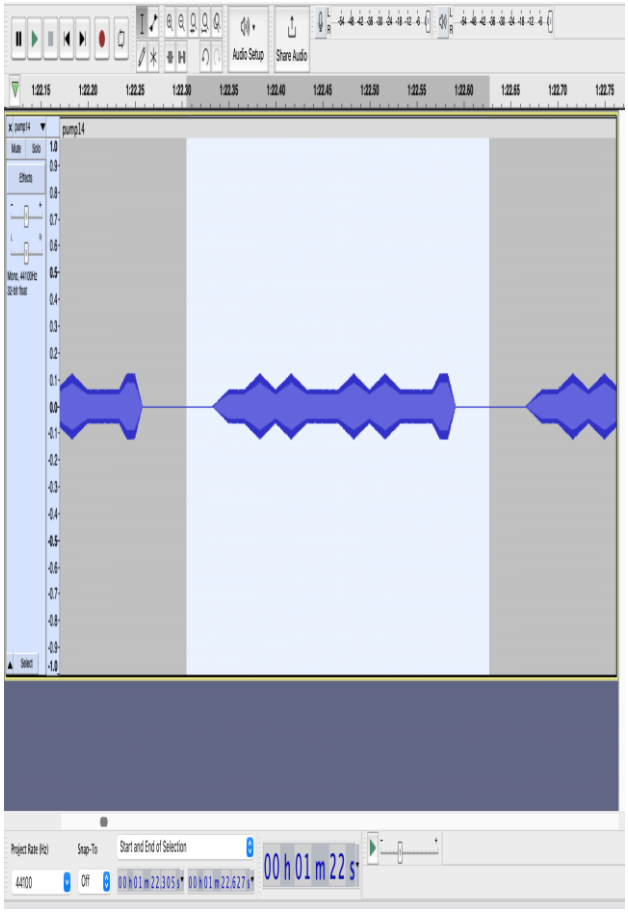

Figure 1: Simple cryptographic identifier embedded into an existing audio content in the inaudible audio spectrum.

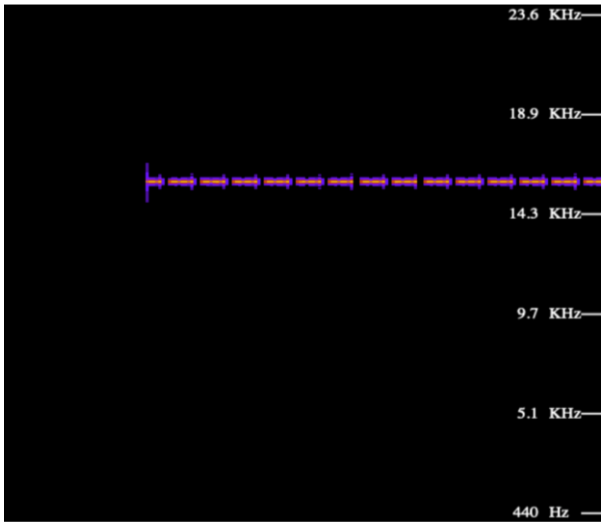

Figure 2: Detailed frequency spectrum analyser output for the same cryptographic embedding alone.

DISCUSSION

The proposed method offers numerous advantages over existing anti-piracy approaches. It provides real-time detection and tracking of piracy incidents, allowing for immediate response and mitigation. Moreover, the inaudible nature of the cryptographic fingerprints ensures that the end-users' listening experience remains unaffected.[4,5] In a study done by Aucsmith et al identification, authentication, content-driven secret key generation for watermarking were depicted.[5] Content creators and streaming partners can use this technology to proactively identify and eliminate the sources of piracy, reducing financial losses and preserving intellectual property rights.[6-8] However, it is essential to address privacy concerns and ensure the responsible use of the tracking capabilities to maintain a balance between anti-piracy measures and user privacy.[9,10]

In a study done by Jain et al they surveyed different methods of digital audio watermarking to preserve the copyright laws and its related issues.[11] A similar study done by Bassia et al shows that audio watermarking helps in copyright protection to an audio signal by time domain processing. The watermark signal does not require an original signal for the watermark detection.[12]

CONCLUSION

The research presented in this paper introduces a novel method for tracking audio content streamed or played over the internet to its source of piracy. By employing cryptographically invisibly fingerprinted technology, we can accurately detect and report piracy incidents within minutes, providing content creators and streaming partners with actionable information to combat piracy effectively. The proposed method has the potential to significantly reduce the occurrence of audio piracy and alleviate the burden on content creators and streaming platforms in protecting their intellectual property.

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