Digital Video Watermarking Using Least Significant Bit (LSB) Technique

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Abstract

Digital Video is becoming popular day after day due to the widespread of video based applications such as Internet videos, wireless videos, video conferencing and many more. However, a byproduct of such popularity is the worldwide unauthorized copying and distribution of digital videos. In recent studies Digital watermarking has proved to prevent illegal and malicious copying and distribution of digital media by embedding watermark into the media content.

Video watermarking involves embedding cryptographic information derived from frames of digital video into the video itself. Ideally, a user viewing the video cannot perceive a difference between the original and the watermarked video, but a watermark extraction application can read the watermark and obtain the embedded information.

This paper presents the different video watermarking techniques. It provides a review on various available algorithms. In addition to it, focus on Least Significant Bit (LSB) Technique.

1. Introduction

Earlier duplicating art work was quite complicated and required a high level of expertise for the counterfeit to look like the original. However in the digital world this is not true. Now it is possible for almost anyone to duplicate or manipulate digital data and not affect the data quality. [3]Similar to the process when artists creatively signed their paintings with a brush to claim copyrights, modern artists can watermark their work by hiding their name within the image.

Watermarking is one of the current copyright protection methods that have recently received considerable attention. It is defined as the practice of altering a work to embed a message about that work.[4] Embedding a digital signal with information which cannot be removed easily is called digital watermarking .Digital watermarking is used to protect, identify and track the digital media.

Various areas where watermarking can be applied:

- Audio
- Video
- Documents
- Images

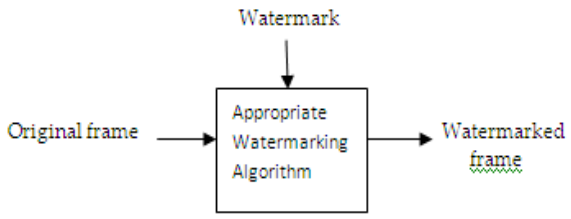
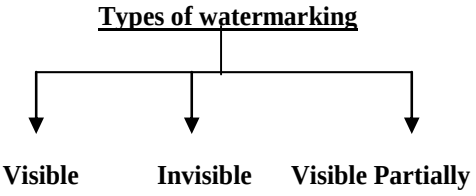


Fig 1: Basic watermarking block diagram.

2 TYPES OF WATERMARKING.



2.1 Visible Watermarking

The watermark that is visible in the digital data. e.g., adding an image as a watermark to another image.

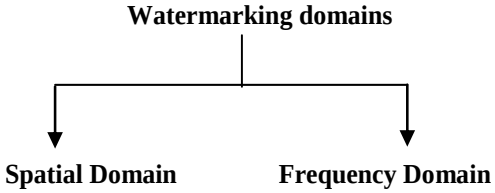
2.2 Invisible Watermarking

In invisible watermarking information is inserted into an image which cannot be seen but can be retrieved with the help of right software.[4] In invisible watermarking the ownership of the image can be proved.

2.3 Partially Visible Watermark

The partially visible watermark is a combination of a visible watermark and an invisible watermark. First a visible watermark is inserted in the host image and then an invisible watermark is added to the already visible-watermarked image.

3 WATERMARKING DOMAINS



3.1 Spatial Domain

In spatial domain pixels of one or two randomly selected subsets of images are modified.[3]

- Algorithms used :
  - LSB
  - SSM Modulation based technique.

3.2 Frequency Domain

Frequency Domain technique is also called transform domain.[3] In this technique values of certain frequencies are altered from their original.

Commonly used Transform domain methods:

- DCT - Discrete Cosine Transform
-DWT - Discrete Wavelet transforms
-DFT- Discrete Fourier Transform

3.2.1 DISCRETE COSINE TRANSFORM WATERMARKING

In DCT the image is divided into different frequency band, and then embedding watermarking into the middle frequency bands of an image.[1] DCT represents data in terms of frequency space rather than an amplitude space. DCT based watermarking techniques are robust compared to spatial domain techniques.

Steps in DCT Watermarking Algorithm (Block Based).

- Divide the image into non-overlapping blocks of 8x8
- Apply forward DCT to each of these blocks
- Apply some block selection criteria (e.g. HVS)
- Apply coefficient selection criteria
- Embed watermark
- Apply inverse DCT transform on each block

3.2.2 DISCRETE WAVELET TRANSFORM WATERMARKING

In DWT a signal is split into two parts, usually high frequencies and low frequencies.[2] The low frequency part of the signal is again split into two parts of high and low frequencies. [1]The process can then be repeated to computes multiple "scale" wavelet decomposition, as in the 2 scale wavelet transform shown below in figure below.

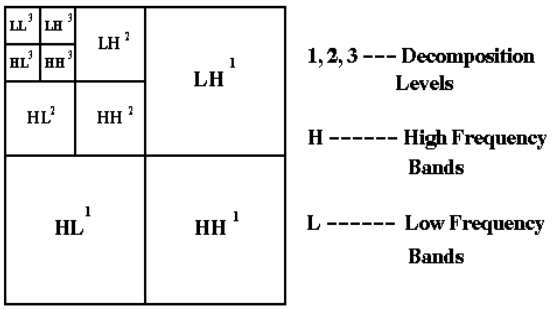


Fig 2: DWT Block

3.2.3 DISCRETE FOURIER TRANSFORM WATERMARKING

In DFT a continuous function is transformed into its frequency components.[2] DFT is an important image processing tool which is used to decompose an image into its sine and cosine components. It has robustness against cropping, translation etc.

Table 1:Difference between Spatial and Frequency Domain.

Factors	Spatial domain	Frequency domain
Implementation Cost	Low	High
Robustness	Fragile	More Robust
Perceptual quality	High control	Low control
complexity	Low	High
Time	Less	More
Capacity	High	Low
Example of Application	Mainly Authentication	Copy rights

4 LEAST SIGNIFICANT BIT (LSB) INSERTION.

To impose Invisible Digital Watermarking many different algorithms are available. But the simplest algorithm is the Least Significant Bit (LSB) Insertion. [5]In this technique every 8-bit pixel's least significant bit is overwritten with the bit from the watermark.

25	**26**	27	28	29
35	31	32	33	34
42	43	44	45	46
49	50	51	52	53
54	55	56	57	58

Fig. 3: Cover Image.

24	**26**	27	28	29
35	31	32	33	34
42	43	44	45	46
49	50	51	52	53
54	55	56	57	58

Fig. 4 Watermarked Image.

0	0	0	1	0	0	0	0	1

Secret Data =’A’

25 - 0001100**1**

26 - 0001101**0**

Like in the above example the first matrix shows the original image to be divided into number of frames with certain values in it. [5]The second matrix is the watermarked image which is created after the original image is watermarked. [5]And the secret data matrix

"A" is the values of the image that has to be watermarked on the original image.

Now the value of frame one of the original image is checked for example it is 25, which in binary terms is 00011001 now the LSB of this value is '1' . So if the LSB value is '1' it is replaced by '0' and if the LSB value is '0' it remains the same.[5] Like in the example shown above, for frame value 25 after applying the technique the LSB value changes to '0' and the resultant value becomes 24. But in case of frame value 26 the LSB value is '0' so the resultant value remains the same. In this way all the frame values are checked. and the watermarked image is formed.

4.1STEPS OF LEAST SIGNIFICANT BIT:

1] To convert RGB image to gray scale image.

2] Making double precision for the image.

3] Shifting most significant bits to low significant bits of watermark image.

4] Make least significant bit of host image to zero.

5] To add shifted version (of step 3) of the watermarked image to modified (of step 4) host image.

4.2 FEATURES OF LEAST SIGNIFICANT BIT:

1] The technique is easy to implement.

2] It is simple to understand.

3] The result of this technique is a stenographic- image which contains hidden data yet to appear.

Table 2:Merits/Demerits of different techniques.

Techniques	Merits	Demerits
Least Significant Bit(LSB).	1. Very easy to implement and understand 2. image quality less tampered.	1. It lacks robustness 2. Vulnerable to noise and cropping, scaling.
Discrete cosine transform(DCT).	1. Here the watermark is embedded directly into the coefficients of the middle value of frequency, hence the visibility of image will not be affected and the watermark will not be removed by any attack.	1. Certain higher frequency components tend to be suppressed during the quantization step.
Discrete wavelet transform(DWT)	1. Allows good localization in spatial and frequency domain .	1. Computing cost may be higher. 2. Longer compression time. 3. Blur near edges of images .
Discrete fourier transform(DFT).	1. DFT is rotation, scaling and translation invariant, hence it can be used to recover from geometric distortions.	1. Complex implementation 2. Cost of computing may be higher.

5.Results and Studies

Fig 5. Original Image.

Fig 6. Watermarked image with LSB 1.

Fig 7. Watermarked image with LSB 2.

Fig 8. Watermarked image with LSB 3.

Fig 9. Watermarked image with LSB 4.

Fig 10. Watermarked image with LSB 5.

Fig 11. Watermarked image with LSB 6.

Video Rate is 25.

6.Conclusion

Here implementation of digital video watermarking scheme using least significant bit is proposed. Through the comparison between different schemes reviewed in this paper, it is shown that watermarking techniques in spatial domain have better perceptual quality control and capacity than schemes proposed in frequency domain.[2]Digital watermarking holds key importance for protecting digital content.

In a watermarking system tampering with a watermark should always be detectable, and attempting to remove a watermark from its host frame should cause that host frame to be useless[4]Currently, the watermarking research is progressing exponentially and various researchers and developers are focusing to develop some scheme providing the creators of digital content with a solid guarantee of copyright protection[4].

7.References.

[1] Hamid Shojanazeri, Wan Azizun Wan Adnan, SharifahMumtadzahSyed Ahmad, Video Watermarking Techniques for Copyright protection and Content Authentication,University Putra Malaysia, Serdang, Malaysia.

[2] H. Shojanazeri, W. Adnan, S. Ahmad, and M. Saripan, "*Analysis of watermarking techniques in video*." IEEE, 2011, pp. 486–492.

[3] C. Rey and J. Dugelay, "*A survey of watermarking algorithms for image authentication*," EURASIP Journal on Applied Signal Processing, vol. 2002, no. 1, pp.

[4] KarnpriyaVyas ,KirtiSethiya, Sonu Jain, '*Implementation of Digital Watermarking Using MATLAB Software*',Volume-I, Issue-I (2012).

[5] Gurpreet Kaur, Kamaljeet Kaur, ' *Image Watermarking Using LSB (Least Significant Bit)*',International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 4, April 2013.