ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 4, Issue 5, May 2015

Video Watermarking Technique Based On Combined DCT and DWT Using PN Sequence Algorithm

Darshan M. S[1], Sudha B. S[2],

[1]M.Tech Scholar, Department of ECE, Dr. Ambedkar Institute of Technology, Bangalore, Karnataka, India
[2]Associate Professor, Department of ECE, Dr. Ambedkar Institute of Technology, Bangalore, Karnataka, India

***Abstract* – A robust quality watermarking scheme will consists of same correlation factor and large PSNR. In this paper, a digital video watermarking scheme based on PN sequence algorithm is implemented. The RGB color image is converted into Grayscale and 2 level DCT and DWT is applied where a secrete image is embedded into cover image. For security purpose a PN sequence will be generated and same will be used during extraction process which consists of IDCT and IDWT. This work has been implemented mat lab. Finally we are comparing uncompressed video quality on the basis of performance parameters such as PSNR, CF and SSIM.**

Keywords: **Video watermarking, DCT, DWT.**

I. INTRODUCTION

Video watermarking is a technique which allows hiding a data into the video, audio, images and other documents. Digital data stored in database and transferred through communication network, in such a situation various kind of distortion will occur. A good assessment of video quality is important task for us in meeting Quality o service. In real time applications, the quality of video should enough in transferring a video, video conference and also in next generation network communication system. Hence it's important to estimate the quality of video. The same will be estimated by various experiments, one of them is psychophysical experiments. Humans will conclude about the quality of video. But, psychophysical experiments are time consuming in estimating the video quality. Hence the ability of measure video quality efficiently without human help is highly desirable. So algorithms that give a physical measure of a video quality are used to estimate the quality of a video when it's being communicated.

Watermarking technique is divided into two domain, they are spatial and frequency domain. In spatial domain is watermark is inserted into an image by adjusting the gray value in an image. In frequency domain, the watermark is inserted into frequency coefficients of the transformed image using DCT and DWT.

There are some constraints in design watermarking algorithms. They are

- Imperceptibility
- Robustness
- Capacity

Imperceptibility is the difference between watermarked image and the original image which is visible to human eyes.

Robustness is the ability of watermarking to survive and withstand to external attacks.

Capacity is the number of bits embedded into the original image.

General block diagram of watermarking technique is shown below:

Darshan M S*, Mtech (VLSI Design and Embedded system) in Electronics and Communication department, Dr. Ambedkar institute of technology, Bangalore, Karnataka, India.*

Sudha B S, *Associate professor in Department of Electronics and Communication Engineering, Dr. Ambedkar institute of technology,Bangalore, Karnataka, India.*

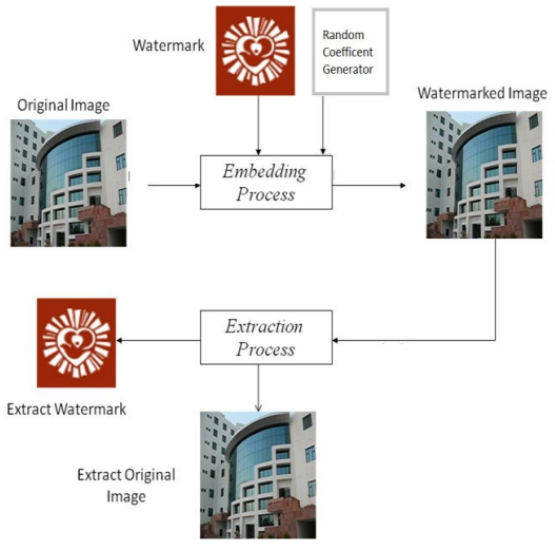

Figure1: Block diagram of Watermarking Technique

This paper proposes the use of watermarking technique to measure the quality of video.

II. TRANSFORM TECHNIQUES

A. Discrete Cosine Transform

Discrete cosine transformation is mainly used to transform a signal from spatial to frequency domain. Here cosine waveform is used for transformation. DCT splits the information content in the bands of different low frequency. An image is divided into different frequency bands, which is easier to embed the watermark information. Embedding is done to the middle band frequency of the image, because to avoid from external noise. FL means low frequency components, FH means high frequency components and FM means mid frequency components. Normally FM is considered in most of the case.

The DCT is calculated by the equation below:

$$F(jk) = a(j)a(k)\sum_{n=0}^{N-1}\sum_{m=0}^{N-1} f(mn)$$

$$\cos\frac{(2m+1)j\pi}{2N} + \cos\frac{(2n+1)j\pi}{2N}$$

Where a (j) = $\sqrt{\frac{1}{M}}$ for m=0

a (j) = $\sqrt{\frac{2}{M}}$ for m=1,2,3…..M-1

a (k) = $\sqrt{\frac{1}{M}}$ for n=0

a (k) = $\sqrt{\frac{2}{M}}$ for n=1,2,3…….N-1

The IDCT is calculated by the equation below:

$$f(jk) = \sum_{n=0}^{N-1}\sum_{m=0}^{N-1} a(j)a(k)F(jk)$$

$$\cos\frac{(2m+1)j\pi}{2N} + \cos\frac{(2n+1)j\pi}{2N}$$

Where m = 0, 1, 2…….M-1

n = 0, 1, 2…….N-1

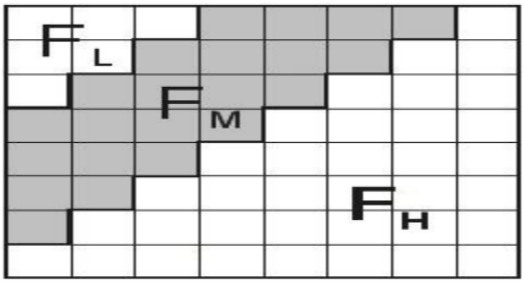

Figure2: Discrete cosine transform

B. Discrete Wavelet Transform

The discrete wavelet transform is mainly used to test an image in both time and frequency domain. The DWT is simple and robust transformation that transform spatial to frequency domain. The DWT gives so many algorithms such as edge detection, compression etc. Here the image is filtered row-by-row and column-by-column format.

The DWT approach is shown below:

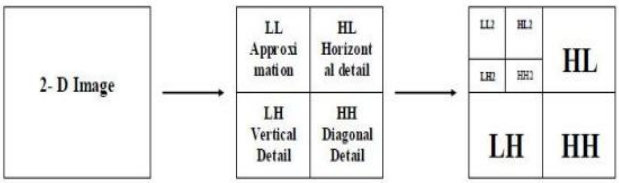

Figure3: Wavelet Transform approach

III. PROPOSED WORK

Initially a reference video is split into number of frames, and then each frame is converted from RGB domain to grayscale domain, the grayscale has been divided into 4x4 blocks, 2level DWT transform is applied for each block. Then, DCT is applied for logo as watermark.

Data hiding is done by PN sequence embedded algorithm here two distinct pseudorandom sequences are generated. One is to insert watermark bit 0 and other is to insert watermark bit 1. A inverse DCT is applied after embedding process, where grayscale is converted into RGB domain and watermark video is generated.

On the other side, to extract watermark from embedded watermarked video, the output of first stage is used, first the output video is divided into number of frames, and each frame is converted from RGB to grayscale, then grayscale is divided into 4x4 blocks and DCT is applied. By using the exact keys generated in first stage from PN sequence we can extract watermark from watermarked video.

The proposed theory consists of three stages:

A. Watermark Embedding process
B. Watermark Extracting process
C. Quality verification.

A. Watermark Embedding process

In this is stage, watermark is split into small parts and they are embedded into video frames of original video. The fine process is as follows:

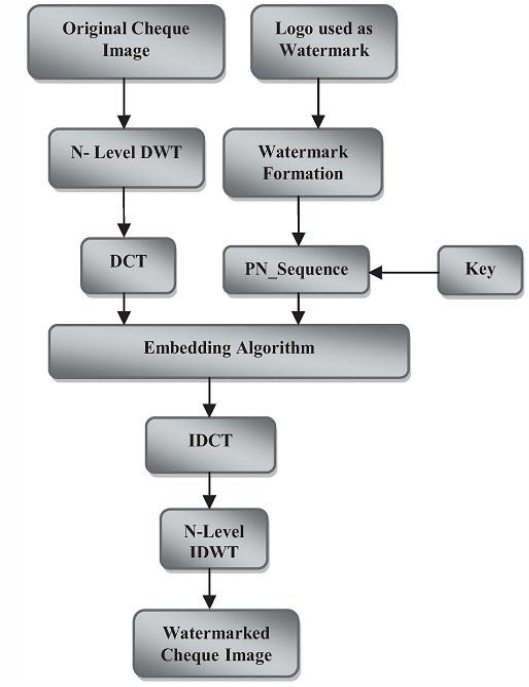

Figure4: Watermark Embedding flow

Initially original video is sliced into N number of frames decompose the frame into sub division bands which are LL1, LH1, HL1 and HH1 on applying DWT. Again sub division is divided into four sub division bands and in that LL2 is selected. The sub division LL2 is divided into 4x4 blocks. On the other side grayscale image of watermark is applied by DCT. Next is to create two different pseudorandom sequences. One sequence is to insert watermark bit 0 and to insert watermark bit 1. These both sequences are used in embedding process in the DCT transformed 4x4 blocks. One important thing here is watermark is not embedded to all frequency. Here we are embedding only to the mid band frequency coefficients of the DCT block. Then inverse discrete cosine transform is applied for embedding watermark. Finally watermarked image will be generated.

B. Watermark Extracting process

The procedure of watermark extraction is same as embedding in most of the steps, here to extract the watermark from output of embedding stage(without original video), first the output video is split into frames, the watermarked frame is divided into 4x4 blocks, DCT transform is applied to the watermark. Pseudorandom sequence different from embedding stage is used at this level and the watermark is subtracted from the watermarked video. Finally by applying IDCT and IDWT original video can be extracted.

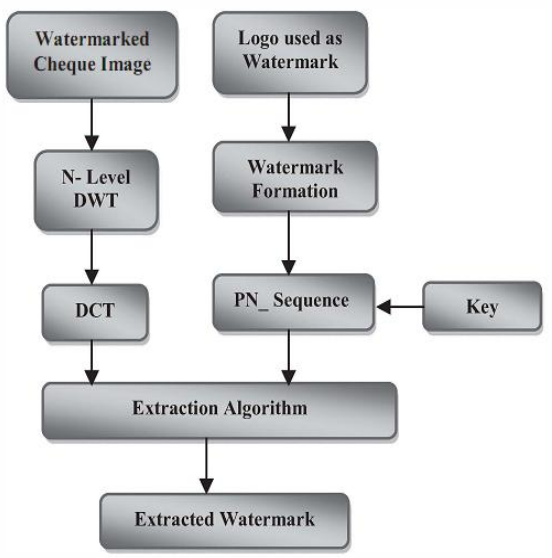

Figure5: Watermark Extraction flow

C. Quality verification:

In this stage the extracted watermark is compared with the original image. By do so we can calculate the robustness, imperceptibility and Normalized Cross-correlation of the extracted watermark and original watermark.

The Normalized Cross-correlation is calculated by the equation.

$$NC = \frac{\sum_m \sum_n W_{(m,n)} W'_{(m,n)}}{\sum_m \sum_n W^2_{(m,n)}} * \frac{\sum_m \sum_n \left(1 - W_{(m,n)}\right)\left(1 - W'_{(m,n)}\right)}{\sum_m \sum_n \left(1 - W^2_{(m,n)}\right)}$$

Imperceptibility can be calculated by using the equation.

$$PSNR_{db} = 10.\ Log_{10}\{Max^2 1 \ / MSE\}$$

Imperceptibility is calculated in terms of decibels (dB).

IV. CONCLUSION

In this paper, a new quality assessment for video watermarking technique is presented. The DCT and DWT are going too applied in video watermarking technique. Here, we are using PN sequence algorithm to hide data as a watermark into the cover image of a video. The combination of two transforms will improve the watermarking performance. The proposed system will ensures the persistency in quality of watermarked video compared to the original video, which is invisible to the human visual system (HVS). The system is robust against any other attacks.

Finally the Normalized Cross-correlation and Peak signal to noise ratio (PSNR) is calculated.

V. REFERENCE

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Darshan M S received his B.E degree in Electronics and Communication Engineering from PES College of engineering, Mandya in the year 2012 & Currently doing his Master degree in VLSI Design & Embedded system, Dr. Ambedkar institute of technology, Bangalore, Karnataka, India. His area of interests is Digital Image Processing, VLSI, Embedded Systems and

Sudha B S received her B.E degree in Electronics and Communication Engineering from PES College of engineering Mandya, Karnataka, India in the year 1991. She completed her Master degree in Industrial Electronics, SJCE Mysore, Karnataka, India in the year 2000. Currently she is working as an Associate Professor in ECE department at Dr. Ambedkar Institute of Technology, Bangalore, Karnataka, India. Her areas of interest include Communication especially in Microwave and Digital communication.