A Digital Video Watermarking Algorithm Based on LSB and DCT

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ABSTRACT: *In this paper a new watermarking algorithm is proposed for videos. The developed method embeds a binary image as watermark into a colour avi video..In the proposed method, LSB and DCT both are embedded in the video frames. We compare our algorithm with 2-LSB using Peak signal-to-noise ratio (PSNR). Experimental results show that the quality of the watermarked image is higher. PSNR value is 63.74db in proposed method. This is higher compare to the other method.*

Keywords: Watermarking, LSB, DCT, Video, PSNR

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1. Introduction

Digital watermarking is gaining importance for protecting the authenticity of multimedia objects as they are easier to copy, exchange, and modify. Many watermarking schemes have been proposed in recent years, but most of them deal with still images, only some of which are extended over to the temporal domain for video watermarking [3]. A watermark is information about origin, ownership, copy control etc. This information is embedded in multimedia content with taking care of imperceptibly and robustness. Imperceptibility means that the host data won't lose much quality and hidden data won't be perceptible. Robustness is the ability of not losing hidden data just because of some modification upon the host data. However, imperfection and robustness sometimes are contradictory. The improvement of imperfection often causes the loss of robustness and vice versa, so the watermarking designers have to compromise between the two properties[2].

Digital video is a sequence or collection of consecutive still images. We embed the watermark in the R,G,B components of the video frames. Experimental results show that the quality of the watermarked video is better and the algorithm is robust to the attacks such as salt-and-pepper noises.

2. Video Watermaking Techniques

Now several watermarking techniques have been proposed. The first one is to embed the watermark information into the original video stream directly, which has the advantage of being rich in embedding method and could apply the embedding methods of

image watermark, while the disadvantage is the increase of video code stream and the reduction of video quality.[1] This is the spatial domain watermarking. The other method is to embed the watermark in the discrete cosine transform (DCT) domain. The transform domain coefficients are then modified using the watermark. The inverse transform is applied to obtain the image watermarked finally. Due to complicated calculations done by the forward and inverse transforms, these methods are more complex and have higher computational costs compared to spatial domain methods.[1]

3. LSB Technique

One of the first techniques for watermarking is the least-significant bit modification. In this the least significant bits of the cover image is replaced by the most significant bits of the watermark. Here we embed the LSB in the blue component of the video frames because of its less sensitivity. [5]If the watermark is smaller than the video frame, we tile several copies of watermark together in order to achieve the correct size. Assuming that the dimensions of the video frame are divisible with the dimensions of the watermark.[6].If the watermark is bigger than the video frame we use only the part of the watermark which is of the size of the frame.

Steps for video watermarking using LSB:

1. Divide the video into frames.

2. Get the blue component of the frames and replace the first and second least significant bits of each pixel with first and second most significant bits of the watermark image.

3. Combine the red, green and the modified blue component of the frame and save it as a tiff image.

4 Repeat the steps 1-3 for the entire frames of the video.

5. Combine the images into a new video..

4. Proposed Method

The implementation of the proposed algorithm is done using MATLAB. The basic block diagram for the proposed algorithm is shown below:

4.1 Embedding Algorithm

Here we take two binary watermark, one for LSB and the other for DCT.

1. Divide the video into frames.

2. Get the blue component of the frames and replace the least significant bit of each pixel with the most significant bits of the watermark image w1 shown in Figure.3.

3. Combine the R,G,and modified B components to get LSB watermarked frame.

4. Now perform the level 2 discrete cosine transformation on each of the R,G,B components of the LSB watermarked frames.

5. Now take the coefficient of watermark's strength, we take this as 0.5

6. Multiply the watermark w2 shown in Figure.4 with the coefficient of watermark's strength and add it effectively across rows and columns. We do this for all the three components.

7. Apply the level 2 inverse discrete transformation of the three components and combine them together to get the LSB and DCT watermarked video frame and save it as a tiff image.

8. Repeat the steps 2-7 for the entire video.

9. Combine all the images to get the watermarked video.

4.2 Extraction Algorithm

1. Get the watermarked video and divide it into frames.
2. Apply level 2 DCT to the R,G,B components of the video frames.
3. Subtract the coefficient from the R,G,B channels.

4. Apply level 2 IDCT to remove the watermark w2.
5. Get the least significant bit of the frame to get the watermark w1.

5. Experiments and Results

In our experimental results 1st frame of the video, traffic.avi which is shown in Figure.2 is used as cover image. We embed the watermark, w1 shown in the Figure.3 using LSB and the watermark w2, shown in the Figure.4 using DCT. We got the watermarked image shown in Fig-5 without noticeable distortion. Now we compare the image quality for the watermarked video by using LSB and by using the proposed method by PSNR. Peak signal-to-noise ratio (PSNR) is most easily defined via the Mean Squared Error (MSE) which for two mXn images I and K where one of the images is considered as a noisy approximation of the other. [4]

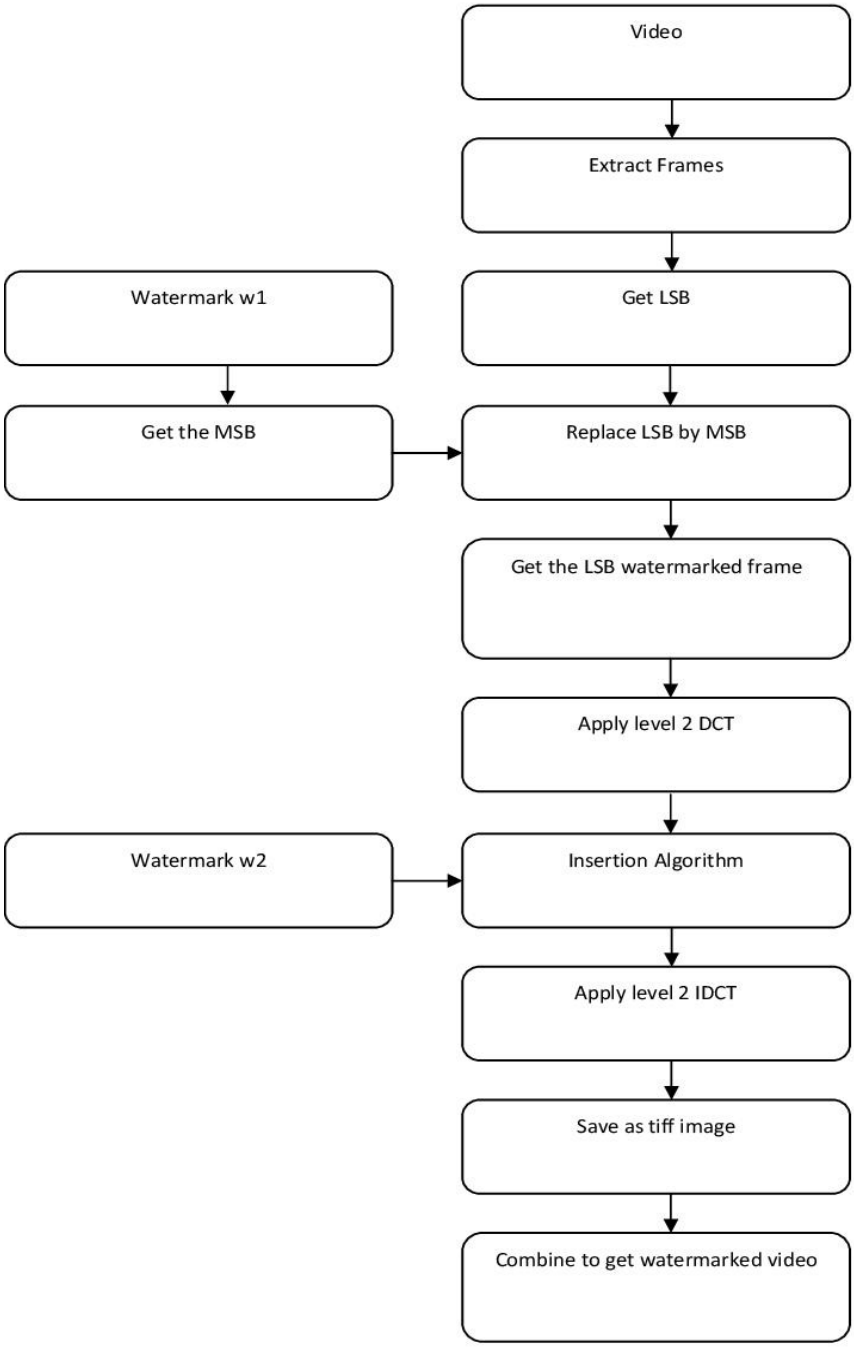

Figure 2. Original video frame

Figure 3. Watermark w1

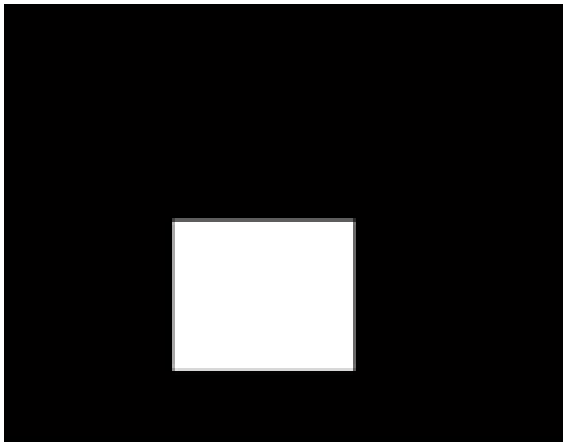

Figure 4. Watermark w2

Figure 5. Watermarked video frame

Peak signal to noise ratio (PNSR) and the mean square error (MSE) are used to evaluate perceptual distortion of our watermark scheme. PSNR is defined as the following equation (1) and the MSE is defined in equation (2) [4].

$$PSNR = 10 * \log_{10} 10 (MAX^2 / MSE) \qquad (1)$$

Where MAX is equal to 255 in grayscale images

$$MSE = 1 / 3 \times m \times n \sum_{i=1}^{m} \sum_{j=1}^{n} [(r (i,j) - r^* (i,j))^2 + (g (i,j) - g^* (i,j))^2 + (b (i,j) - b^* (i,j))^2 \qquad (2)$$

Where $r (i,j)$, $g (i,j)$ and $b (i,j)$ represents a color pixel in location (i, j) of the original image, $r^* (i,j)$, $g^* (i,j)$ and $b^* (i,j)$represents a color pixel of the watermarked image and m , n denote the size pixels of these color images.

Based on equations (1) and (2), we calculate the PSNR for our proposed algorithm to see the quality of the watermarked images, which is shown in Table 2.Table 1 shows the PSNR calculated for 2-LSB.

Image	**PSNR (Db)**	**MSE**
Frame 1	57.3108	0.1208
Frame 2	57.3108	0.1208
Frame 3	57.3227	0.1205

Table 1. Frame Values

Image	**PSNR** (Db)	**MSE**
Frame 1	63.7457	0.0274
Frame 2	63.7457	0.0274
Frame 3	63.7320	0.0275

Table 2. Frame Values

6. Conclusion

This paper proposed a new algorithm for embedding watermark in a video. After we embed the watermark , we get the video without noticeable distortion on it. Therefore, this digital watermarking algorithm can be used to hide data inside video. Experimental results show that it has a better PSNR value. It is within the acceptable range of PSNR value which is 60 and 80db.It is robust to various watermarking attacks like the salt-and-pepper noises.

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