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Original Research Article

Identifying the source of movie piracy: cryptographic fingerprinting for tracking movie content

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ABSTRACT

Background: The unauthorized distribution of movies through piracy has become a widespread issue affecting both movie studios and OTT streaming partners. This research introduces a novel method utilizing cryptographic fingerprinting to track movie content, with the goal of identifying the precise source of piracy.
Methods: The developed specialized software that utilizes the cryptographic fingerprinting algorithm to analyze pirated movie content obtained from various online piracy platforms. The software employs computer vision techniques to identify the source of piracy, including the specific theatre, showtime, and recording location within the theatre.
Results: Our experiments demonstrated the effectiveness of the proposed cryptographic fingerprinting approach. The software successfully detected and analyzed pirated movie content from a wide range of online piracy platforms.
Conclusions: The cryptographic fingerprinting technique allows for the identification of the source of piracy, including the specific theatre, showtime, and recording location within the theatre. By swiftly reporting these details, our software aims to aid in the prevention of future piracy incidents, ultimately eliminating the source of piracy.

Keywords: Movie piracy, Cryptographic fingerprinting, Content tracking, Piracy detection, Source identification

INTRODUCTION

The unauthorized distribution of movies through piracy has become a widespread issue affecting both movie studios and OTT streaming partners. Existing anti-piracy measures, such as DRM technologies and legal actions against infringing websites, have proven to be insufficient in curbing piracy effectively.[1,2] This research introduces a novel method utilizing cryptographic fingerprinting to track movie content, with the goal of identifying the precise source of piracy.

Objective

The proposed software aims to streamline the process of eliminating piracy by promptly providing actionable information regarding the piracy incident.

METHODS

Cryptographic fingerprinting algorithm

We developed a sophisticated cryptographic fingerprinting algorithm capable of encoding invisible

patterns within movie keyframes. The encoding remains imperceptible to the human eye, even at high resolutions or when the content is compressed to lower resolutions. This algorithm ensures accurate detection and reporting of the cryptographic fingerprint within seconds.

Software implementation

We developed specialized software that utilizes the cryptographic fingerprinting algorithm to analyze pirated movie content obtained from various online piracy platforms. The software employs computer vision techniques to identify the source of piracy, including the specific theatre, showtime, and recording location within the theatre. Additionally, the software extracts relevant metadata to aid in source identification.

Study period

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 video 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 & 3GP in few websites as well as certain torrent websites in very low quality upto 480p all the way up to 1080p. 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 & pirated copies.

RESULTS

The piracy to cost TV and film industry was US $52 billion by 2022 and is increasing gradually (Figure 1).

Our experiments demonstrated the effectiveness of the proposed cryptographic fingerprinting approach. The software successfully detected and analyzed pirated movie content from a wide range of online piracy platforms. The invisible cryptographic fingerprint was consistently identified, even at low resolutions (Figure 4). The software accurately pinpointed the source of piracy, providing details such as the theatre, showtime, and recording location.

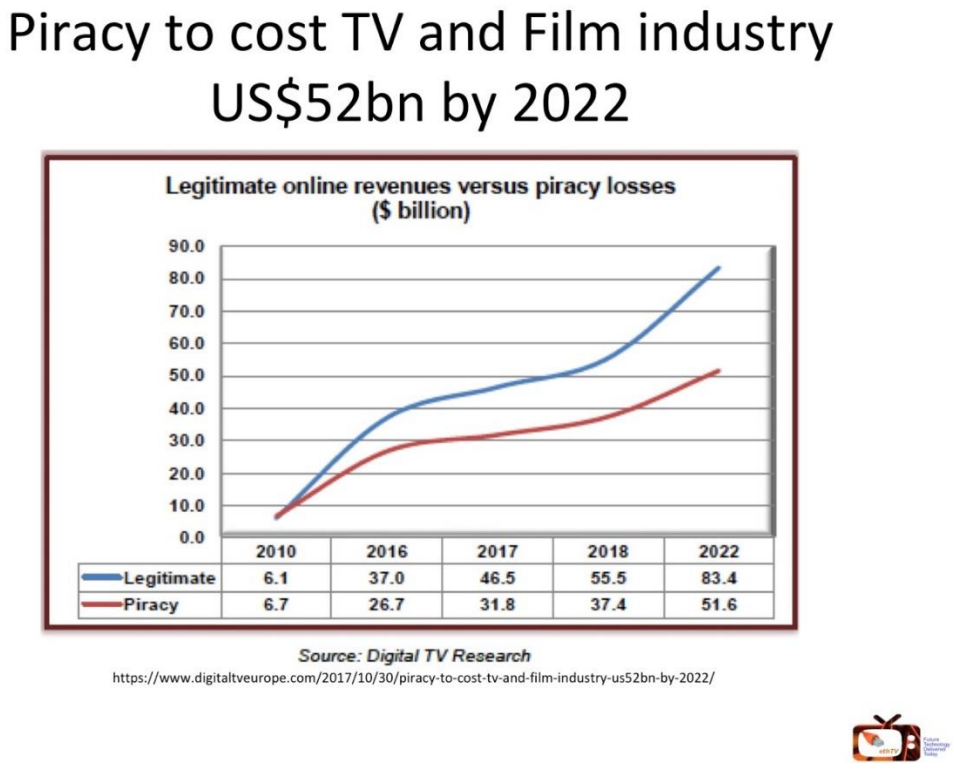

Figure 1: Piracy to cost TV and film industry.

Figure 2: A visible cryptographic fingerprinting.

Figure 3: An invisible cryptographic fingerprinting.

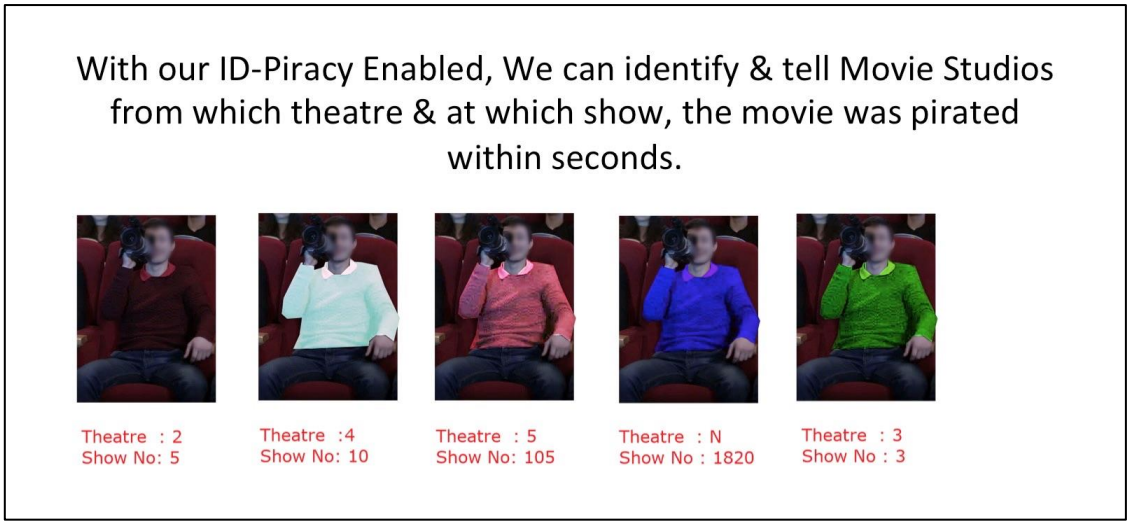

Figure 4: ID-piracy enabled detecting and identifying which theatre, which show and which movie was pirated within seconds.

Figure 5: New movie screening with different shows and theatres.

DISCUSSION

The introduction of cryptographic fingerprinting for tracking movie content represents a significant advancement in combating movie piracy. The ability to identify the precise source of piracy allows movie studios and OTT streaming partners to take targeted action to prevent future incidents.[5] By eliminating the source of piracy promptly, the industry can effectively protect their intellectual property rights and mitigate revenue loss.[6-8]

Digital TV Research suggests emerging economies such as India and Brazil will be among the most damaged by piracy in the next five years, with the former seeing its US$700 million losses in 2016 grow to US$3.1 billion. Brazil will add another US$1.1 billion in losses over the same period.[9]

In a similar study it was shown that video fingerpeints were stored, copied and compared in such a way that no matter how much a user can edit or manipulate the video, the copyrighted material will be detected easily and disallowed immediately.[10] This aforementioned study detects copyright infringement for owners of sites, thus giving a sufficient level of protection.

In a study done by Megias et al showed that digital fingerprinting can effectively trace the source of the piracy, which subsequently makes it possible for the copyright owner to take necessary legal action for the violation of the copyrights. In this study, the digital fingerprinting solutions were available for peer-to-peer distribution networks and broadcasting.[11]

CONCLUSION

The cryptographic fingerprinting technique allows for the identification of the source of piracy, including the specific theatre, showtime, and recording location within the theatre. By swiftly reporting these details, our software aims to aid in the prevention of future piracy incidents, ultimately eliminating the source of piracy.

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