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DWT-SVD BASED WATERMARKING ALGORITHM FOR THE PROTECTION OF OWNERSHIP OF AN IMAGE

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Abstract: *As the demand is growing day by day for the protection of ownership of the digital media against various unauthorized attacks. The ownership can be protected by embedding the watermark into the images. This paper proposes a combination technique of the algorithm of watermarking. The combination technique by which we are trying to embed the watermark is the DWT (Discrete Wavelet Transform) and SVD (Singular Valued Decomposition). this combination technique provides a better robustness against various attacks like cropping, rotation etc. The watermark can be extracted by applying the Inverse Discrete Wavelet Transformation (IDWT) and Inverse Singular Valued Decomposition (ISVD). In this paper, four level decomposition of an image has been done. The experimental results of the proposed method has been discussed in this paper.*

Keywords: Watermarking, Discrete Wavelet Transform, Singular Value Decomposition, Color band, Embedding, Extraction.

1. INTRODUCTION:

In these days, watermarking has gain a more popularity in modern digital media. Hence, watermarking is used as a best security for the protection of ownership of digital media0 . The digital media can be a image, an audio, a video etc. The protection of ownership can be done by embedding the watermark into it. Basically, the watermarking is the message that is embedded into the digital data like image, video and ab audio0. The message can be a number, a group of characters, a text or many more. The watermark can be visible or invisible. that means the message that is embedded can be visible or invisible to a human eye. Invisible watermarking is the best method for secret communication over internet0. After embedding the watermarking into an image, we have to make sure that the quality of a watermarked image should not be distorted. Basically, there are two domains for embedding the watermark to an image. The two domains are spatial domain and transformation domain. The spatial domain is the procedure that operates directly in the pixels of an image, whereas, in other domain i.e, transformation domain, transformation of an image is done. The transformation domain has many advantages over spatial domain like quality, compression, robustness etc. There are some methods of both domains to embed and eAxtract the watermark to the digital media. LSB (Least Significant Bit) and patchwork method are the methods of spatial domain the transformation domain has some methods like, block based DCT (discrete Cosine Transform), DWT (Discrete Wavelet Transform), DFT (Discrete Fourier Transform), SVD (Singular Valued Decomposition) etc0.

2. REVIEW OF DWT AND SVD:

2.1 DISCRETE WAVELET TRANSFORM (DWT):

The DWT transform has gainin more popularity in the world of digital media. The DWT is a process of composition of an image into frequencies. This technique is used to decompose an image in erms of frequency. It is the process of another way to represent the signal which does not change the information. It is used for image watermarking and image compression with an excellent visual quality of an image. The idea behind is to decompose the image into different sub bands like LL, LH, HL, HH0. The lower frequency band is LL which contains the approximation value of an image. The HL is a higher frequency which gives the horizontal details an d HL gives a vertiacla details of an image. The LH is also a higher frequency. The HH sub band represents a frequency which contains the diagonal details of an image. the N level decomposition of an image is shown in fig1.

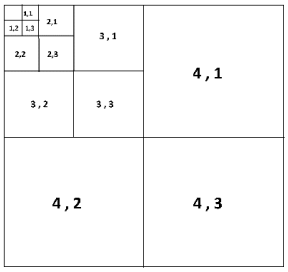


Fig-1.: N level decomposition of an image

2.2 SINGULAR VALUE DECOMPOSITION (SVD):

The SVD is a powerful numerical tool for matrices, which has a minim um truncation error. It has an application of noise reduction. By applying this technique, we decompose the input matrix into three matrices as shown below:

$$A = U*S*V$$

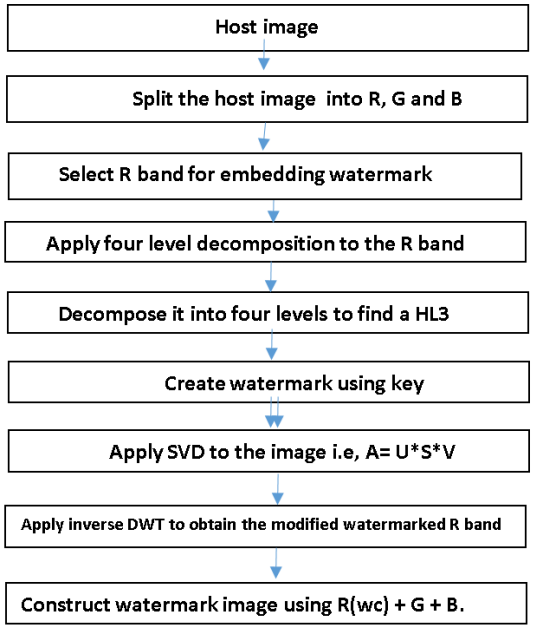
Where, A = input matrix of an input image.
U & V are the m*m and n*n matrices.
S = diagonal matrix.

If we are adding the additional ingormation to the diagonal matrix m then it gives an insignificant effect of an image.

3. PROPOSED METHOD:

3.1 EMBEDDING PROCESS:

The procedure for embedding the watermark to an image is shown through a flow chart.



3.2 EXPERIMENTAL RESULTS OF EMBEDDED PROCESS:

Fig-2: Original image

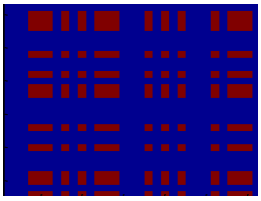


Fig-3: Watermark

Fig-4: Watermarked image

3.3 EXTRACTION PROCESS:

The process of the extracting the watermark is shown through a flow chart as shown below:

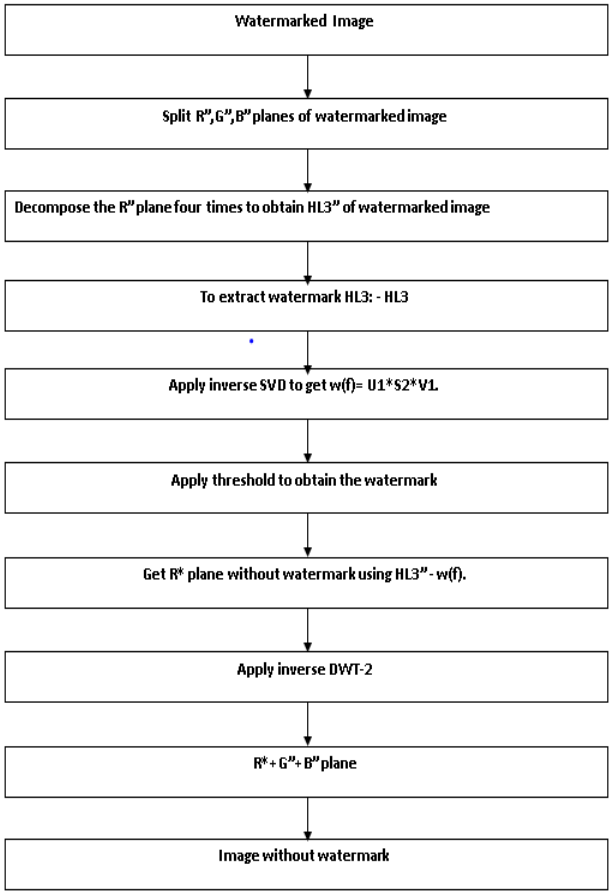


Fig-5 Embedding process

3.5 EXPERIMENTAL RESULTS OF EXTRACTION PROCESS:

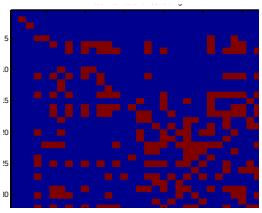


Fig-6: Recovered watermarked

Fig-7: Recovered image

4. DISCUSSION ON EXPERIMENTAL RESULTS:

In this paper, the quality of an image is measured by the Peak Signal To Noise Ratio (PSNR). It is measured in decibels (Db). The PSNR represents the peak error. The higher the PSNR gives a better quality of an output image i.e., watermarked image. the PSNR and MSE (Mean Squared Error) are the two matrices which are used to compare the quality between two mages. The mathematical expression for MSE and PSNR are given below:

$$MSE = \frac{\sum_{M,N}\left[I_1(m,n) - I_2(m,n)\right]^2}{M * N}$$

Where,

$I_1(m,n)$ = input image..

$I_2(m,n)$ = reconstructed image.

M and N = rows and columns of an inout image.

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

Where, R is the maximum possible pixel value of the input image and MSE is the Mean Squared Error which calculated earlier.

The Table 1, we calculated the values of MSE and PSNR as given below:

Images	MSE	PSNR
Lena	3.26E-04	83.039
Peppers	6.51E-04	80.0287
University	0.0148	66.4723
Funny-cat	0.0015	76.5069
Dog	3.26E-04	83.039
Rose	0.0043	71.7875

TABLE NO.1 SHOWS THA QUALITY OF AN WATERMARKED USING PSNR AND MSE.

5. CONCLUSION:

In this paper, we are focusing on robustness of an image as well as the quality of a watermarked image. these things are achieved by applying the the combination technique i.e., DWT-SVD. Im future experiment, we will concentrate on the new technique to improve the imperceptibility of an image.

6. REFERENCES:

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