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IMPROVISING VIDEO SECURITY USING HYBRID DCT-DWT, DWT-SVD, AND DCT-DWT-SVD WATERMARK TECHNIQUES

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ABSTRACT

As we are living in the era of information exchanging worldwide where millions of bits of data is created in every fraction of a second and through the internet can be shared and spread, creation and broadcasting of digital data (images, video and audio files, digital libraries(text), web publishing)is easily possible. After this authentication and ownership security problem arises. Watermarking provides secure and authenticity to the genuine owner. There are various techniques such as LSB, DCT, DWT, SVD, and H.264 which is past few years used to watermark data. Hybridization of these techniques gives more robustness to the data. This paper is discussed about hybrid technique with best possible robustness. DCT - DWT, and DWT-SVD are such hybrid technologies.

Keywords: Video Watermarking; Robustness; Hybridization; Copyright; DCT-DWT; DWT-SVD; DCT-DWT-SVD

I. INTRODUCTION

The DCT (Discrete Cosine Transform) sequence of data converted into the spatial domain. It is converted to the sum of sine and cosine with different amplitude and different frequency bands. It is much easier to embed watermarking information into the middle-frequency bands of an image. Middle-frequency bands are minimized. It avoids the visual parts of the image without exposing them. It is robust for blurring, contrast, adjusting and brightness. Discrete wavelet Transform uses different wavelet filters such as haar filter, *Daubechies and* bi-orthogonal filters. This filter decomposes images in several frequencies such as lower resolution image (LL), horizontal (HL), vertical (LH) and diagonal (HH). It is efficient and uses simple filter convolution. LL is chosen as it has larger result and smaller result for other (LH, HL HH). As large magnitude it is more significant so it is chosen.In SVD (Singular Value Decomposition) -based watermarking, different types of approaches are possible. Each singular value specifies the

luminance of an image and corresponding pair of singular vectors specifies the geometry of that image .A common approach is to apply SVD to the image, and modify all the singular values to the watermark data. Hybrid techniques are such as DCT-DWT, DWT-SVD provides more robustness to data.

II. PROPOSED ALGORITHM

1.1 Watermark Embedding DWT-DCT-SVD Method

Step 1: Initially choose video in a proper format(MP4/Avi) Divide the video into frames.

Step 2: Convert every video frame is in matrix format.

Step 3: Compute following steps.

Step 4: The Y matrix is divided into blocks of size $p_1 \times p_2$. Find out the spatial frequency of all blocks.

Step 6: Find out the significant blocks with host image f_{ref}, of size M× N.

Step 7: Perform DWT on the host image and watermark image. Select the LL band to perform DCT on LL band.

Step 8: Perform SVD transform on the DCT Coefficients of the Host and watermark image.

Step 9: Modify the singular values of reference image with the singular values of watermark.

Step 10: Perform inverse SVD on cover image.

Step 11: Perform inverse DCT and inverse DWT on cover image and the coefficients obtained are divided into blocks of size $p_1 \times p_2$ and mapped onto their original positions for constructing the watermarked image.

Step 12: Convert the video frames to matrix *i*

Step 13: Reconstruct frames into final watermarked video scene.

1.2 DWT-DCT-SVD Watermark Extraction Procedure

Step 1: take watermarked video. Convert every watermarked video frame into color matrix format.

Step 2: Using positions of significant blocks, make the reference image from the watermarked matrix bits.

Step 3: Perform DWT and DCT on both watermarked host and original reference image.

Step 4: Perform SVD transform on DWT and DCT coefficients.

Step 5: Extract the singular values of the watermark. Obtain the extracted watermark.

1.3 Hybrid Procedures

1.3.1 Watermark for DCT-DWT / DWT-SVD

Similarly the embedding algorithm for DCT-DWT and DWT-SVD can be implemented by modifying the embedding algorithm procedure of DWT- DCT-SVD.

1.3.2 Watermark Extraction for DCT-DWT / DWT-SVD

The extraction algorithm can be implemented by modifying the extraction algorithm of DWT- DCT-SVD. Algorithm can be modifying with better hybridization.

III. EQUATIONS AND CALCULATIONS

The PSNR of the watermarked image is calculated using the formula Where R= maximum fluctuation in the input image=256

$$PSNR = 10 \log_{10}\left(\frac{255^2}{MSE}\right)$$

MSE calculated by, Where r = number of rows plane of cover image and watermarked image.

$$MSE = \sum_{j=1}^{r}\sum_{k=1}^{c}\frac{[W(j,k) - W'(j,k)]^2}{rc}$$

c = number of columns W (j,k) and W'(j,k) represent blue

VI.RESULT

Appling DCT-DWT, DWT-SVD, and DCT-DWT-SVD (mean square error)MSE and (peak signal to noise ratio) PSNR are calculated following tables are detail information about the result which we obtained.Table1. shows how external attacks are affect on frames. Attacks are cropping, rotating, swapping, ad contrasting. Table.2 and Table.3 is a video frame summary of after watermark in technique with DCT-DWT, DWT-SVD, and DCT-DWT-SVD. Last three columns are detailed effect on frame after watermark as well as MSE and PSNR are provided. As we choose same video NC value is 0.0039 same for all frames.

These values are changes with the image quality and watermarking hybridization. DCT-DWT-SVD gives more PSNR than DCT-DWT, DWT-SVD watermark. Which means more hybrid techniques provides more security to data as well as it is more robust than 2 technique hybridization. PSNR values are high in SVD based watermark frame because of image is highly stable in SVD technique.

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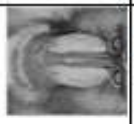
ATTACK TYPE	FRAME [LENA]	PSNR	MSE	ATTACK TYPE	FRAME [LENA]	PSNR	MSE	FRAME [MANDRIL]	PSNR	MSE
Image 256x256		184.2227	8.8954e-009	Flip		185.7644	8.8954e-009		Crop 182.6113	8.8954e-009
Image 512x512		184.6298	8.8954e-009	Flip B &W		185.7644	8.8954e-009		Crop Rotate 182.9439	8.8954e-009
Flip and contrast		185.7644	8.8954e-009	B&W 180 Rotate		189.1276	8.8954e-009		Contrast 189.0157	8.8954e-009
Gray		185.7436	8.8954e-009	Flip B &W Contrast		189.1276	8.8954e-009		Gray 182.7558	8.8954e-009
Gray flip		185.7436	8.8954e-009	Crop		56.9190	8.8954e-009		Rotate 182.8639	8.8954e-009
Gray Roatate90		185.7408	8.8954e-009	Contrast		185.7644	8.8954e-009		B&W 189.8805	8.8954e-009

Table1. DCT-DWT, DWT-SVD, and DCT-DWT-SVD External/Geometrical attacks with PSNR and MSE calculation

FRAME NO	VIDEO FRAMES	DCT+DWT		DWT+SVD		DCT+DWT+SVD		DCT DWT	DWT SVD	DCT DWT SVD
		PSNR	MSE	PSNR	MSE	PSNR	MSE			
1ST FRAME		44.5862	4.5922	48.1278	1.232	52.5286	0.1235			
2ND FRAME		44.5911	2.2916	48.2450	2.1007	52.5252	0.8511			
3RD FRAME		44.5868	3.2710	48.1271	1.9564	52.8549	0.2522			
4TH FRAME		44.5867	1.2322	48.1290	1.8579	52.3972	0.1145			
5TH FRAME		44.5896	2.2203	48.1282	1.5452	52.5503	0.7855			
6TH FRAME		44.5874	2.3791	48.2795	1.4543	52.6082	0.3722			
7TH FRAME		44.5865	3.4545	48.2120	2.014	52.5848	0.2322			
8TH FRAME		44.5621	2.2588	48.2467	1.9521	52.6082	0.3644			

Table2. DCT-DWT, DWT-SVD, and DCT-DWT-SVD External/Geometrical attacks with PSNR and MSE calculation

FRAME NO	VIDEO FRAMES	DCT+DWT		DWT+SVD		DWT+SVD		DCT DWT	DWT SVD	DCT DWT SVD
		PSNR	MSE	PSNR	MSE	PSNR	MSE			
9th FRAME		44.5289	2.5462	48.1211	2.0461	52.5569	0.4533			
10th FRAME		44.5899	3.0145	48.2375	1.5423	52.6844	0.5521			
11th FRAME		44.6144	3.5471	48.2312	1.4879	52.6535	0.1235			
12th FRAME		44.6887	2.9960	48.2588	1.5467	52.6549	0.7521			
13th FRAME		44.6890	2.1457	48.1331	1.4872	52.6019	0.1452			
14th FRAME		44.6538	2.4512	48.2809	1.0541	52.4957	0.1777			
15th FRAME		44.5655	1.9852	48.2122	2.0441	52.5963	0.1558			
16th FRAME		44.6550	2.1964	48.1222	2.1145	52.4696	0.1899			

Table3. DCT-DWT, DWT-SVD, and DCT-DWT-SVD External/Geometrical attacks with PSNR and MSE calculation

VII.CONCLUSION

With different watermarking techniques with hybridization robustness is improved. DCT-DWT-SVD is more robust than other two techniques (DCT-DWT, DWT-SVD). PSNR and MSE for DCT-DWT is average of 44.31 and 2.4857 for DWT-SVD, PSNR and MSE value is 48.22 and 1.721 and for DCT-DWT-SVD value for PSNR and MSE is 54.62 and 0.122. Which is clear that more hybrid watermark is most robust and stable and more prominent towards the attacks. Also geometrical attacks are much prevented due to strong data security. During extraction it gives more stable cover image. Hybridization with SVD is most stable and quick technique.

VIII.FUTURE SCOPE

Hybrid techniques of audio and video watermarking can be combining to make a more robust watermark. This watermark will give more robust with security and authenticity to the video and audio data. As well as H.264 method can be hybridize for more excellence.

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