Poster Presentation on "An Approach to Embed Image in Video as Digital Watermark"

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Abstract

In today's digital world, copyright protection of digital contents, ownership proof has become a critical issue. To overcome these challenges a blind invisible dual video watermarking approach is discussed. This method involves embedding a watermark image at the second level of the Discrete Wavelet Transform (DWT) and further enhancing it by embedding it into the third level DWT, focusing solely on the video's luminance component. This invisible watermark safeguards copyrights and prevents unauthorized use. The approach analyzes execution time, Peak Signal to Noise Ratio (PSNR), Mean Square Error (MSE), and Normalized Correlation Coefficient (NCC) in the embedding and extraction processes.

Introduction

This involves embedding an image in a video, which is primarily in the spatial domain. Additionally, it utilizes the Discrete Wavelet Transform (DWT), which operates in the frequency domain. approach's steps are depicted in Figures 1 and 2.

Figure 1. Watermark Embedding Block Diagram

Figure 2. Watermark Extraction Block Diagram

Approach

The main objective is to secure the motion video and simultaneously add the watermark image (secret image) without affecting the quality. Unlike traditional video watermarking techniques that use a single image, this method embeds a watermarked image into the video.

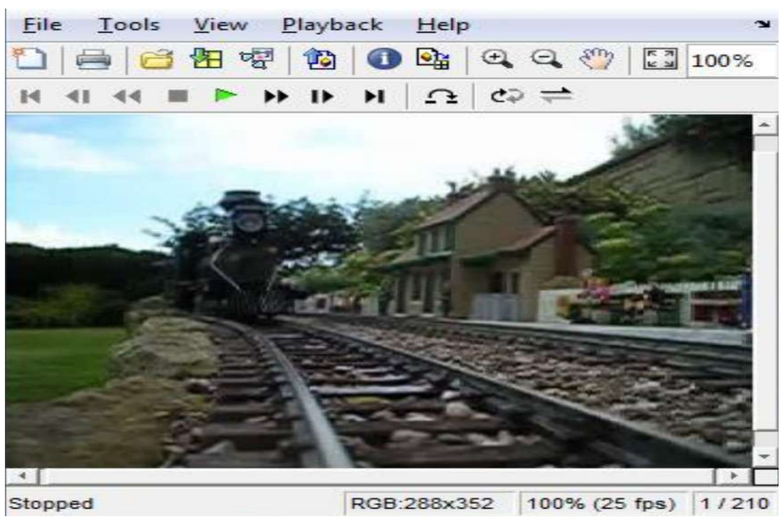

Figure 3. One frame of Original Video

To achieve this, a watermark image is generated through Discrete Wavelet Transform (DWT), obtaining different frequency subbands : LL, HL, LH, HH as shown in Fig.3

Pairs of elements with similar values are identified in the left singular value matrix and modified to embed the watermark content.

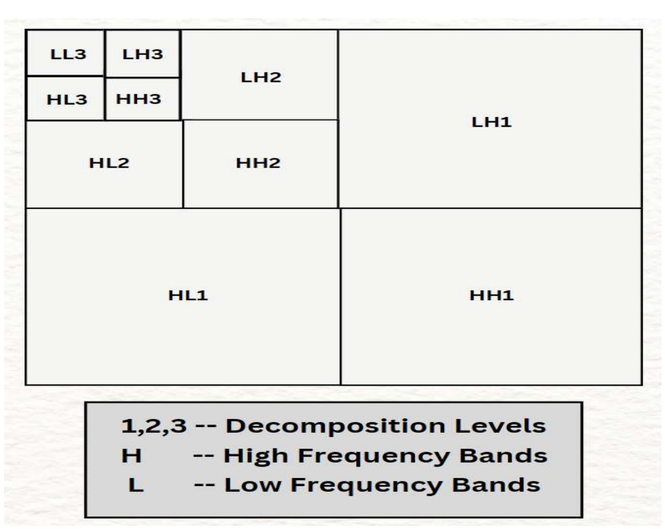

Figure 4. DWT Bands

The two images are then overlaid, creating an invisible watermark image. Next, First video is being converted into frames then processed using third-level DWT, and the watermark image is embedded into the video. This process is followed by the extraction of the watermark image from the frames.

Watermark Embedding Process

The embedding is done with the video frame, watermark image along with an embedding strength parameter x.

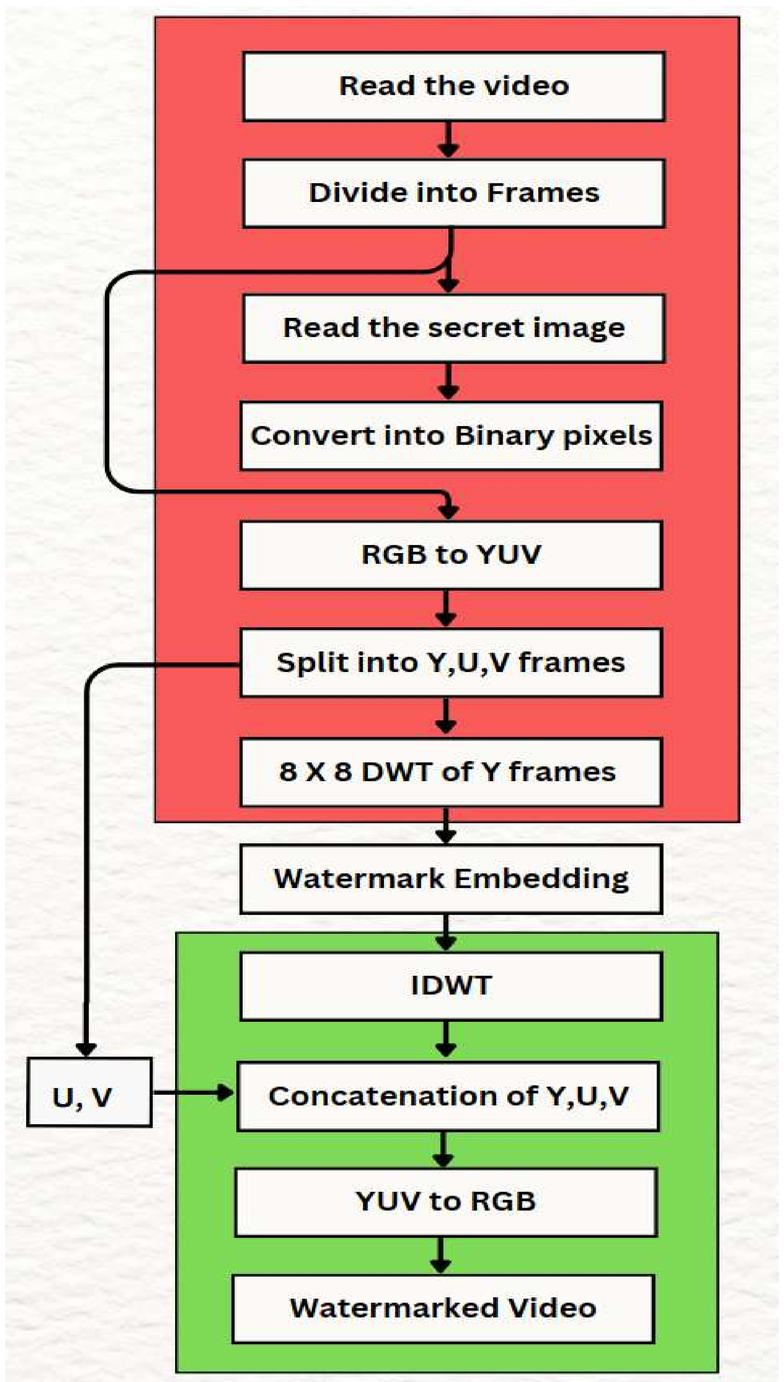

Figure 5. Flowchart of Watermark Embedding

An embedding function 'a' is used to add the two sub bands using equation New LL3 = LL3 + a* wLL3. This watermarked image is embedded in the input video frames

Watermark Extraction Process

The watermark extraction is the reverse of the watermark embedding procedure.

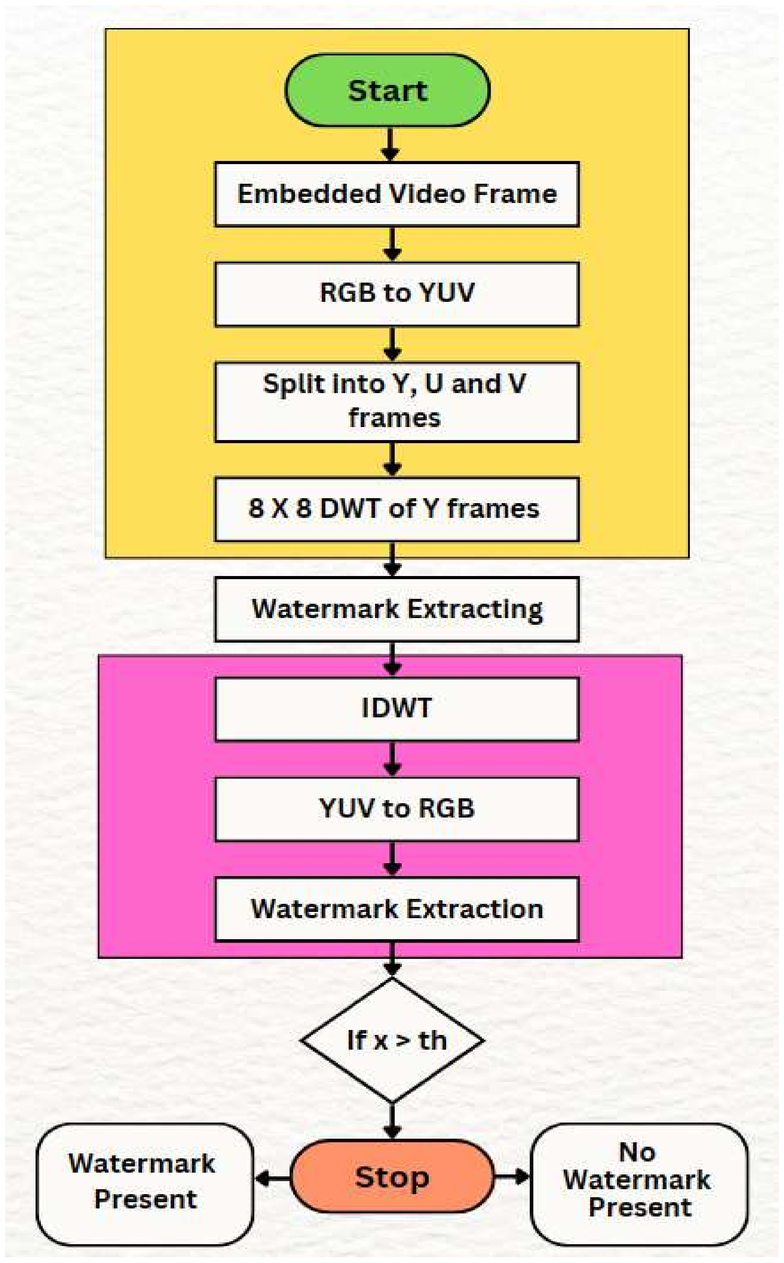

Figure 6. Flowchart of Watermark Extraction

Extraction is done to acquire wLL3 with the same value of 'a' as in embedding with equation wLL3 = newLL3 – LL3 / a

Performance Analysis Factors

* Execution time to construct a watermark.
* Higher PSNR indicates better quality and visibility of extrated image .
* Lower MSE implies improved visual quality.
* NCC to assess watermark extraction quality.

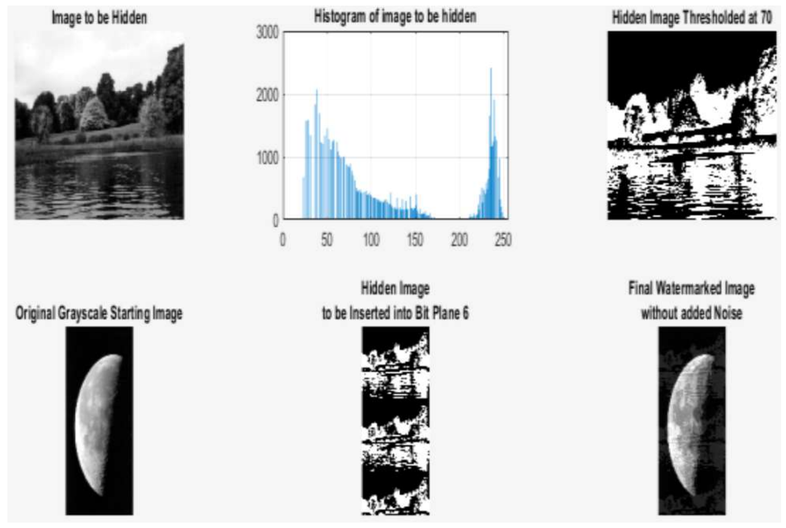

Figure 7. Watermark image

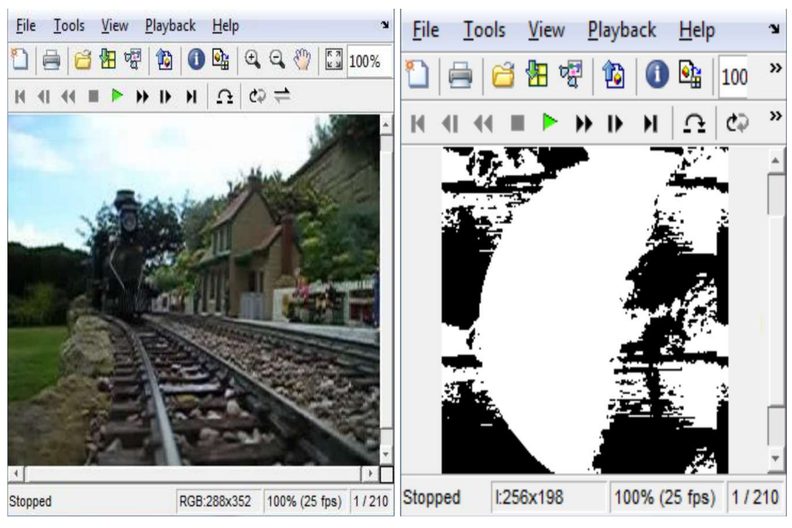

Figure 8. Embedded video and Extracted image

Simulation Results

Watermark embedding strength:

- Ensures minimal degradation in watermarked images and maximizes extraction quality (PSNR and NCC).
- Low values resist alteration but are hard to extract.
- High values may make the watermark visible.

Embedding Strength	MSE	PSNR	NCC
0.1	0.0068	160.7011	1
3.1	0.2115	126.3612	1
4.1	0.4161	119.5924	1
9.1	0.6208	115.5925	1

Table shows that PSNR and MSE change inversely with embedding strength, while NCC remains constant across different embedding values.

Conclusion

In summary, digital watermarking is a technique used to embed hidden data within text, images, or videos to verify ownership and enhance copyright protection. This work presents a blind invisible dual watermarking method for image authentication. The performance analysis, including a PSNR score of 160.7011dB, demonstrates the approach's high invisibility. Metrics like MSE (0.0068) and NCC (1) confirm the watermark's resilience against attacks.

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References

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