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Hybrid Watermarking Techniques

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Abstract:-

Here, we are implementing watermarking scheme for digital images based on Discrete Wavelet transform (DWT), Discrete Cosine transform (DCT) and singular value decomposition (SVD).
The two main phases of watermarking schemes are robustness and copyright protected .In first step we will perform the embedding and in second step we will apply attacks on embedded image. In third step, we will remove the hidden image from attacked embedded image. Finally, we will compare the quality of embedded image and extracted image on the basis of values of some parameters like PSNR (Peak signal to noise ratio), MSE (Mean Square Error), Normalized Correlation Coefficient. Scaling factor is an important factor and image dependent so we are providing it in the form of a matrix. To provide efficient robustness and dependability of the scheme depends on scaling factors. We just follow the reverse procedure of embedding algorithm in extraction process.
Keywords- DWT (Discrete wavelet transform), DCT (discrete cosine transform), SVD(Singular value decomposition), PSNR(Peak signal to noise ratio)

I. INTRODUCTION

DIGITAL WATERMARKING:

Internet and Multimedia technologies have become our daily needs. Hence it has become a mutual practice to create copy, transmit and distribute digital data. Perceptibly, unauthorized replication problem will occur. Digital image watermarking provides copyright protection to image by hiding proper information in original image to declare rightful ownership [11].There are four vital factors those are normally used to determine quality of watermarking scheme. They are imperceptibility, robustness, capacity and blindness [2]. A digital watermark is code carrying information about the creator of the work, copyright owner the authorized consumer and whatever is needed to handle the property rights related to any certain piece of information. The watermark is proposed to be permanently embedded into the digital data so that authorized users can easily read it [3].
There are two types of schemes that are based on domain in which watermark is embedded. These are spatial domain and transform domain. Embedding the watermark in the spatial domain is the direct method [1]. It has high capacity, less computational cost, more perceptual quality but less robust and it is basically used for only authentication applications. We embed the watermark with the transformed coefficients of host image in the frequency domain schemes. It has less control of perceptual quality, more robust, and mainly used for copyright application. Scaling factor is the parameter to find out the robustness and perceptual quality of the watermarking schemes. How much percentage of the watermark is embedded into host image is termed as Scaling factor [4].

II.WATERMARKING TECHNIQUES

DWT (DISCRETE WAVELET TRANSFORM):

The DWT decomposes input image into four components i.e. LL, HL, LH and HH. Here the first letter refers to applying either a low pass frequency operation or high pass frequency operation to the rows, and second letter refers to the filter applied to the columns [5] which is shown in figure1.

Embedding a visual watermark in both low and high frequencies is a robust scheme that can resist to different kinds of attacks [11]. Embedding in low frequencies will increases the robustness with respect to attacks that have low pass characteristics like filtering, and lossy compression, geometric distortions while making the scheme more sensitive to modifications of the image histogram,

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such as gamma correction, contrast/brightness adjustment, and histogram equalization[12].

Watermarks embedded in middle and high frequencies are typically less robust to low-pass filtering, small geometric deformations of the image and lossy compression but are highly robust with respect to nonlinear deformations of the gray scale, and noise adding [14].
Advantages and disadvantages of low and middle-to-high frequency watermarks are complementary; the authors propose a new scheme where two different visual watermarks are embedded in one image [13].
In two-dimensional DWT, each level of decomposition produces four bands of data denoted by LL, HL, LH, and HH. The LL sub band can further be decomposed to obtain another level of decomposition. This process is followed until the preferred number of levels determined by the application is reached. Figure 1 shows two levels of decomposition. In DWT-based watermarking, the watermark data is embedded into the DWT coefficients. Because of the conflict between robustness and transparency, the modification at a given level is usually made in HL, LH, and HH sub band [13,15].

III. DCT (Discrete Cosine Transform)

The DCT allows an image to be divided into different frequency bands, making it much easier to embed watermarking information into the middle frequency bands of an image. A reasonable trade-off is to embed the watermark into the middle-frequency range of the image. In order to invisibly embed the watermark that can survive lossy data compressions [11] .The middle frequency bands are chosen so that because they avoid the most visual important parts of the image (low frequency) without over-exposing themselves to removal through compression and noise attacks. DCT domain watermarking can survive against the attacks such as noising, compression, sharpening, and filtering [15].
The Discrete cosine transform (DCT) is most popular due to that most of the compression techniques developed in the DCT domain (MPEG1, JPEG, MPEG2, MPEG) & then image processing is more familiar with it.
DCT based frequency domain watermarking is useful in pan card, i-card of employee of companies, fingerprint identification, medical imaging where is low cost required. DCT is one of the most common linear transformations in digital signal process technology [16].

IV. SINGULAR VALUE DECOMPOSITION (SVD)

In this algorithm a matrix is decomposed into two orthogonal matrices U and V and one diagonal matrix S[9,13]. The entries in this diagonal matrix are called the singular values of the matrix A. This decomposition is called Singular Value Decomposition of A. The major properties of Singular value decomposition according to the image processing applications are given as:
(a) Singular values represent intrinsic algebraic image properties.
(b) When a small perturbation is added to an image, its singular values do not change significantly because the singular values of an image have very good stability [14, 15].

V. PROPOSED METHOD

The proposed Watermarking scheme is implemented in two phases. First watermark embedding and then extraction phase.

1) Watermark Embedding Algorithm

a) First we have to apply Haar wavelet transform on image and will get four sub band images.
b) In second step we will apply first DCT on sub band and then SVD method will be apply on all the values of that DCT matrix.
c) Watermarking step is performed by scaling down the pixel values of watermark and then embedding those values into the cover image
d) After this the watermarked image is obtained on which various attacks are applied in order to achieve the robustness in watermarking algorithm [14, 15].

2) Watermark Extraction Algorithm

a) After embedding phase has been completed.
b) Then we follow the extraction phase where we apply again the Haar wavelet transform, DCT and SVD and extract the watermark under attacks.

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c) Finally the correlation is determined between the watermark extracted and original watermark.
d) It is a measure of comparison of quality of image.
e) This proposed technique will help to overcome all issues occurring in existing models and providing the better quality of image after extraction phase [13,15].

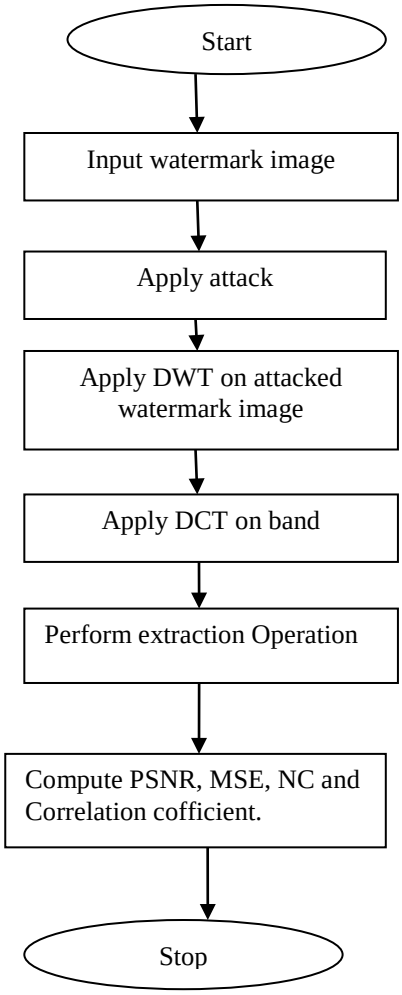

Fig.1. Watermark Embedding Algorithm

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VII. CONCLUSIONS

By embedding the principle components of the watermark into the DCT of horizontal sub band of DWT decomposition of host image, we can provide better imperceptibility as well as reliability. By doing this, we can avoid the false positive problem and hence we can provide the copyright protection. We also got a suitable scaling factor for any watermark which is image dependent. Thus we can get the robustness and transparency of the scheme for any watermark.

The performance of the proposed method is tested by applying different compression and image processing attacks like different type of noises, image rotations and pixel values transformations and we have got the values of correlation coefficients all are above 0.75 which are acceptable. Thus proposed method will be more robust as well as reliable watermarking technique. .

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