iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** VI **Month of publication:** June 2021

DOI: https://doi.org/10.22214/ijraset.2021.35324

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VI Jun 2021- Available at www.ijraset.com

A Novel Video Watermarking Algorithm using DTCWT

Sridevi Tumula
Department of CSE, Chaitanya Bharathi Institute of Technology(A)

Abstract: ***In this paper a new novel color video watermarking algorithm has been proposed using Dual Tree Complex Wavelet Transform (DTCWT). Digital watermarking is an emerging technology for copyright protection for digital multimedia data. Now-a-days a lot of digital data are exchanged in the internet, so to protect the digital multimedia data, digital watermarking is used, the data may be an image or video or an audio data. The main objective of this paper is to maintain perceptivity of digital video and design a robust watermarking algorithm and maintaining the tradeoff between robustness and perceptivity.***
Key words: Watermarking, DTCWT, Digital Video, robustness perceptivity.

I. INTRODUCTION

The success of the internet and digital media devices has profoundly changed the market in recent years. Exchange of digital media is also increased as well on the internet. However, the concern is to secure the digital data which is published on internet and preventing unauthorized use. According to recent survey the multimedia companies are losing billions of rupees per year due to illegal copying and downloading of copyrighted images and videos from the internet. So comes a technique to deal with these issues is digital watermarking. Digital watermarking emerged as a tool for protecting digital multimedia data from copyright infringement. Digital watermarking is the process of embedding information into a digital signal in a way that is difficult to remove. The signal may be audio, pictures or video, for example. If the signal is copied, then the information is also carried in the copy. A signal may carry several different watermarks at the same time. Figure 1 shows the generic digital watermark embedding process and Figure 2 shows extraction process.

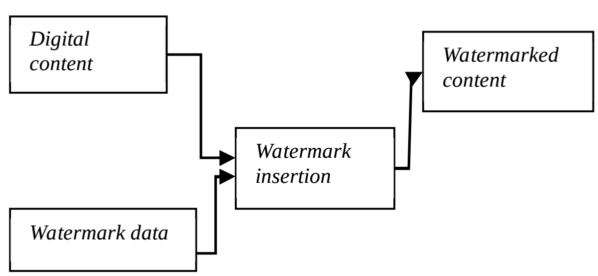

Figure 1 Generic watermark insertion

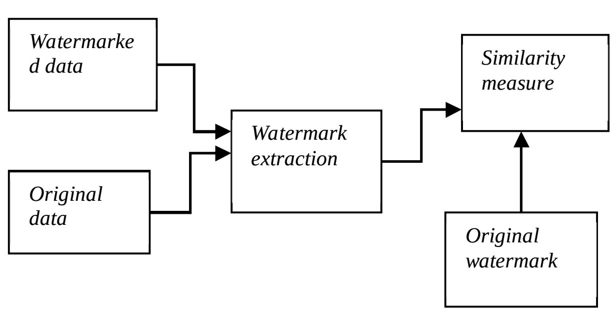

Figure 2 Generic watermark extractions

II. VIDEO WATERMARKING

Video is the technology of electronically capturing, recording, processing, storing, transmitting, and reconstructing a sequence of still images representing scenes in motion. Video watermarking is embedding watermarks in a video sequence in order to protect the video from illegal copying and identify manipulations. 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, unmarked video and the marked video, but a watermark extraction application can read the watermark and obtain the embedded information. Because the watermark is part of the video, rather than part of the file format or DRM system, this technology works independently of the video file format or codec. A watermark even persists in the video when it has been converted from digital to analog form. Video watermarking may also be used for tracking or tracing video content and broadcast monitoring, as well as for linking the video to its provider and facilitating value-added services that benefit both the providers and the consumers.

III. DTCWT

The dual-tree complex wavelet transform (CWT) is a relatively recent enhancement to the discrete wavelet transform (DWT), with important additional properties: It is nearly shift invariant and directionally selective in two and higher dimensions. It achieves this with a redundancy factor of only 2^d for d-dimensional signals, which is substantially lower than the undecimated DWT. The multidimensional (M-D) dual-tree CWT is non separable but is based on a computationally efficient, separable filter bank (FB).

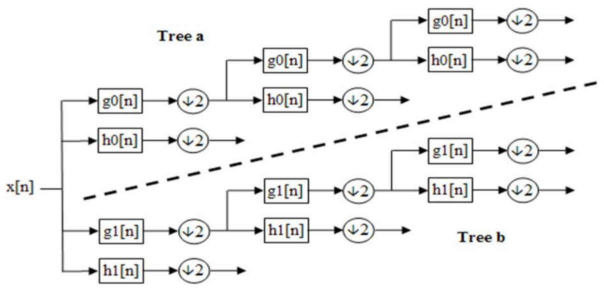

Figure 3 Decomposing into levels using DTCWT

Another major drawback of DWT is its poor directional selectivity for diagonal features, because the wavelet features are separable and real. The way to increase the directionality is to use the complex extension of DWT, named as Dual Tree Complex Wavelet Transform (DTCWT). DTCWT gives better directional selectivity in 2-D with Gabor like filters. Standard DWT offers the feature selectivity in only 3 directions with poor selectivity for diagonal features, where as DT-CWT has 12 directional wavelets (6 for each of real and imaginary trees) oriented at angles of ±15°, ±45°, ±75° in 2-D as shown in following Figure 4 and Figure 5. The improved directionality with more orientations suggests the advantage of DT-CWT in a wide range of directional image processing applications, e.g. texture analysis. Approximate Shift Invariance, Good Directional Selectivity in 2-Dimensions, Perfect Reconstruction, Limited Redundancy and Efficient order - N Computations are the major properties of DTCWT. The filter bank structure of the CWT has CWT filters which have complex coefficients and generate complex output samples. This is shown in Figure 6, in which each block is a complex filter and includes down sampling by 2 (not shown) at its outputs. Since the output sampling rates are unchanged from the DWT, but each sample contains a real and imaginary part, a redundancy of 2:1 is introduced. The complex filters may be designed such that the magnitudes of their step responses vary slowly with input shift only the phases vary rapidly. The real part is an odd function while the imaginary part is even. The level 1 filters, Lop and Hip in Figure 6, include an additional pre filter, which has a zero at $z = -j$, in order to simulate the effect of a filter tree extending further levels to the left of level 1.

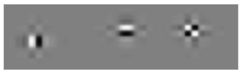

Figure 4 DWT

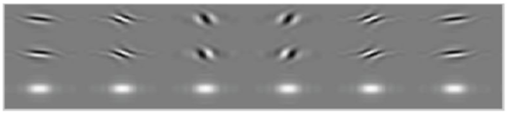

Figure 5 DTCWT

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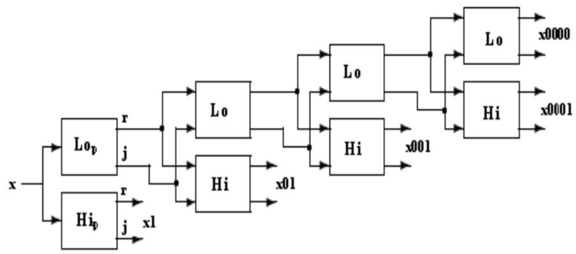

Figure 6 Four levels of Complex Wavelet Tree for real 1-D input signal x.

IV. IMPLEMENTATION

In this video watermarking process are discussed. The Figure 7 shows the flowchart of embedding and extraction of video watermarking.

A. Embedding:

Step 1: Read video sequence and watermark image of size 256 by 256.

Step 2: Divide the video into individual frames.

Step 3: Apply the DTCWT Transformation to each frame one by one and watermark image. DTCWT is explained in section 2.8

Step 4: Create a key and embed the watermark image into each frame.

Step 5: Apply inverse DTCWT to the watermarked frame and calculate similarity measure.

Step 6: Merge the all frames into a sequence to make video.

B. Extraction:

Step 1: Read video watermarked sequence which is previously embedded and original video sequence.

Step 2: Divide both the videos into individual frames.

Step 3: Apply the DTCWT Transformation to each frames which are divided in previous step.

Step 4: Use the same key which is used for embedding and extract the watermark image each frame.

Step 5: Apply inverse DTCWT to the extracted watermarks and calculate similarity measure.

Step 6: Merge the all frames into a sequence to make video.

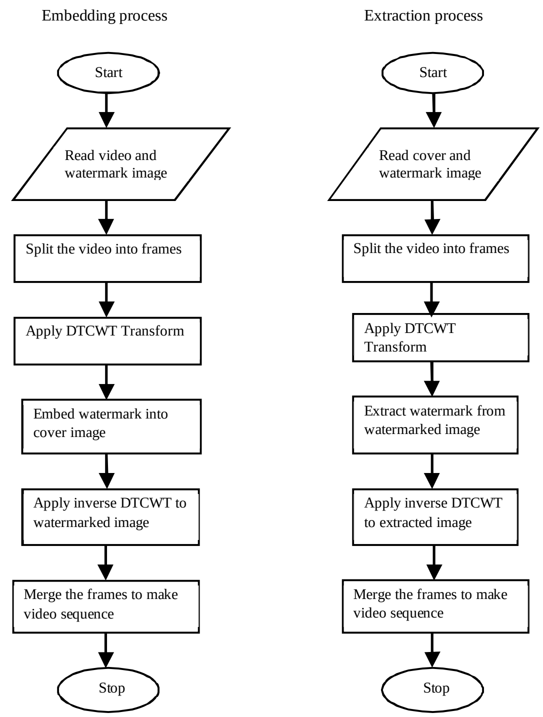

Figure 7 video watermark embedding and extraction using DTCWT

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V. RESULTS

Below tables shows the results PSNR (Peak signal Noise Ratio), MSE (Mean Square Error) and RMSE (Root Mean Square Error) values of Images after embedding and extraction of watermark image from watermarked image using DTCWT, DTCWT (Low Levels), SCDFT, and QFT (before applying any type attack on the watermarked image) with different scaling factor. The formula for PSNR and MSE are shown in Equation 1and Equation 2.

$$\mathrm{PSNR(dB)} = 10 \times \log(255^2 / \mathrm{MSE}) \qquad \text{Equation 1}$$

$$\mathrm{MSE} = \sum_{i=1}^{x} \sum_{j=1}^{y} (|A_{ij} - B_{ij}|)^2 / x \times y \qquad \text{Equation 21}$$

In this section the graphs and output values and screen shots are shown

The Table 1 shows the average PSNR (dB) values of video frames after embedding and extracting the watermark from the video. Embedding the watermark into low frequency levels. The Table 2 shows the average PSNR (dB) values of video frames after embedding and extracting the watermark from the video. Embedding the watermark all frequency levels.Table 3,4 shows PSNR values after attacks like Histogram equalization and Guasian Noise.

Table 1 DTCWT (Low frequency Level)

strength	PSNR(dB) (Embedded)	MSE
0.01	64.9168	0.021
0.1	43.8953	2.6518
0.25	35.9954	16.3459
0.5	30.005	64.7606
0.75	26.5391	144.542

Table 2 DTCWT (all levels)

Strength	PSNR(dB) (Embedded)	MSE
0.01	44.4892	2.3129
0.1	24.7157	217.1815
0.25	17.116	1.32E+03
0.5	11.3415	5.12E+03
0.75	8.5775	9.54E+03

Table 3 a. Embedding using DTCWT (All levels) (Histogram equalization)

strength	PSNR (dB) (Embedded)
0.01	14.2641
0.1	13.9884
0.25	12.9918
0.5	11.3596
0.75	9.6796

Table 3 b Embedding using DTCWT (Low Level) (Histogram equalization)

strength	PSNR (dB) (Embedded)
0.01	14.2582
0.1	14.2544
0.25	14.1983
0.5	14.0724
0.75	13.8892

Table 4 a.Embedding using DTCWT (All levels) (Gaussian noise)

Strength	PSNR (dB) (Embedded)
0.01	20.2046
0.1	19.0618
0.25	15.813
0.5	11.8514
0.75	9.8272

Table 4 b. Embedding using DTCWT (Low Level) (Gaussian noise)

strength	PSNR (dB) (Embedded)
0.01	20.2177
0.1	20.1913
0.25	20.0910
0.5	19.8131
0.75	19.4188

***A.** Graphs*

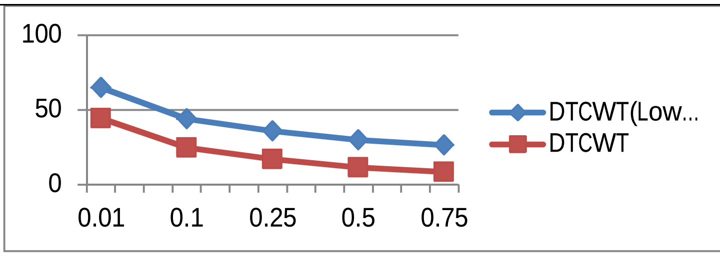
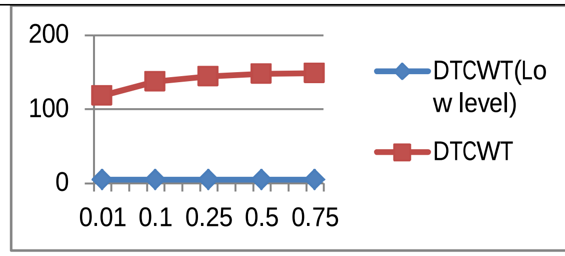
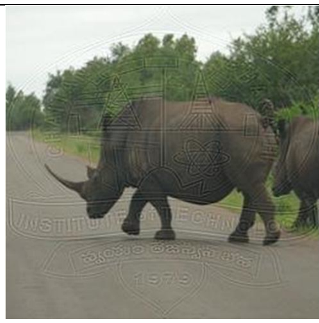
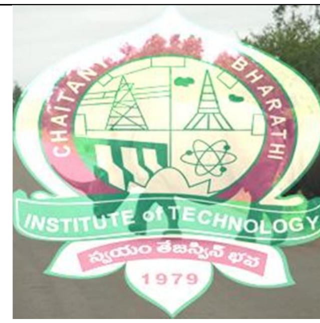
	

Figure 8 Comparing PSNR Values of Watermarked	Figure 9 Comparing PSNR Values of Extracted Watermark
Embedding into low frequency level of DTCWT	Embedding into all levels of DTCWT
 Watermark strength=0.01	 Watermark strength=0.01
 Watermark strength=0.1	 Watermark strength=0.1
 Watermark strength=0.25	 Watermark strength=0.25

 Watermark strength=0.5	 Watermark strength=0.5
 Watermark strength=0.75	 Watermark strength=0.75
Fig 10. Comparing the visual perceptivity of frames embedded using DTCWT (Low Level) and DTCWT	

VI. CONCLUSION

In order to simulate tradeoff between perceptivity and robustness of the watermarking algorithm DTCWT, DTCWT (low level), SCDFT, and QFT algorithms are implemented. From the above results it can be concluded that for perceptivity, robustness and similarity measure embedding watermark using DTCWT into low levels can be used, it given optimal results. For extracted watermark embedding into DTCWT gives good results. Under different attacks SCDFT gives optimal results and DTCWT (low level) gives better results than other algorithms. The similarity measures used in this are PSNR (dB), MSE. The perceptivity measure considered is watching the outputs normally.

REFERENCES

[1] Sourav Bhattacharya, T. Chattopadhyay and Arpan Pal, “A Survey on Different Video Watermarking Techniques and Comparative Analysis with Reference to H.264/AVC. IEEE, 2006.
[2] R. Lancini, F. Mapelli and S. Tubaro. A Robust Video Watermarking Technique in the Spatial Domain. 4 th EURASIP-IEEE Region 8 International Symposium on Video/Image Processing and Multimedia Communications (VIPromCom), June 16-19, 2002:251-256.
[3] Xianghong Tang , Liping Chen, A Color Video Watermarking Algorithm based on DTCWT and Motion Estimation, International Conference on Communications and Mobile Computing 2009.
[4] D. V. Satish Chandra, “Digital image watermarking using singular valued decomposition”, in IEEE 2002, pp 264-267.