

Combating Digital Piracy: Safeguarding Intellectual Property Across Diverse Platforms

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ABSTRACT

Digital piracy remains a significant challenge globally, with India emerging as a major hotspot for this activity. According to the Irdeto Global Consumer Piracy Threat Report (2018), India ranks among the top five countries utilizing **peer-to-peer** (P2P) downloads extensively. This alarming statistic underscores the prevalence of unauthorized file sharing and content distribution within the country. Additionally, **Muso**, a company dedicated to tracking piracy statistics, has identified India as the third largest contributor to global piracy, with over 9.5 billion visits to pirate sites annually, placing it just behind the United States and Russia.

The issue of digital piracy has been further exacerbated by the **COVID-19 pandemic**. A report by Markscan, a firm aiding the entertainment industry in combating piracy, reveals a staggering **1092% surge in video piracy** on the social media application Telegram during the lockdown period. This dramatic increase highlights the urgency for effective anti-piracy measures, particularly on social media platforms that have become breeding grounds for illicit content distribution.

Given the scale of the problem, this research work aims to develop a comprehensive approach to mitigate piracy during the transmission of files across various digital platforms. The proposed solution will focus on leveraging advanced technologies such as **Machine Learning and Computer Vision** for secure and transparent content distribution, and identifying pirated content, and machine learning algorithms for detecting and preventing unauthorized file sharing in real-time.

Furthermore, the proposal will explore the implementation of stricter legal frameworks and international cooperation to address the cross-border nature of digital piracy. By integrating technological, legal, and collaborative strategies, this research aims to formulate a robust anti-piracy framework that can significantly reduce the incidence of digital piracy and protect intellectual property rights. The ultimate goal is to foster a secure and fair digital environment that supports content creators and the entertainment industry while curbing the pervasive threat of piracy.

1. Introduction

The Indian film industry, renowned as one of the largest and most prolific in the world, boasts an expected annual turnover of \$3.7 billion by the end of 2020, with a projected annual growth rate of 11.5%. Producing between 1,000 and 1,500 films each year, it serves as a significant cultural ambassador, exporting Indian culture globally. Despite its vast output and status as the largest film industry in terms of production, it ranks second in cinema hall footfall, surpassed only by China. However, the industry is facing formidable challenges, notably a projected loss of \$3.3 billion by the end of 2020, largely attributable to the pervasive issue of digital piracy.

1.1 Digital Piracy Explained:

Digital piracy has emerged as a critical threat to the entertainment industry worldwide, with India being a major focal point. The Irdeto Global Consumer Piracy Threat Report (2018) positions India among the top five countries engaging in peer-to-peer (P2P) downloads, highlighting the extensive unauthorized sharing and distribution of digital content.

Additionally, Muso, a company specializing in piracy statistics, ranks India third globally for visits to pirate sites, with over 9.5 billion visits annually, trailing only the United States and Russia.

1.2 COVID-19

The COVID-19 pandemic has exacerbated the piracy problem, with a report by Markscan indicating a 1092% increase in video piracy on the social media platform Telegram during the lockdown period. This surge underscores the need for effective anti-piracy measures, particularly on social media platforms, which have become hotspots for illegal content distribution.

1.3 Media and Entertainment Industry

A 50% reduction in digital piracy could add \$700 million to the Media and Entertainment (M&E) industry's \$1.3 billion contribution to India's GDP, highlighting the economic benefits of effective anti-piracy measures.

1.4 Emergence of Smart Phones

By 2022, the number of smartphone users in India is projected to reach approximately 850 million. This substantial growth indicates that internet access via smartphones will become a central component of the Indian economy. As a result, the issue of digital piracy becomes increasingly urgent. With such widespread smartphone usage, the potential for unauthorized sharing and downloading of digital content escalates, posing significant threats to various industries, especially the entertainment sector. Addressing digital piracy is not just a matter of protecting intellectual property but also of safeguarding economic growth and stability. Therefore, implementing effective anti-piracy measures is essential to ensure the continued prosperity of the Indian economy in the digital age.

2. Relevance of the Research

India, a nation with a deep-seated passion for cricket and movies, faces significant economic challenges due to digital piracy. The Media and Entertainment (M&E) sector is one of the country's largest revenue generators, contributing substantially to the GDP. However, the rampant issue of piracy severely hampers the growth and potential of this vital industry. Unauthorized sharing and distribution of digital content undermine the revenue streams of content creators, producers, and distributors, leading to substantial financial losses.

2.1 Entertainment as a Cornerstone

Cricket and films are not only cultural cornerstones but also major economic drivers. The Indian film industry, one of the largest globally, produces between 1,000 and 1,500 films annually and is a significant exporter of Indian culture. Similarly, cricket, with its massive fan base, generates considerable revenue through broadcasting rights, sponsorships, and merchandise sales. The financial impact of piracy on these sectors is profound, as it erodes legitimate sales and diminishes the returns on substantial investments made in content creation and distribution.

2.2 More Market in a Sector

Addressing piracy is crucial for the sustainable growth of the M&E sector. Effective anti-piracy measures can protect intellectual property rights, ensuring that creators and investors receive their due rewards. This protection, in turn, fosters innovation and encourages further investments in high-quality content. Moreover, reducing piracy can lead to significant economic benefits. For instance, a 50% reduction in piracy could potentially add \$700 million to the M&E industry's contribution to India's GDP, underscoring the substantial economic upside of combating digital piracy.

For a country where cricket and movies play a pivotal role in cultural and economic life, tackling piracy is essential. Protecting the M&E sector from piracy not only preserves a critical revenue source for the nation but also ensures the continued vibrancy and growth of these beloved industries.

Year	Movies Contribution (in billion USD)	Cricket Contribution (in billion USD)
2015	1.5	0.8
2016	1.7	0.9
2017	1.9	1

2018	2.1	1.2
2019	2.4	1.3
2020	2.7	1.5

Table 1: Comparison Movie to Cricket

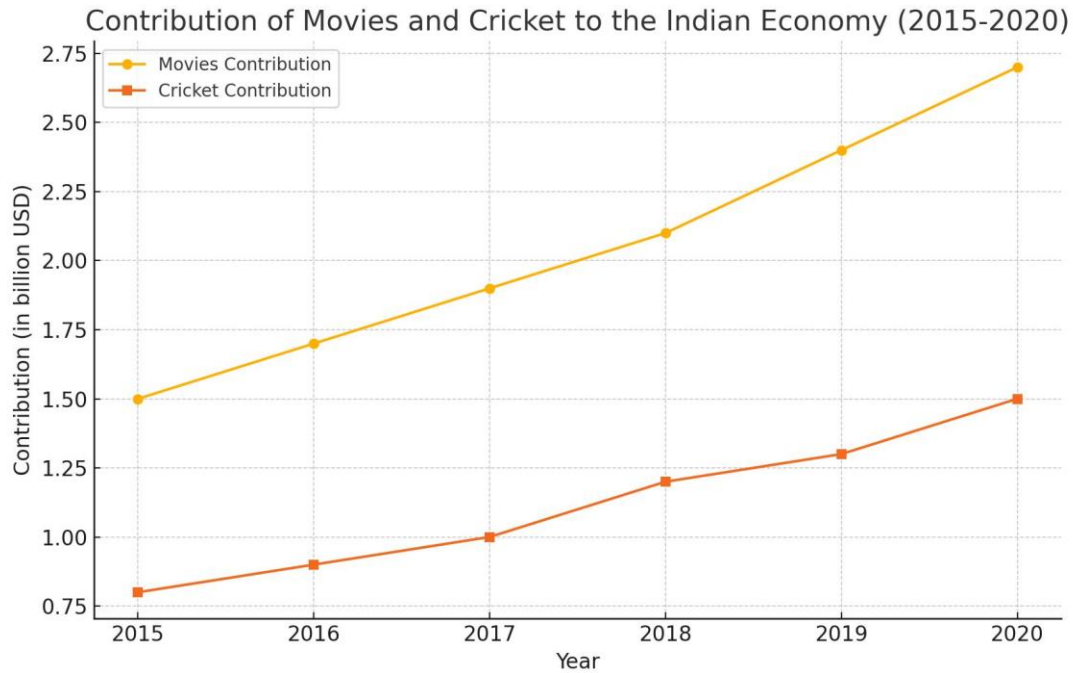


Fig -1: Contribution of Movies and Cricket to the Indian Economy

3. Existing Work

3.1 Secure Anti - Piracy System

The research paper introduces a strategy for safeguarding digital media by applying watermarking and encryption directly at the production stage. This strategy is augmented by an authentication process that involves sending a One-Time Password (OTP) from the content owner. The aim is to enhance content security during its distribution and viewing.

The proposed approach employs watermarking to embed discrete, invisible markers within the digital content, serving as a unique identifier that helps track and identify unauthorized copies. Encryption further protects the content by encoding it, making it inaccessible without the correct decryption key. Together, these technologies form a comprehensive defense against unauthorized copying and sharing.

To specifically counteract piracy in movie theaters, the paper suggests using Infrared (IR) LEDs during projection. This method causes the content to appear blurred or distorted when viewed through an IR LED, thus deterring attempts to record or capture the content. As a result, any pirated recordings made during theatrical showings would be of poor quality and unusable.

The research underscores the benefits of combining these methods to create a strong protection framework against digital piracy. By integrating watermarking and encryption at the production level, along with employing IR LED technology in theaters, content owners can significantly reduce the risk of unauthorized distribution and better protect their intellectual property.

Overall, this approach represents a significant advancement in digital media security, offering a balanced combination of technological and procedural measures to effectively combat piracy. The use of watermarking, encryption, and IR LED projection provides a promising solution to safeguard digital content throughout its distribution and viewing processes.

3.2 Multimedia Tools Application

The article addresses video security by embedding watermarks in the red channel of video frames. This technique focuses on minimizing the impact on the original video while maintaining robust protection against unauthorized use. The method is designed to reduce the complexities associated with key sharing, offering a more efficient solution for digital content protection.

In this approach, a watermark is embedded directly into the red channel of each video frame. This choice of channel helps ensure that the watermark remains subtle, with minimal distortion to the video's visual quality. By concentrating on this specific channel, the method achieves a high level of robustness without significantly altering the appearance of the video. This minimizes the risk of noticeable changes that could alert potential infringers or detract from the viewing experience.

Additionally, the approach addresses key sharing overhead by streamlining the watermarking process. Traditional watermarking methods often involve complex key management, but this technique simplifies the process, making it more practical for widespread use. The reduction in key sharing complexity enhances the overall efficiency of the watermarking system, facilitating easier implementation and management.

Overall, the proposed method offers an effective solution for video watermarking, balancing robust protection with minimal impact on video quality. By embedding watermarks in the red channel and simplifying key management, this approach provides a practical and efficient means of securing digital video content against unauthorized distribution and piracy.

3.3 Ambient Intelligence – Software and Applications

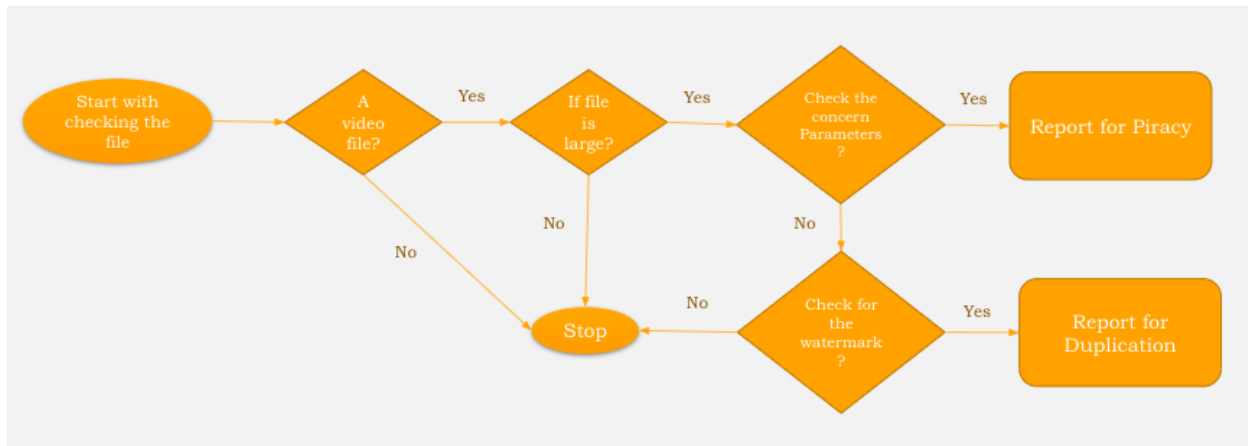
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4. Proposed Work



Proposed Methodology

This research proposes a comprehensive approach to developing a robust system for video watermarking and protection. The methodology will encompass handling video files across various popular formats and resolutions. The primary goal is to address challenges related to video file management, watermark embedding, and algorithm design.

4.1. Video File Handling:

The system will be designed to support video files in any widely-recognized format and standard resolution. This versatility ensures that the methodology is applicable to a wide range of video content, accommodating diverse specifications and use cases.

4.2. Watermark Embedding:

The main focus is on embedding watermarks within video frames, specifically targeting the red channel. This method aims to achieve a strong protective measure while minimizing visual impact on the video. The goal is to ensure that the watermark provides robust security without significantly altering the viewing experience.

4.3. Managing Partial File Uploads:

An additional challenge considered is the potential for users to upload video files in segments. This scenario adds complexity to the watermarking process and requires effective strategies for seamless video reassembly. The methodology will explore and develop algorithms that handle segmented file uploads while maintaining effective watermarking.

4.4. Addressing Compression Variability:

The research will also examine the impact of different file sizes with identical pixel dimensions and length, resulting from varying compression techniques used by users. The methodology will focus on adapting the watermarking algorithm to accommodate these variations, ensuring the watermark's resilience and consistent video quality despite changes in file size and compression methods.

4.5. Algorithm Design and Evaluation:

The methodology involves designing and evaluating algorithms that address various file formats, manage partial uploads, and adapt to different compression techniques. Thorough testing will be conducted to assess the effectiveness of the watermarking system under diverse conditions and ensure it meets security and quality standards.

Through these approaches, the proposed methodology aims to enhance video watermarking and protection, providing a practical solution for securing digital content and addressing real-world challenges in the field.

5. Conclusion

This research investigates a novel method for video matching by focusing on watermark embedding to protect against piracy. While the current phase has effectively demonstrated the algorithm's success with image matching, there is significant potential to extend these findings to video applications.

Given that the approach involves using randomly selected short video clips, it is possible that piracy could occur with content outside these clips. Nevertheless, the positive outcomes observed with image matching suggest that the proposed algorithm holds promise for video content as well. The successful implementation for images provides a strong foundation for adapting the algorithm to handle the complexities of video.

Future research will focus on modifying and testing the algorithm with video clips to address specific challenges such as varying content and piracy scenarios. Building on the achievements in image matching, the aim is to refine the approach to ensure its effectiveness in the video domain.

In summary, the initial results are encouraging and suggest that with further development, the algorithm could become a valuable tool for securing video content. Ongoing efforts will continue to enhance the system's performance and robustness, aiming to effectively prevent unauthorized distribution and protect digital media integrity.

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