Video Watermarking Using DCT and DWT: A Comparison

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ABSTRACT

The main Objective of this paper is to develop digital watermarking system for authentication of video. Here we present implementation of a visible digital video watermarking system. The system is implemented using Discrete Cosine transform (DCT) and discrete wavelet transforms (DWT) and simulated using MATLAB/ Simulink.

Key words: Discrete cosine transforms (DCT), discrete wavelet transforms (DWT) and MATLAB/ Simulink
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INTRODUCTION

More information is transmitted in a digital format now than ever, and the growth in this trend will not plateau in the foreseeable future. Digital information is susceptible to having copies made at the same quality as the original. A watermark is pattern of bits inserted into a digital image, audio or video file that identifies the file's copyright information (author, rights, etc.). The name 'watermark' is derived from the faintly visible marks imprinted on organizational stationery. Unlike printed watermarks, which are intended to be somewhat visible (like the very light compass stamp watermarking this report), digital watermarks are designed to be completely invisible, or in the case of audio clips, inaudible.
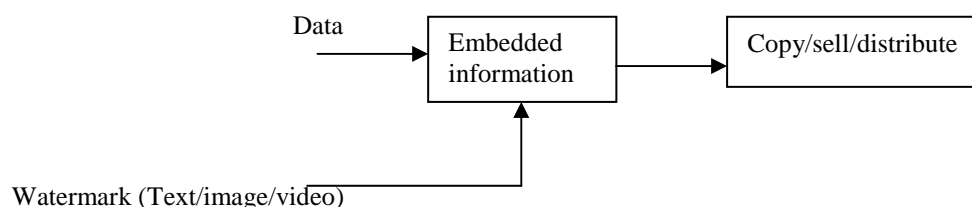

Fig.ure 1 Block diagram of DWM

In addition, the bits representing the watermark must be scattered throughout the file in such a way that they cannot be identified and manipulated. And finally, a digital watermark must be robust enough to survive changes to the file it's embedded in, such as being saved using a lossy compression algorithm e.g. JPEG. Satisfying all these requirements is no easy feat, but there are a number of companies offering competing technologies. All of them work by making the watermark appear as noise - that is, random data that exists in most digital files anyway.

The watermarking techniques can be broadly classified as 1.Visible water marking 2.Invisible water marking. Visible watermarks are visual patterns which are inserted into the digital data. Invisible watermarks involve marking imperceptible alteration on the cover data to convey the hidden information. The water marking scheme can also be classified as [3] 1.Non Blind and 2.Blind. The watermarking scheme in which the extraction of embedded information using the original, unwatermarked data is done is called as non-blind or nonoblivious watermarking scheme; otherwise it is called as blind or oblivious.

Video Watermarking can be of two types 1.frame based 2. Stream based [1]. In the case of frame based watermarking the watermark bits are embedded in the video by means of complete frame or tiles of the frame whereas in stream based watermarking only the lines of the video frame are embedded.

This paper presents about 1. Design of visible video watermarking technique.2.MATLAB/Simulink simulation of the watermarking modules.

IMPLEMENTATION

In order to implement digital video watermarking the following transforms are used and also their PSNR values are compared.

Discrete Cosine Transform (DCT)

The discrete cosine transforms (DCT) is a member of a family of sinusoidal unitary transforms [2]. The properties of DCT includes, they are real, orthogonal, and separable with fast algorithms for its computation. They have a great relevance to data compression.

Discrete Wavelet Transform (DWT)

The discrete wavelet transform (DWT) [4] is a linear transformation that operates on a data vector whose length is an integer power of two, transforming it into a numerically different vector of the same length. It is a tool that separates data into different frequency components, and then studies each component with resolution matched to its scale.

Here the water marking technique is applied to the video to embed the data using both DCT and DWT and their results are compared. The steps which are used to embed the data into the video are as follows

At the Video Block

• Video that is to be water marked is selected from multimedia file.
• Then it is converted into frames using to sample block.
• It is converted in to unsigned integer format.
• The video is selected using selector block. Using this block we can select block size where we want to embed the data.
• Then it is pre-processed using 2D-DCT/DWT block processing unit.
• The output of the above step is given to matrix block.
• Simultaneously we can observe the video using video viewer by connecting it to the output of multimedia file.

At the Image Blocks

• Image that is to be embedded is selected using the image from file block.
• Then it is converted into unsigned data format.
• It is selected using selector block.
• Then this message is processed using 2D-DCT/DWT using block processing block. And the output of this is given as input to the matrix sum block.

Embedding Process

• In the matrix sum block the image is embedded into the video which is to be watermarked.
• Then the output of this is again given to the block processing unit where it under goes 2D-DCT/DWT.
• The output of this is converted single data type which is again connected to the input terminal of video viewer to observe the result.
• At the same time PSNR is calculated for the watermarked video.

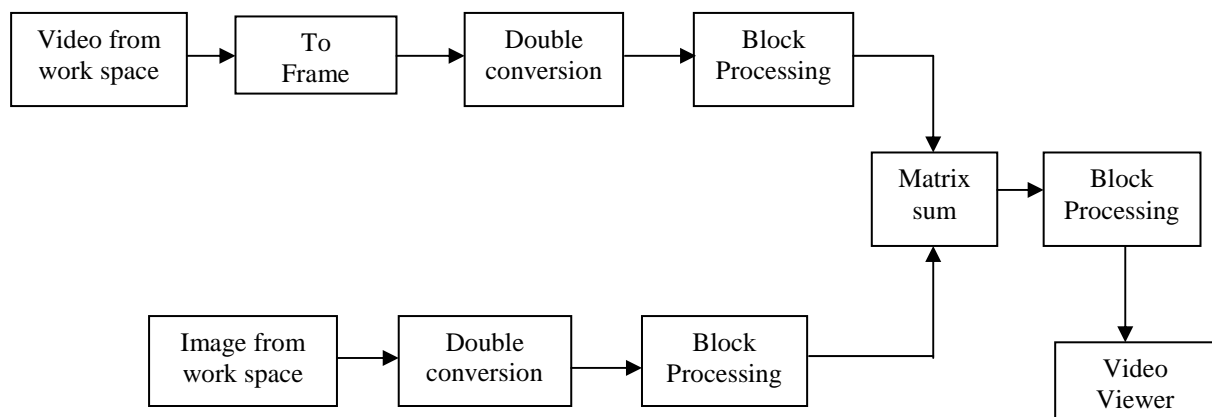The PSNR is calculated for both the techniques and showed that DWT is better than DCT.

Fig.. 1 Simulink model for video watermarking using DCT/DWT

RESULTS

Results of DCT and DWT

The, results are shown for the embedding process using both DCT and DWT along with the PSNR values. Fig. 2 shows the original video frame 'vipunmarkedroad.avi' of resolution 240×320 with a speed of 1 frames per second.Fig..3 shows the watermark image 397×167 which is to be embedded into the video m3.jpg using Simulink model. Fig. 4&5 shows the watermarked video using DCT and DWT with PSNR 43.62db and 44db respectively. The DCT and DWT are subjected to various enhancements like

    a)   Gamma correction   b) Contrast adjustment   c) Histogram equalization

Fig. 2 Original Video to be water marked

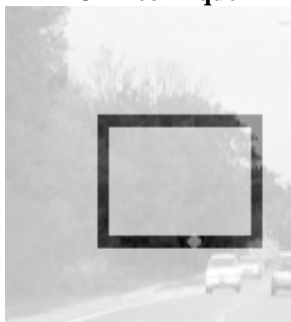**Fig. 3Image to be embedded in to the video**

Fig. 4 Watermarked video using DCT [PSNR=43.62db]

Fig. 5 Watermarked video using DWT [PSNR=44db]

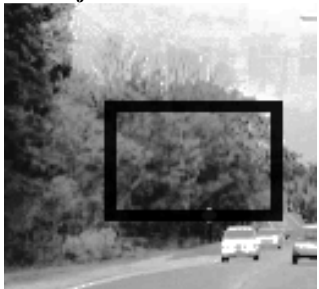**Table - 1 Results of Various Enhancements for DCT and DWT**

DCT Technique	**DWT Technique**
Gamma correction with PSNR=47.85db	**Gamma correction with PSNR=46.82db**
Contrast adjustment with PSNR=5.126db	**Contrast adjustment with SNR=6.1473db**
Contrast adjustment with PSNR=0.7412db	**Histogram equalization with PSNR=3.1924db**

Results of Different Attacks
The watermarked video is also applied to various geometric attacks like [5]

Rotate
Rotate image by specified angle. The Rotate block uses the 3-pass shear rotation algorithm to compute its values.

Translate
It move an image up or down and/or left or right. We can specify two-element offset vector using the dialog box or the Offset port.

Shear
Shifts each row or column of an image by a linearly increasing or decreasing distance. Use the Shear direction parameter to specify whether you want to shift the rows or columns horizontally or vertically.

Edge Detection
It finds the edges in an input image using Sobel, Prewitt, Roberts, or Canny methods. In this work sobel operator is used to detect the edges.

Corner Detection
It can be used this block to find the location of the corners, and the corner metric values. Corner locations are returned as M-by-2 matrix of one-based [x y] coordinates, where M is the number of detected corners.

Image Complement
Computes the complement of a binary or intensity image. For binary images, the block replaces zeros with ones and ones with zeros. In the output image, black and white are reversed. For intensity images, the block subtracts each pixel value from the maximum value that can be represented by the input data type and outputs the difference. In the output image, dark areas become lighter and light areas become darker.

Table – 2 Results of Geometric Attacks for DCT and DWT

Rotation by 60 degree with PSNR=47.85db   Rotation by 60 degree   with PSNR=49.28 db
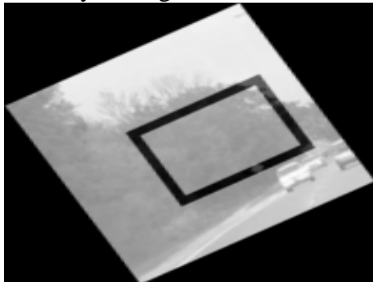
Translation with PSNR=50.09db   Translation with PSNR=50.92db

Shear horizontally with PSNR=50.19db   Shear horizontally with PSNR=50.19db

Shear vertically with PSNR=50.19db   Shear vertically with PSNR=50.19db

Edge detection using sobel operator   Edge detection using sobel operator

Corner detection

Image complement

Median filter
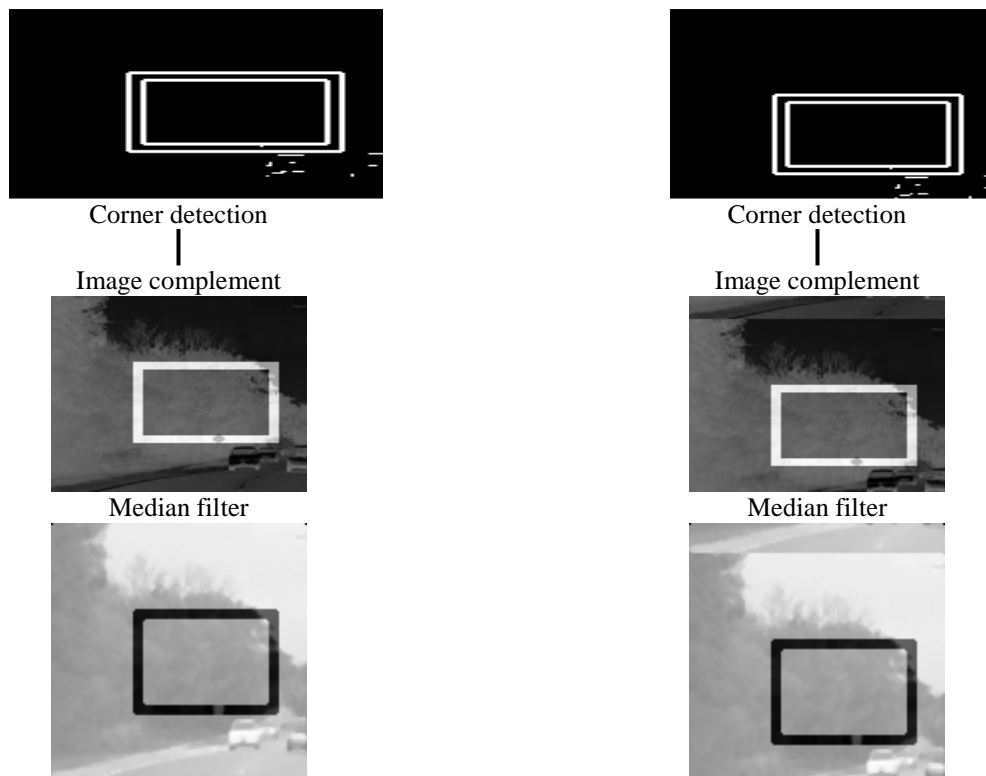
CONCLUSION

In this paper, it is shown that digital video watermarking is implemented using DCT and DWT transforms. By observing the simulation results it is shown that DWT gives better results than DCT for digital video watermarking for grayscale sequence. And also for various attacks DWT provides better results compared to that of DCT. Digital watermarking seems to be the only potential encryption technology to provide protection even after data is decrypted.

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