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Digital Video Disambiguation Technique using Spread Spectrum Technique

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Abstract **– Digital video watermarking technique was introduced in 1954 by Hembrooke. The watermark encodes or represents information that can defend the video, typically identifying the proprietor (source) or the deliberate recipient (destination) of the video. In this paper, we proposed a digital video watermarking technique which is based on indistinguishable frame extraction in 3-Level Discrete Wavelet Transform (DWT). In this proposed method, first host video is separated into video shots. Then from each video shot one video frame called indistinguishable frame is selected for embedding watermark. Each identical frame is decomposed into 3-level DWT, then select higher sub band coefficients to insert the watermark and the watermark are adaptively embedded to these coefficients. Second method is to embed a high frequency co-efficient watermark in Y-plane rather than X-plane to guarantee perceptual unobtrusive of watermark.**

Keywords **– Digital Video Disambiguation, Discrete Wavelet Transform (DWT), Spread Spectrum Technique, PSNR, MSE, Entropy, Processing Time.**

I. INTRODUCTION

Digital watermarking is nothing but insertion or embedding of a signal, known as the watermark, into original video in an unobtrusive manner. The process of embedding watermark introduces distortion; however, watermarking techniques use heuristics or perceptual models to reveal the presence of the watermark introduced in the watermarked video. Ideally, the watermarked and original videos are perceptually impossible to differentiate when displayed. The embedded watermark may be detected by using a watermark detector, which enables an application to respond to the presence or absence of the watermark in a video. In addition to video, watermarking techniques have been anticipated to protect images, audio, text, and other types of data. A confront in watermarking is that processing the watermarked video may remove or destroy embedded watermark making the watermark more difficult to detect. The watermarked video may be processed for any number of reasons, including the normal processing that occurs in an application; unintentional damage or loss during storage, retrieval, or transmission over a network; or deliberate processing by a (hostile) user for the purpose of removing the embedded watermark. Processing the watermarked video is known as an attack, whether the intent such processing is malicious or not. The watermark encodes or represents information that can protect the video, typically identifying the owner (source) or the intended recipient (destination) of the video.

II. SPREAD SPECTRUM TECHNIQUE

This method proposes an algorithm for copyright protection of videos. The algorithm presented embeds a watermark into temporal dimension of cover contents which is not perceivable to eyes but contains necessary information regarding copyright claim of video. In literature, several color space representations have been reported for color image watermarking. In reported scheme, Y channel is used to embed watermark to achieve maximum possible robustness against compression based attacks. Though modified Y channel gives good imperceptibility because it can cause visual artifacts but as watermark is embedded in temporal dimensions, it causes minimum distortion in x-y spatial dimensions. There are many options to obtain plane for embedding watermark in video. In x-y axis embedding can be done in few selected individual frames or every frame of video. Choosing temporal axis is a good alternative for embedding because attacks and noise imparted to videos mainly affect x-y axis. Also, watermark and noise imparted to frame has less effect on temporal relations. Video of size MXN is decomposed into frames followed by conversion to YCbCr format for each frame. Y channel of any M selected frames are stacked. To obtain watermark embedding plane (Vp) one column is chosen from each of the Y frame of these M frames of video. 1st column is obtained from first frame, 2nd column from 2nd and so on. In this way embedding plane is obtained by joining these columns sequentially. Watermarking is done by adding a pseudo random noise sequence to high frequency wavelet coefficients of selected watermarking plane for each of watermark bit and is extracted by finding correlation between regenerated PN sequence and modified wavelet coefficients.

A. Watermark Embedding Algorithm:

The steps of embedding algorithm are as follows:

Input: RGB color video (V) of size MXN and a binary watermark (W).

Output: Watermarked Video (Vw)

1) The host video V is divided into RGB frames.

2) Any N frames are selected from these video frames & transformed into YCbCr color space.

3) Watermark embedding plane (Vp) is prepared from all Y channels.
4) Vp is decomposed into CA2, CH2, and CV2& CD2 by 2 level wavelet decomposition. Select diagnose wavelet (CD2) wavelet coefficient for level 2 watermarking.
5) An initial seed is selected to generate pseudo random sequence (PNS) of size equal to size of frequency band CD2 using PNS = R1 x (PN – R2)
6) Where R1 = 2 & R2 = 0.5 & PN is random sequence of normal distribution.
7) The 2D watermark is converted into 1D array & if watermark bit is 0 (black) then CD2 coefficients are modified by using following relation CD2′ = CD2 + K.PNS, where k is embedding strength.
8) If watermark bit is 1 (white) then wavelet coefficient are left unchanged.
9) The steps 5 & 6 are repeated for all '0' bits in watermark with every time newly generated PN sequence.
10) CD2′ along with CA2, CH2, CV2 are transformed into modified embedding plane (Vp′) using inverse DWT
11) The modified Y channel of M frames is obtained from plane (Vp′) by placing each column of (Vp′) in its respective space.
12) The modified Y channel, Cb and Cr channel of all M video frames are transformed back into RGB color space to get the modified watermarked video (Vw).
13) Compute the PSNR for V and Vw to check that how much the host video is modified.

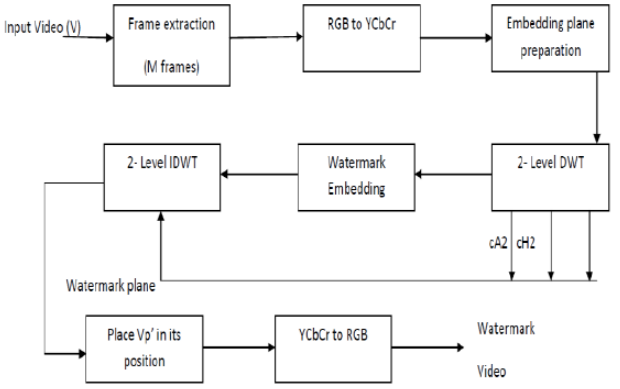

Fig.1. Watermark Embedding Algorithm

B. Watermark Extraction Algorithm:

Watermark is extracted using correlation based technique. The steps of extraction algorithm are as follows:

Input: Watermarked Video (Vw) of size *M* x *N*.

Output: Extracted Watermark (Wr).

1) RGB color Video (Vw) is broken into frames.
2) The watermarked M frames are selected and transformed into YCbCr color space.
3) The temporal watermarked plane (Vp′) is obtained from Y channel of all M frames.
4) (Vp′) is then decomposed into 2-level wavelet coefficients to get modified wavelet coefficients CD2′.
5) An initial seed is selected to generate pseudo random sequence (PNS) of size equal to size of frequency band CD2 using PNS = R1 x (PN – R2).
6) Where R1 = 2 & R2 = 0.5 & PN is random sequence of normal distribution.
7) The Ith correlation coefficient is obtained between PNS and diagonal coefficient matrices CD2′ as r (i) = corr2 (PN, CD2′)
8) Steps5 & 6 is repeated for all watermark bits.
9) Threshold is computed as T = means (r (i)) & row matrix W′ of size equal to that of watermark is initialized with all values of '1'.
10) For every watermark bit, compare r (i) with T & modify W.
11) Reshape row matrix W′ into matrix equivalent to size of original watermark matrix (W) to get recovered watermark (Wr).
12) Correlation between original watermark (W) & recovered watermark (Wr) is computed to check how much watermark is extracted.

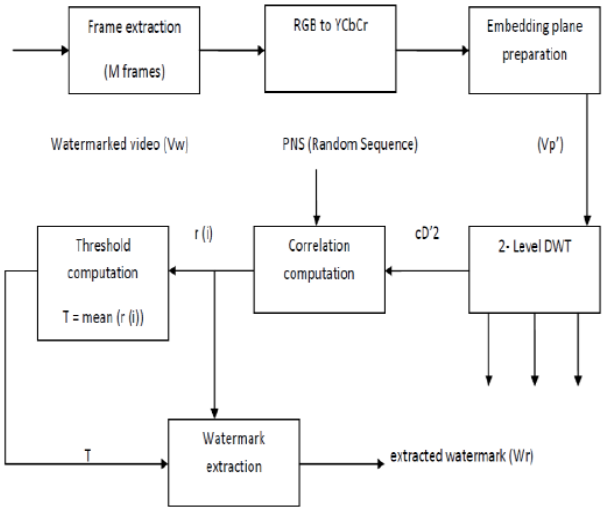

Fig.2.Watermark Extraction Algorithm

III. Evaluation and Results

If we embed both logos i.e. watermarks shown below in a video and distinguish this video into identical frames 73 identical frames are formed of that video.

(a) **(b)**

Then if we decide to embed a logo or watermark in say 73rd frame then following results have been achieved.

Fig.3. Proposed Video

Fig.4. Watermarked 73rd Frame of video

Table 1: Parameter comparison for Spread Spectrum

Parameter	Before embedding	After embedding for (a)	After embedding for (b)
PSNR	infinite	91.55	94.9681
MSE	0	4.55×10^{-5}	2.07×10^{-5}
Entropy	Nil	6.5605	6.5605
Embedding Processing Time	Nil	0.1641 sec	0.1735 sec
Embedding Extraction Time	Nil	0.1915 sec	0.1870 sec

Thus by comparing the results we can conclude that if watermarks are having more numbers of white pixels it is difficult to extract perfectly because of losses and if we use (b) watermark which is having more number of black pixels less damage or cropping to watermark occurs.

IV. Conclusion

In this paper, watermark is embedded in temporal dimensions using spread spectrum technique; this gives robustness against various types of attacks. The proposed scheme provides high value of PSNR which gives better imperceptibility thus giving negligible artifacts in watermarked video.

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