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DIGITAL TRANSPARENT WATERMARKING USING HAAR TRANSFORM AND ORTHOGONAL TRANSFORM

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ABSTRACT
Today, due to rapid use of digital applications and services, the data lose is very usual. To protect the digital data a way, we proposed a new robust digital watermarking technique using Haar Transform and Orthogonal Transform where a transparent watermarking or visible watermarking is used. By using this technique, we can get digital data without degradation in quality. Digital watermarking technique is a technology to embed the additional or authorized information into a host signal to ensure the security and protection of the digital information. The watermarking scheme deals with the two procedures: Embedding the watermark and Extracting the watermark. There are two approaches used to follow the procedures: Digital Wavelet Transform (DWT) and Principle Component Analysis (PCA).

Keywords: Digital Transparent Watermarking Technique, Digital Wavelet Transform (DWT), LL (Low Frequency Band), Principle Component Analysis (PCA).

INTRODUCTION
Recently, digital multimedia distribution over the internet has increased as result of latest development in the technology. So, digital information is easy to use, duplicate, modify which leads to the need for the copyright protection techniques. The digital watermarking is one of the solution to avoid unauthorized copying or tempering of the digital information. In case of any dispute, authentication data is extracted from media and can be used as an authoritative proof to prove the ownership. The process of digital watermarking involves two images, one is cover image and another is watermark image and the watermarked image containing key information such as authentication and copyright codes. The main aim is to get the approximate same quality of watermark image as same as in original image. In transform domain, watermark is embedded by modifying the frequency coefficients of the transformed image. In digital watermarking technique, watermarking approaches can be classified into two main categories based on the method of hiding watermark bits in the host signal. The two main categories are: Spatial domain watermarking where embedding and detection of the watermark are performed and the second one is Transform Domain Technique which is also called alter-spatial technique. Transform Domain can be categorized in some further domain techniques that are: Discrete Wavelet Transform (DWT), Discrete Fourier Transform (DFT) and Discrete Cosine Transform (DCT). In this paper, we are using Discrete Wavelet Transform because it is more efficient and gives the more clear result than DFT and DCT.

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WATERMARKING APPROACHES
In this paper, a new robust watermarking technique is used by using two watermarking approaches. The approaches are: Discrete Wavelet Transform and Principle Component Analysis.
Discrete Wavelet Transform (DWT) is a hierarchical transform. It is capable to study or analyze a signal at different levels, means it offers multi resolution analysis. It is widely used in the signal processing application. It is basically used to create the sub-images or frequency bands of the particular image. We can create the several bands with respect to different phases or levels. From the first level, it starts to divide the image into two levels or phases and so on. Two – dimension DWT can create the frequency bands in both the directions that can be horizontal direction or vertical direction. It creates the four sub-bands of any image. The four sub-bands are:

- LL (Low resolution approximation sub-band)

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- HL (Horizontal bands)
- LH (Vertical bands)
- HH (Diagonal Detailed Component)

According to the proposed method of watermarking scheme in this paper, we have taken a cover image of 512px*512px. And by using 2D- DWT, frequency bands are created into different phases. The block diagram of DWT frequency bands are shown in Fig 2.1:

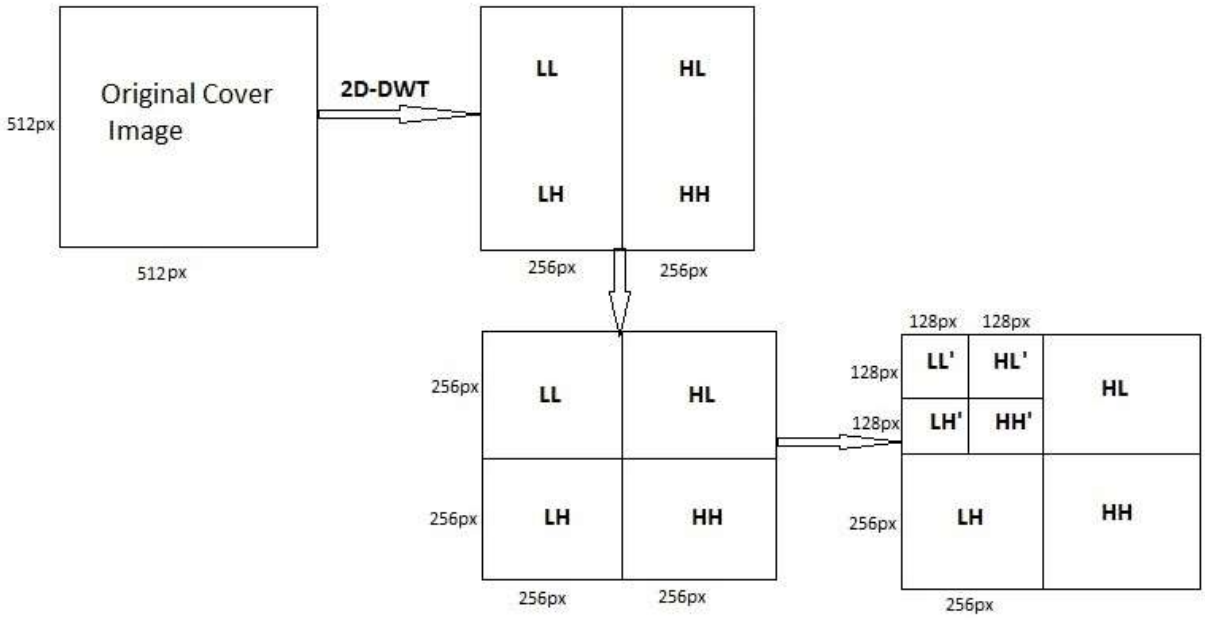

Fig 2.1: 2-D DWT Frequency Bands

Principle Component Analysis (PCA) is mathematical procedure that uses an orthogonal transformation to reduce the data dimension or data decorrelation. The number of principle components are always less than or equal to the original variables. In this, the first application which consists in an image color reduction while the three color components are reduced into one contains a major part of the information. PCA is a very effective tool to analyze the data and recognize the pattern which is often used in image processing and signal processing as well. If these patterns in the data have been indentified, then data can be compressed by reducing the number of dimensions without much loss of information.

PROPOSED TECHNIQUE

The proposed technique is divided into the two sections: Embedding Technique and Extraction Technique.

Algorithms for embedding technique and extraction technique are described below.

Embedding Technique:

Step 1: Take an image to make it cover image of size N*N.
Step 2: Covert this RGB image into YUV color format.
Step 3: Apply 2-DWT to the cover image for creating the sub-bands of it.
Step 4: DWT creates the four non-overlapping sub-bands and they are: LL, HL, LH, HH bands.
Step 5: Select a LL band to embed the watermark. But for embedding the watermark image into LL band, we have to create further non-overlapping sub-blocks of LL band as shown below in the Fig. 2.1.
Step 6: Then take another image as a watermark of the size same as the size of LL band.
Step 7: Watermark bits are embedded with the key value α.

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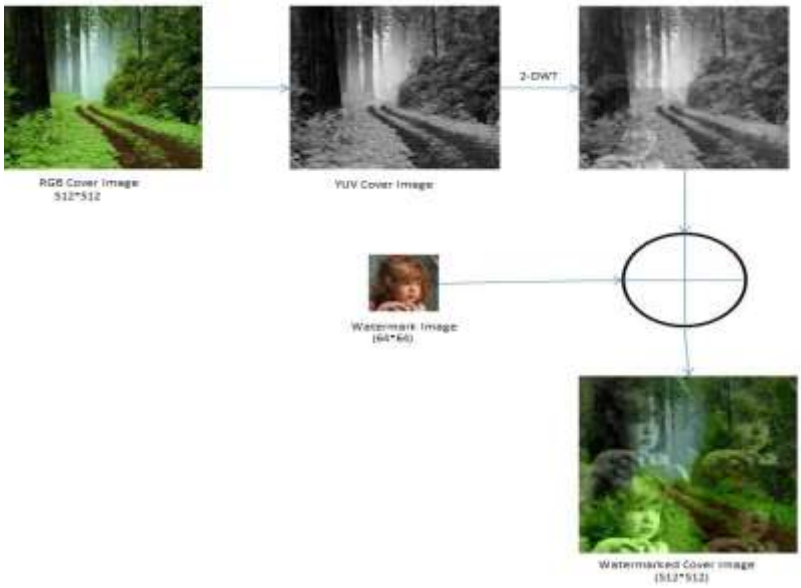

Fig 3.1: Embedding Watermark Technique

Block Diagram of Embedding Technique:

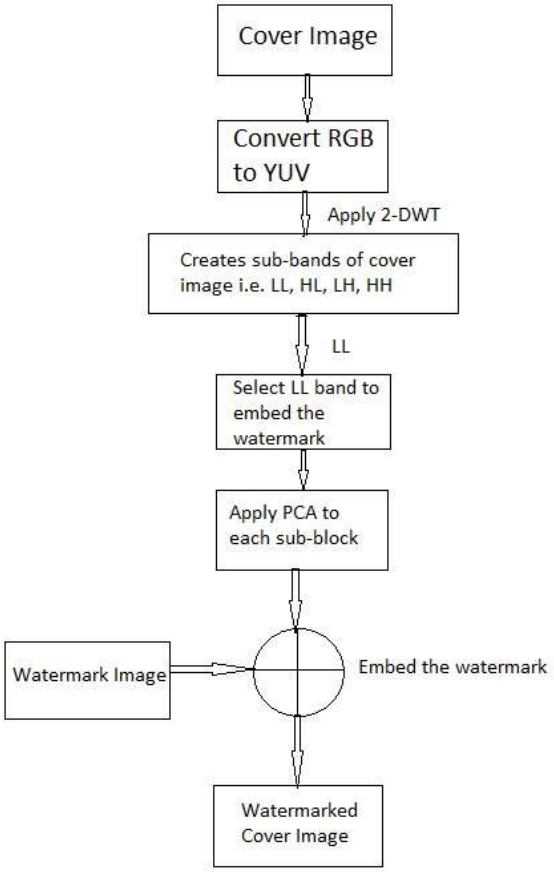

Fig 3.2: Block Diagram of Embedding Watermark Technique

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Extracting Technique:

1. Take watermarked cover image.
2. Convert RGB watermarked image into YUV color format.
3. Choose luminance component Y of the image.
4. Apply 2-DWT to decompose the Y component into the four sub-bands i.e. LL, HL, LH, and HH.
5. Select the LL band to create non-overlapping sub-blocks of same size.
6. Apply PCA to each block in the chosen sub-bands LL.
7. The watermark bits are extracted from the principle component of each sub-block of LL band.

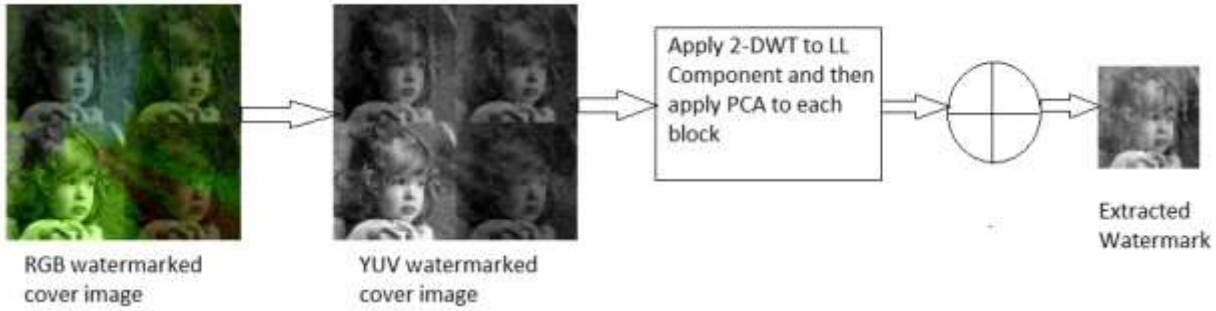

Fig 3.3: Extraction Technique

Block diagram of Extraction Technique:

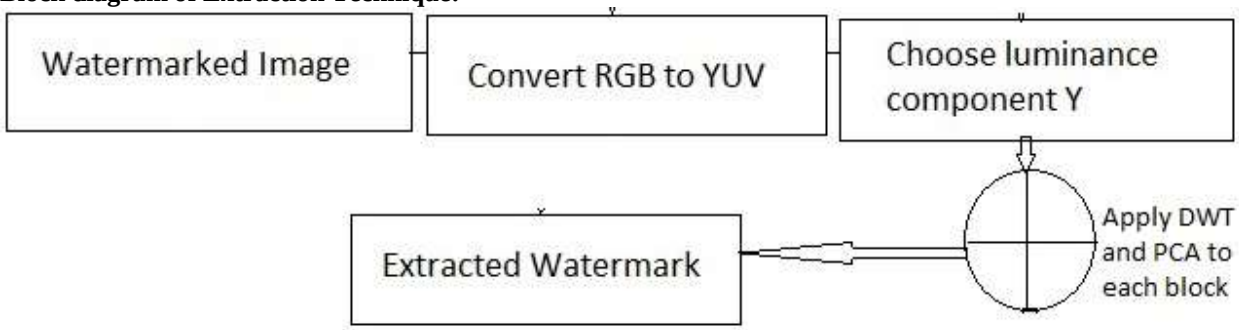

Fig 3.4: Block Diagram of Extraction Technique

EXPERIMENT RESULTS

The proposed algorithm applied to a cover image of size 512*512 and watermark image of size 64*64. Firstly, convert both the RGB images into grayscale format. Then, embedding and extraction procedures are followed.

The performance of the algorithm has been measured in terms of its imperceptibility and robustness against the possible attacks like filtering and noise addition etc.

PSNR: It stands for the Peak Signal-To-Noise Ratio (PSNR) and it's used to obtain the imperceptibility between the original cover image and watermarked image.

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Fig 4.1: Original image and Watermarked image

NC: It stands for the Normalized Coefficient and it's used to measure the robustness of the watermark image.

Fig 4.2: Original Watermark image and Extracted watermarked image

After applying the concepts of PSNR and NC on several images, some graphs are drawn. And on the basis of these graphs, the tradeoff value is set. The graphs are shown below.

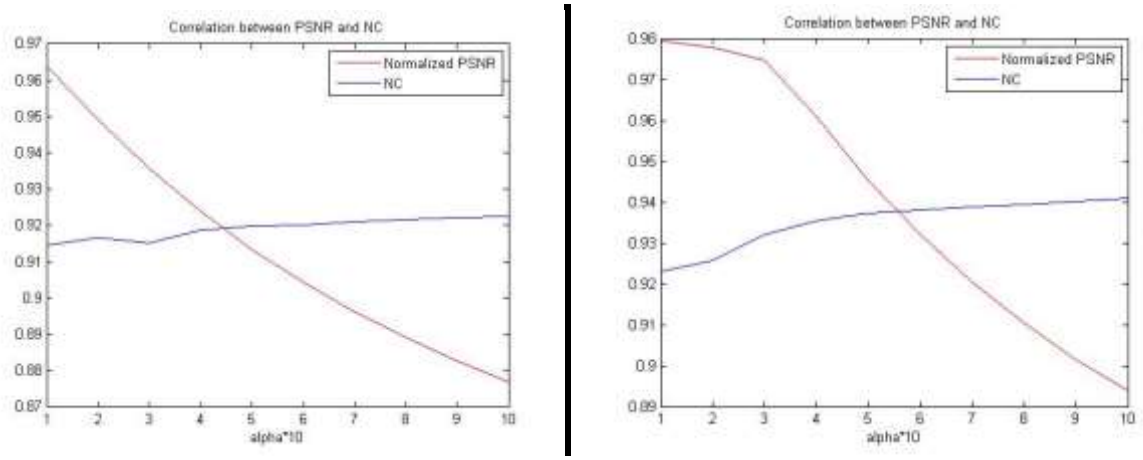

Fig 4.3: PSNR and NC graphs

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CONCLUTION

In this paper, the algorithms implemented with the help of two approaches i.e. DWT and PCA. By using these, the robustness and the imperceptibility of the watermark image getting improved. The quality is not much degraded.

As a future work, the value of PSNR and NC can be more optimized for the colored images, so that the approached method works well on all types of images.

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