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"A VIDEO WATERMARKING TECHNIQUE WITH VIDEO AND IMAGE AS WATERMARK USING DWT AND PCA"

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1. Abstract

A comprehensive approach for watermarking is displayed in this System, and a hybrid progressed watermarking plot based on Discrete Wavelet Alter (DWT) and Central Component Examination (PCA). There are a number of watermarking strategies like DCT, DWT, and DWT-SVD, but there's downside inside the watermarking to stand up to attacks. In this way the present day computerized picture watermarking calculation is proposed which grant overwhelming watermarking with irrelevant entirety of bending in case of ambushes. DWT offers versatility and PCA makes a distinction in reducing relationship among the wavelet coefficients gotten from wavelet rot of each square in this way scrambling the watermark bits into the uncorrelated coefficient. Beat hail extent is utilized to degree intangibility whereas closeness between two pictures by normalized relationship coefficient test the straightforwardness and vigor against diverse ambushes like altering, clamor, turn, filtering etc. The proposed System got to deliver recover.

Key Points: DWT, Watermark, DWT-PCA, Digital Watermarking. Video Image.

2. Introduction

Progresses in computer systems and program advanced artifacts are effectively created, conveyed and capacity and it is simple to control. It has made a risk on verification and copyright. Watermarking procedure is an effective way Watermarking may be a concept of inserting advanced artifacts into diverse artifacts so that given piece of data is secure whereas transmission. It embeds confirmation information such as possession data without influencing its unique quality.

Watermarking methods can be classified concurring to the sort of watermark utilized, i.e., watermark may be an outwardly recognizable symbol or an arrangement of arbitrary numbers. Stowing away data can be drained two ways, viz. spatial space procedure and Change space procedure and In Spatial space strategy pixel esteem is altered straightforwardly to insert the mystery data. In Change space strategy, unique picture is changed into change coefficients by utilizing different well known changes like DCT, DFT and DWT etc. At that point, Change coefficients are altered to insert the mystery data. Change space offers exceptionally tall vigor against compression such as JPEG, scaling, turn, editing, push and column expulsion,

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expansion of clamor, sifting, cryptographic and measurable assaults as well as addition of other watermarks. Vigor, imperceptibility and capacity are the three clashing necessities of advanced watermarking. The included mystery data ought to not corrupt .Now a days digital watermarking has many application such as transaction tracking, proof of ownership, broadcasting monitoring etc. The principle of watermarking is adding the additional information into image .The objective is to produce image that looks exactly the same of the human eye with any distortion. Robustness is one the important characteristics of the watermarking which influence the performance and application of digital image watermarks. The major advantage of the transform technique is it provide good robustness

Due to enhancement in technology world is becoming small and small day by day. The internet is compacting the distance fastest. The drawbacks of internet are also arising as the technology grows. One of the biggest drawbacks is regarding copyrights. After the available facility of uploading photographs, videos, audio etc. it is becoming very easy for any person to download it and share or sell it without owner's permission. It also generates crime of piracy.
So, to prevent piracy and authorize the contents we need such a technique which can prevent from such crimes. A company distributing photographs, audio, and video can authorize its content through this technique and can take step against the piracy. Also it can be used for making identity card, so a only an authenticated photograph can be scanned and authorized. Any person can print that photograph and can use it as its identity card.
To deal with such problems an advance technique digital watermarking is used. It is advance technique which capable to include the texts, or message within body of the image, or any other format of data. For simplicity of project we have considered Image Digital Watermarking.
In short, "Watermarking" is the process of hiding digital information in a carrier signal. Like traditional watermarks, digital watermarks are only perceptible under certain conditions, i.e. after using some transformations or applying some type of decryption algorithm on it. In digital watermarking, a watermark is embedded into a cover image in such a way that the resulting watermarked signal is robust to certain distortion caused by either standard data processing in a friendly environment or malicious attacks in an unfriendly environment.

In our project we are going to develop this algorithm so, we can hide a message or information or a legal notice with the image.

3. Related Work

"**A ROBUST DIGITAL IMAGE WATERMARKING USING DWT –PCA",** at IJIERT Apr-2019. In this paper author introduced the watermarking technique to embed watermark image inside host image (cover image) using DWT and PCA algorithm with successfully retrieving original watermark image with comparatively high PSNR and low MSE sufficient to identify message by human perception.

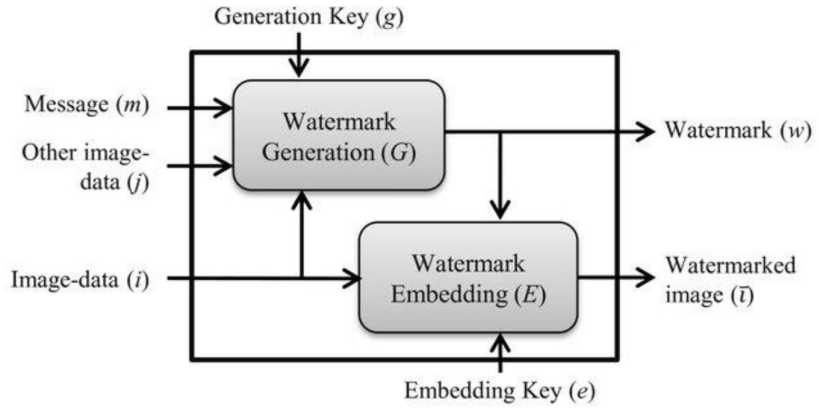

Figure 3.1 Flow of encoding algorithm.

The encoding method is shown in *Figure 3.1*. DWT is used to divide the original image into sub bands. DWT on image divides the image into 4 sub bands LL, LH, HL & HH. LL band has information about lower frequency component of the image. The embedding can be performed on N level of image till image is sufficient size to accommodate watermark image. Meanwhile watermark image is resized for sufficient size to encode inside original image than PCA coefficient of watermark image is calculated.

The PCA coefficients are merged with the LL band using blending parameter **'Alpha'.** Alpha parameter ranges from 0 to 1. As the parameter towards 1 dominant value PCA coefficient over the LL band increases. So blending parameter also affects the recovery of watermark image. Now we will apply inverse DWT using LL', LH, HL, HH sub bands and will generate watermarked image.

After embedding the watermark coefficients it becomes LL' band. During the process of embedding original LL band and PCA coefficients are stored for retrieving original watermark image during recovery or extraction process.

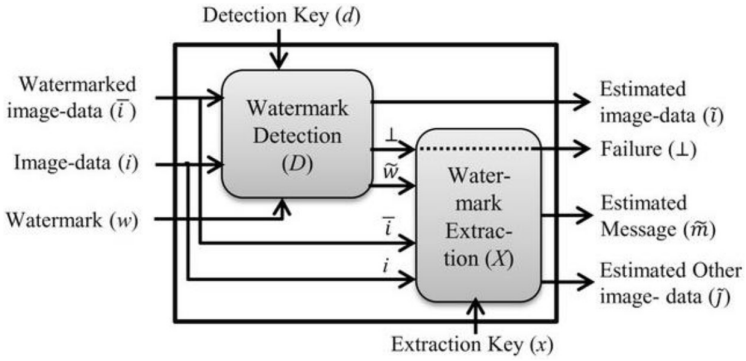

Figure 3.2 Flow of decoding Algorithm

Watermark decoding or extraction process is shown in Figure 3.2. During received watermarked image, it may be corrupted by various noises and attacks to destroy the watermark/copyright content hidden inside image. On extraction process we will apply DWT

on distorted watermarked image. It will generate 4 sub bands the sub bands are LL'', LH, HL, HH. The watermark is embedded inside LL'' sub bands. So by using original LL band we extract PCA' coefficients of watermark image. Than inverse PCA is applied using original PCA coefficients to get back original watermark Image.
This extracted watermark image can be compared with original watermark image to check PSNR, MSE between the images. As the PSNR approaches higher value, structure similarity between two images are high, same way as the MSE tends towards 0, it indicates the images tends towards identical.

4. RESULTS

4.1 Video Watermarking Using Image as Watermark Image

Figure 4.1 Original watermark image

Original watermark image is shown in Figure *9.1*. After watermark insertion the property of cover image is changed. To compare the amount of original cover image changed can be checked by PSNR, MSE, and MAXERR.

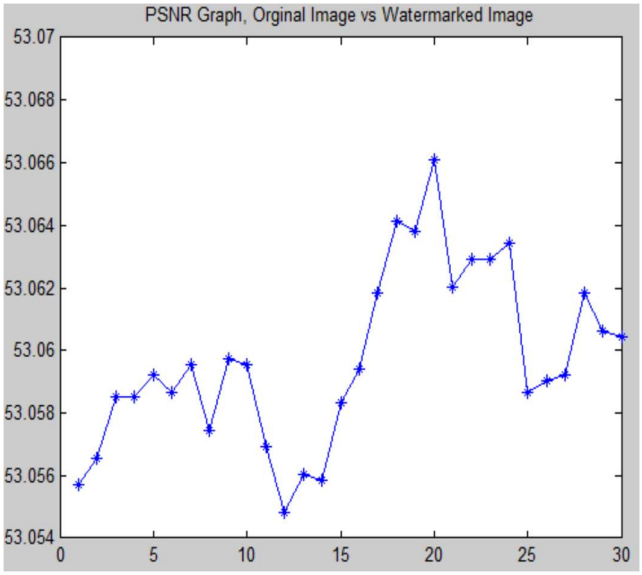

Figure 4.2

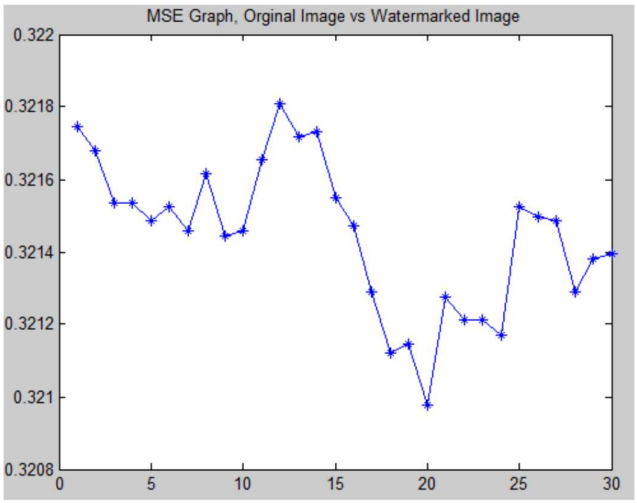

Figure 4.3

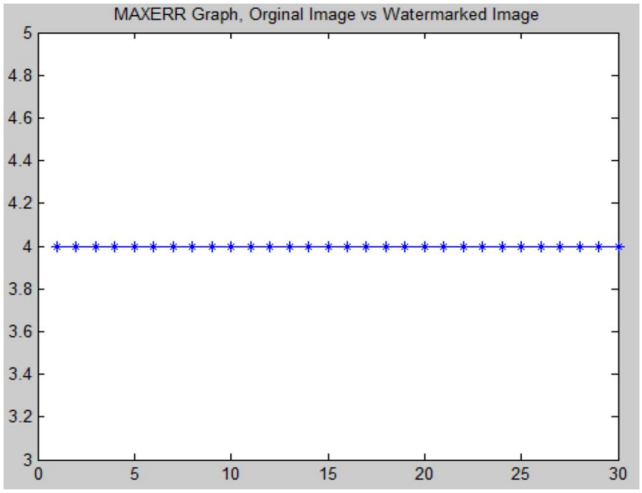

Figure 4.4

As shown in Figure 4.*2*, Figure *4.3*, and Figure *4.3* we can see graphs of PSNR, MSE, and MAXERR graph. We can see the MSE is less for some frames as each frames has different spatial data.

As the cover image values are not exactly ideal, the extracted watermark may have some distorted output. We can check the quality of recovered watermark image by the graph generated of PSNR, MSE, and MAXERR between original watermark and extracted watermark.

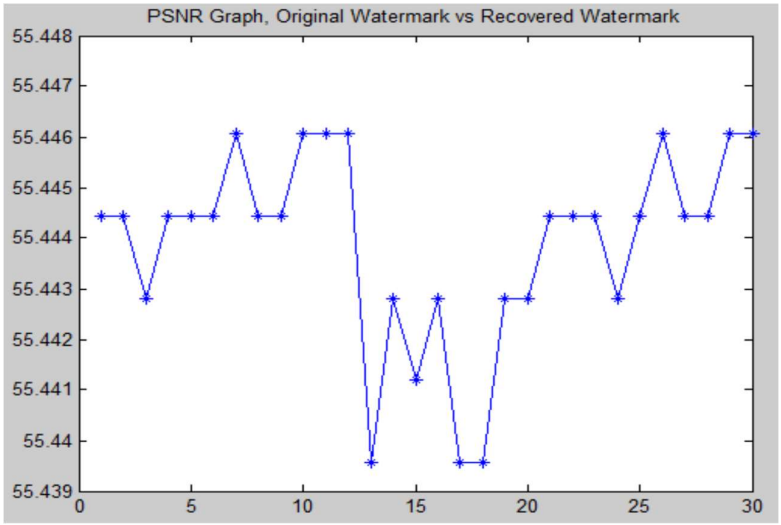

Figure 4.5

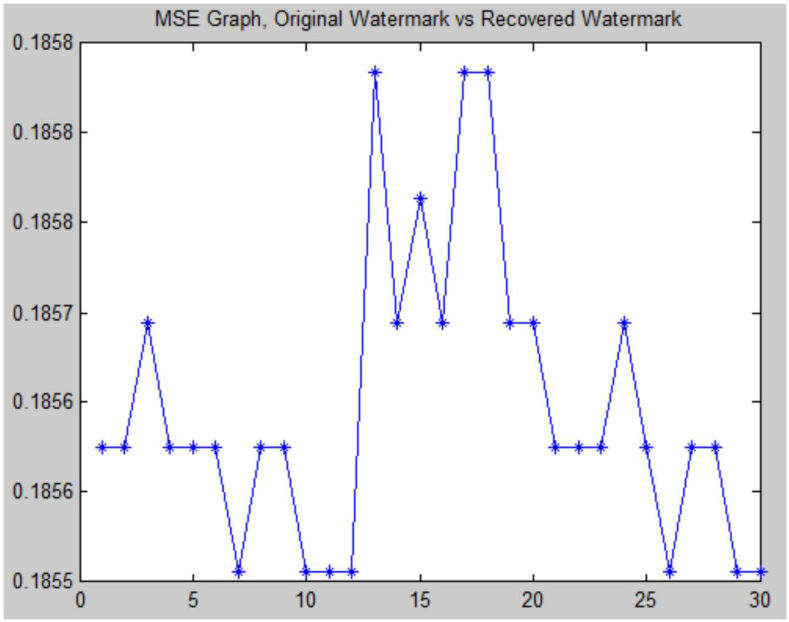

Figure 4.6

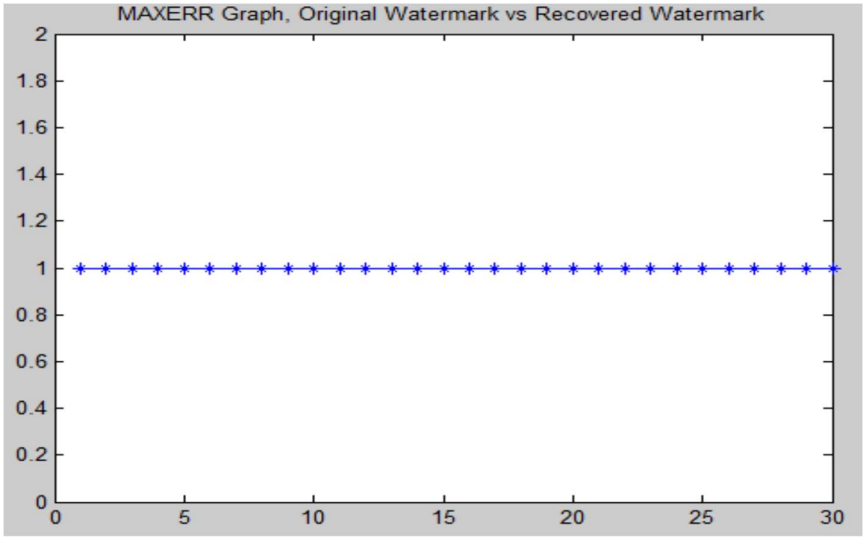

Figure 4.7

5. Video Watermarking Using GIF frames as Watermark Image

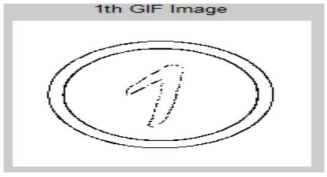

Figure 4.8

Original watermark image is shown in Figure *9.1*. After watermark insertion the property of cover image is changed. To compare the amount of original cover image changed can be checked by PSNR, MSE, MAXERR.

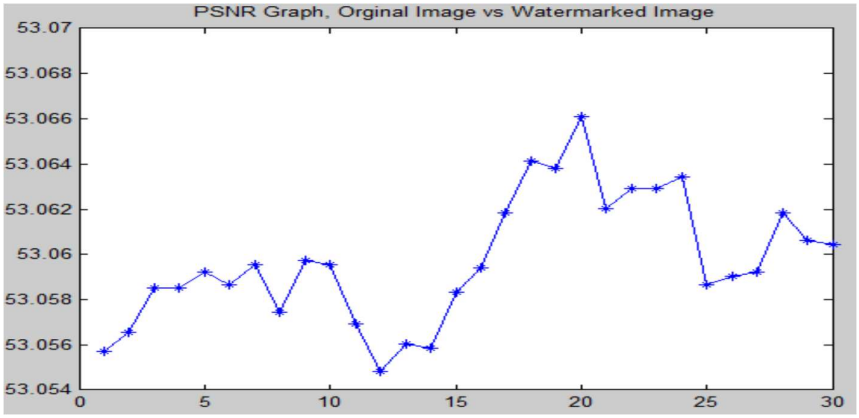

Figure 4.9

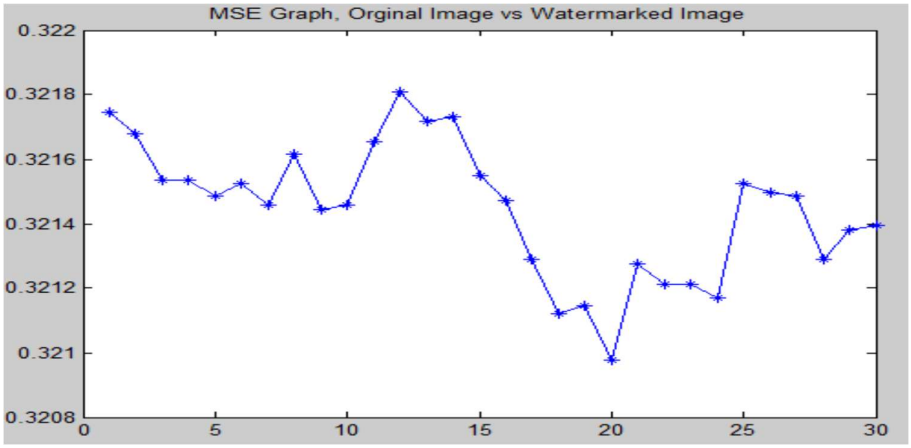

Figure 4.10

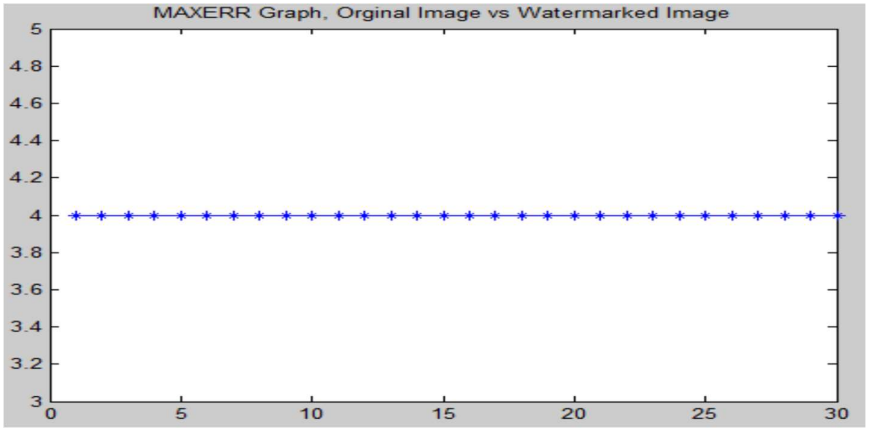

Figure 4.11

As shown in Figure 4.*2*, Figure *4.3*, and Figure *4.3* we can see graphs of PSNR, MSE, and MAXERR graph. We can see the MSE is less for some frames as each frames has different spatial data.

As the cover image values are not exactly ideal, the extracted watermark may have some distorted output. We can check the quality of recovered watermark image by the graph generated of PSNR, MSE, and MAXERR between original watermark and extracted watermark.

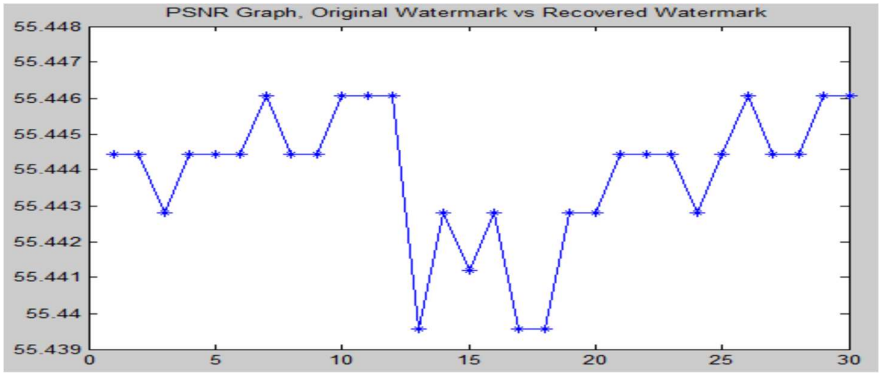

Figure 4.12

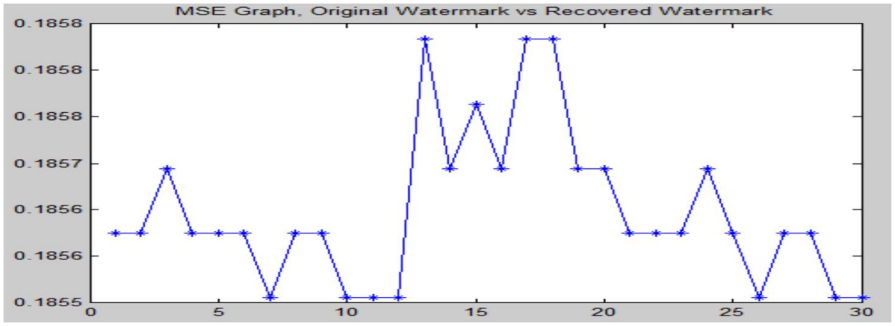

Figure 4.13

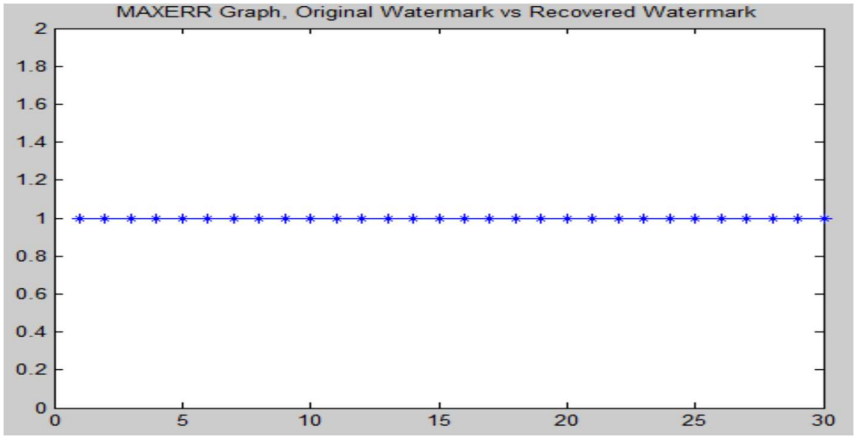

Figure 4.14

6. Effect of Alpha on PSNR, MSE, MAXERR

6.1 Video Watermarking Using Image as Watermark Image

In watermark embedding *Alpha* is the key parameter which decides how much dominance of PCA components to be applied on LL band. Alpha value ranges from 0 to 1. As the value changes from 0 to 1, dominance of PCA component on LL band increase.

As the PSNR, MSE, MAXERR also changes as each frame has different spatial pixel details and value ranges. So, we take the performance only on first frame and check effect of changing *Alpha* on PSNR, MSE and MAXERR

	Alpha=0.1	Alpha=0.3	Alpha=0.5	Alpha=0.8	Alpha=1
PSNR	Inf	71.052	64.987	59.049	53.056
MSE	0.00	0.005	0.021	0.081	0.322
MAXERR	0.00	1.000	2.000	3.000	4.000

Table 1

	Alpha=0.1	Alpha=0.3	Alpha=0.5	Alpha=0.8	Alpha=1
PSNR	48.566	50.125	50.602	51.632	55.444
MSE	0.905	0.632	0.566	0.447	0.186
MAXERR	1.00	1.000	1.000	1.000	1.000

Table 2

6.1.2. Video Watermarking Using frame of GIF file used as Watermark Image

In watermark embedding Alpha is the key parameter which decides how much dominance of PCA components to be applied on LL band. Alpha value ranges from 0 to 1. As the value changes from 0 to 1, dominance of PCA component on LL band increase.

As the PSNR, MSE, MAXERR also changes as each frame of cover image and as well as GIF watermark has different spatial pixel details and value ranges. So, we take the performance only on first frame of cover video and watermark GIF frame and check effect of changing Alpha on PSNR, MSE and MAXERR.

	Alpha=0.1	Alpha=0.3	Alpha=0.5	Alpha=0.8	Alpha=1
PSNR	Inf	69.824	64.783	61.317	56.003
MSE	0.00	0.007	0.022	0.048	0.163
MAXERR	0.00	1.000	1.000	2.000	2.000

Table 3

	Alpha=0.1	Alpha=0.3	Alpha=0.5	Alpha=0.8	Alpha=1
PSNR	48.297	50.779	51.508	52.222	54.374
MSE	0.962	0.544	0.459	0.390	0.238
MAXERR	1.000	1.000	1.000	1.000	1.000

Table 4

7. Conclusion

The goal of the video watermarking technique is to embed watermark image/frame into cover image/frame of video. It is preferable the technique should have high PSNR between original image/frame and watermarked image/frame, and lowest MSE. The parameter may vary depending on the user requirement and the spatial data of cover image and watermark image/frame

In this method each frame of watermark video is considered as cover image and watermark image is embed in it using DWT+PCA algorithm. Comparison of performance parameter is shown in *Table .1*. Result of Table *1* shows the effect of increasing 'alpha' on the output watermarked image. As the 'alpha' increases towards 1 the dominance of its increases on watermarked image. Thus dissimilarity between original cover image video frame and

watermarked image increases. Thus PSNR decreases with increase in 'alpha'. Comparison parameters MSE and maximum error MAXERR increases. It indicates that as we add more dominant factor of watermark image the cover image spatial details changes.

As we increase 'alpha' it also affects extracted watermark image. As we same value of 'alpha' is being used during embedding and decoding process it affects the result and quality of image recovered after decoding process. *Table 2* shows the comparison parameter of watermark technique in which cover image is a frame of video and watermark image. Effect of changing blending parameter *Alpha* on original watermark image and extracted (recovered) watermark image is shown in Table *2*. We can see that as Alpha value reaches 1, PSNR increases, MSE decreases, MAXERR remains constant. It shows that as the Alpha reaches 1, the dominance of watermark component in cover image increases and it helps to recover watermark in better quality.

We can see that as the 'alpha' increases the quality of watermark extracted increase and it more similar to original watermark image. As the quality of watermark image also depends on various noise parameters but still we can extract conclusion that as the 'alpha' increases the quality of extracted watermark increases but it also deteriorates original image so it depends on the user how much dominance they want on original cover image. In second method of video watermarking, as cover image the frame of a video is taken and watermark image as frame of a GIF image. As GIF image has less frames we can encode only certain frames of original watermark video. So, in our method our GIF has 5 frames so only 5 frames of original watermark frame is watermarked.

As the blending parameter 'alpha' changes from 0 to 1. It changes the spatial details of original image influenced by watermark image. Table 3 shows the result of video watermarking using video frame. Here GIF video frames are used. In this method frame of watermark video is considered as cover image and watermark GIF frame is embed in it using DWT+PCA algorithm.

In Table 3 effect of changing blending parameter Alpha on original cover image frame and watermarked cover image frame is shown. We can see that as value of Alpha reaches 1, PSNR value decreases, MSE increases, MAXERR increases. It indicates that as we add more dominant factor of watermark image the cover image spatial details changes. It is shows that the blending parameters changes the spatial details of watermarked image more as dominance of watermark image increases, hence it becomes more dissimilar to original cover image frame.

In Table 4 effect of changing blending parameter Alpha on original watermark image and extracted (recovered) watermark image is shown. We can see that as Alpha value reaches 1, PSNR increases, MSE decreases, MAXERR remains constant. It shows that as the Alpha reaches 1, the dominance of watermark component in cover image increases and it helps to recover watermark in better quality. It depends on user how much blending parameter it should take for embedding watermark so over all image quality of watermarked image and cover image can be preserved.

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