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A digital watermarking for social network data sets for enabling the data trust

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ABSTRACT

Digital watermarking has become a promising research area to face the challenges created by the rapid growth in distribution of digital content over the Internet. To prevents misuse of this data Digital watermarking techniques are very useful, In which a Secret message called as a watermarks which could be a logo or label, is embedded into multimedia data which again could be used for various applications like copyright protection, authentication, and tamper detection etc.. Based on the requirement of the application the watermark is extracted or detected by detection algorithm to test condition of the data. This paper presents another approach for watermarking image and extracting it for authentication purposes.

Keywords: *Digital Watermarking, DWT, Embedding, and Extraction*

1. INTRODUCTION

The use of social networks is increasing day by day. Recent statistics show that there were more than 32 million social network users worldwide. The social networks users perform different actions such as sharing their activities and news about their events, sharing news, sharing their personal data, and discussing various topics. With the exponential growth in use of social networking on the Internet the storage and distribution of multimedia content is become very easy and this ease has given rise to issues like copyright protection, piracy and authenticity while handling the digital multimedia. Thus to face these challenges digital watermarking can be a suitable solution.

Fig. 1: Visible Watermarking on an image: (a) Image that is taken for watermarking, (b) Image after watermarking.

Fig. 2: Invisible Watermarking on an image: (a) Image that is taken for watermarking, (b) Image after watermarking

In Digital watermarking, information is embedded into cover media then the media is distributed the same information can be later extracted for authentication. The watermark may visible or invisible LOGO are examples of visible watermarks but the hidden watermark should be inseparable from the host image robust to resist manipulation while preserving the image quality.

Several studies had been made about the effect of visible and invisible watermarking on images and their extracting techniques. Thus these digital signature embedding approaches are useful in authenticating ownership claims and protecting proprietary hidden information and discourage unauthorized copying and distribution of images over the internet and also make sure a digital picture has not been altered.

2. LITERATURE SURVEY

The basic model of any Digital watermarking consists of two parts first the watermark embedding and the watermark extraction but with different method used for embedding and extraction. There are four factors used to classify digital watermarking techniques

a) Robustness: It is a measure watermarks ability against attempts to image modification and manipulation.
b) Imperceptibility: A watermark is imperceptible if the original cover signal and the marked signal are perceptually indistinguishable.
c) Capacity: It is the measure of how much information is added into the host image.
d) Embedding method: These are mostly classified into to type according to domain in with embedding is done, first is spatial domain and other is frequency domain.

Application of Digital watermarking can be found used in for copyright protection image authenticity fingerprinting medical application and broadcasting monitoring.

3. DISCRETE WAVELET TRANSFORM

Compared to spatial domain techniques [7] , frequency-domain watermarking techniques proved to be more effective with respect to achieving the imperceptibility and robustness requirements of digital watermarking algorithms[8]. Commonly used frequency-domain transforms include the Discrete Wavelet Transform (DWT), the Discrete Cosine Transform (DCT) and Discrete Fourier Transform (DFT). However, DWT has been used in digital image watermarking more frequently due to its excellent spatial localization and multi-resolution characteristics, which are similar to the theoretical models of the human visual system. Further performance improvements in DWT-based digital image watermarking algorithms could be obtained by increasing the level of DWT.

A discrete wavelet transform (DWT) is any wavelet transform for which the wavelets are discretely sampled [9]. It is useful for processing of non-stationary signals. In transform small waves, which are called wavelets of varying frequency and limited duration, are used as mother wavelet. Wavelets are created by translations and dilations of a fixed function called mother wavelet. Wavelet transform provides both frequency and spatial description of an image DWT is the multi resolution description of an image the decoding can be processed sequentially from a low resolution to the higher resolution. The DWT splits the signal into high and low frequency parts. The high frequency part contains information about the edge components, while the low frequency part is split again into high and low frequency parts. The high frequency components are usually used for watermarking since the human eye is less sensitive to changes in edges [11] . In two-dimensional applications, for each level of decomposition, we first perform the DWT in the vertical direction, followed by the DWT in the horizontal direction. After the first level of decomposition, there are 4 sub-bands: LL1, LH1, HL1, and HH1. For each successive level of decomposition, the LL sub-band of the previous level is used as the input. To perform second level decomposition, the DWT is applied to LL1 .To perform third level decomposition, the DWT is applied to LL2 band which decompose this band into the four sub-bands {LL3, LH3, HL3, HH3. This results in 10 sub-bands per component. LH1, HL1, and HH1 contain the highest frequency bands present in the image tile, while LL3 contains the lowest frequency band and the approximate image.[10].

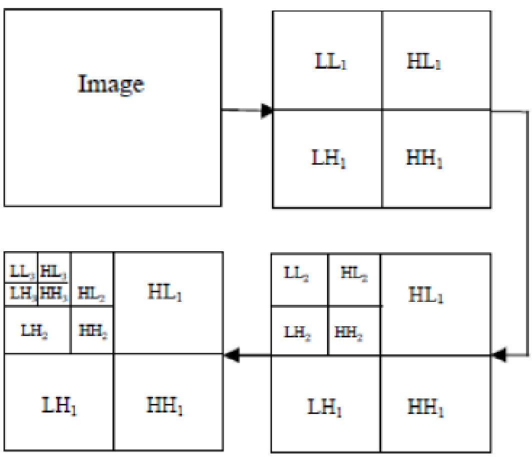

Fig. 3: level DWT transform of an image

4. PROPOSED SYSTEM

Digital Watermarking makes an attempt to resolve the problems associated with the management of property of media. It ends up in unauthorized copying and redistribution of digital content. We have faced many challenges for completing this project with good results. Both qualitative and quantitative analysis is performed on this work and the results obtained are quite satisfactory.

4.1 Proposed Architecture

The watermarking schemes proposed here are also based on DWT technique. Where the benefits of DWT are taken into consideration in choosing the most proper sub band for watermark embedding in order to provide both robustness and imperceptibility.

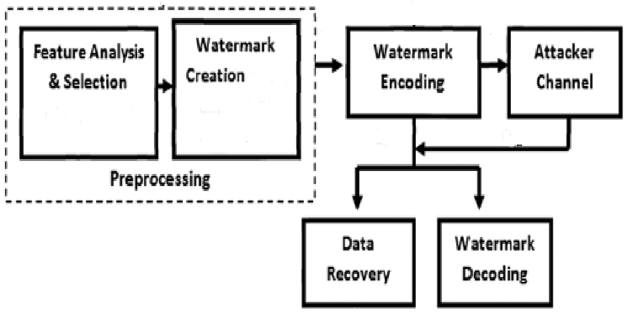

Fig. 4: Simplified Proposed Architecture

4.2 Modules

The project is done in three different modules. The first module performs preprocessing, second module performs watermark embedding, third module performs watermark extraction, then PSNR and MSE calculation is done for result analysis.

4.2.1 Preprocessing: The preprocessing phase comprises certain steps such as:

- Select the cover image.
- Select the watermark image.
- Do the 3 levels DWT function in cover image and Watermark?

Following figures show the different preprocessing steps:

Fig. 5: Selected cover image

Fig. 6: Selected watermark image

4.2.2 Watermark Embedding

Embedding algorithm: For embedding we need a host image and a watermarked Image.

Fig. 7: 3 Level DWT function in cover image

Fig. 8: 3 Level DWT function in watermark image

Step1: First level DWT is performed on the host image to decompose it into four sub bands LL1, HL1, LH1 and HH1.

Step2: The second level DWT is performed on the LL1 sub band to get four smaller sub bands LL2, HL2, LH2 and HH2.

Step3: The third level DWT is performed on the LL2 Sub band to get four smaller sub bands LL3, HL3, LH3 and HH3.

Step4: First level DWT is performed on the watermark image to decompose it into four sub bands wLL1, wHL1, wLH1 and wHH1.

Step5: The second level DWT is performed on the LL1 sub band to get four smaller sub bands wLL2, wHL2, wLH2 and wHH2.

Step6: The third level DWT is performed on the LL2 sub band to get four smaller sub bands w LL3,wHL3, w LH3 and wHH3.

Step7: A embedding function is used to add the two sub bands are added with a embedding formulae with value 'a' as in is as follows: new LL3=LL3+ a*wLL3 new LL3=LL3+ a*wLL3.

Step8: Now Inverse DWT is performed using the sub bands newLL3,LH3,HL3,HH3 to get image new LL2.

Step9: Inverse DWT is performed using the sub bands newLL2,LH2,HL2,HH2 to get image new LL1.

Step10: Inverse DWT is performed using the sub bands newLL2,LH1,HL1,HH1 to get the watermarked image now we get the watermarked image that can be used for various purposes.

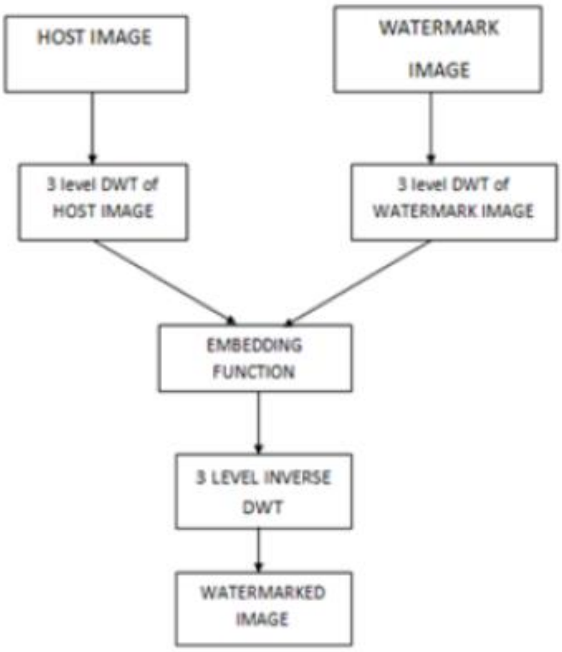

Fig. 9: Embedding Algorithm

4.2.3 Watermark Extraction: Extraction algorithm: For extraction host image and watermarked images are used.

Step1: Step 1: First level DWT is performed on the host image to decompose it into four sub bands LL1, HL1, LH1 and HH1.

Step2: Step 2: The second level DWT is performed on the LL1 sub band to get four smaller sub bands LL2, HL2, LH2 and HH2.

Step3: Step 3: The third level DWT is performed on the LL2 sub band to get four smaller sub bands LL3, HL3, LH3 and HH3.

Step4: Step 4: First level DWT is performed on the watermarked image to decompose it into four sub bands nLL1, nHL1, nLH1 and nHH1.

Step5: Step 5: The second level DWT is performed on the LL1 sub band to get four smaller sub bands nLL2, nHL2, nLH2 and nHH2.

Step6: Step 6: The third level DWT is performed on the LL2 sub band to get four smaller sub bands n LL3,n HL3,n LH3 and nHH3.

Step7: Step7: Then following extracting is performed to get wLL3 with the extraction formulae with same value of 'a' as in embedding wLL3= new LL3-LL3/ a

Step8: Step 8: Apply inverse DWT on wLL3 with all other sub bands (LH ,HL, HH) equal to zero to get wLL2.

Step9: Step 9: Repeat step 8 two times each level to get the extracted watermarks.

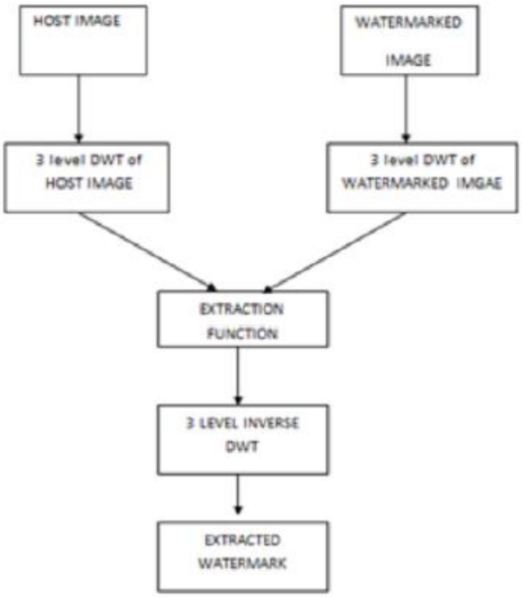

Fig. 10: Extraction Algorithm

The extracted watermark can be used for various applications.

5 RESULTS AND DISCUSSION

To implement this technique we have used two RGB .jpg images as host and watermark . Both the images are of equal size of 256X256 and implemented the algorithm in MATLAB. The project is done in four steps. The first step performs watermark embedding, second step watermark extraction, then PSNR and MSE calculation. The results of the embedding and extraction steps are as follows:

Fig. 11: Watermark Embedded Image

Fig. 12: Watermark Extracted Image

5.1 MSE Calculation

The mean-square error (MSE) and the peak signal-to-noise ratio (PSNR) are used to compare image compression quality. The MSE represents the cumulative squared error between the compressed and the original image, whereas PSNR represents a measure of the peak error. The lower the value of MSE, the lower the error. The mean squared error (Emsq) is calculated using the following equation.

$$E_{msq} = \frac{\sum_{e,double}[[pic1(i,j) - pic2(i,j)]]^2}{mn}$$

Where m and n are the number of rows and columns of the input image.

5.2 PSNR Calculation

Peak Signal to Noise Ratio (PSNR) is a metric used to compare the error between two images in decibels. Here, the two images taken for comparison are the original and a compressed image. PSNR value is calculated at the end of each step. This ratio can be used as a quality measurement, which shows how much the original is similar to the compressed image. A high value for PSNR means the output obtained is of high quality. To calculate PSNR, first calculate the mean-squared error (Emsq). Now, the PSNR value can be calculated as follows:

$$PSNR = 10\log_{10}\frac{double[m]^2}{E_{msq}}$$

If the data type of the input image is double-precision floating-point, then m is 1. If the data type is an 8-bit unsigned integer, m is 255, etc. We have calculated the peak signal to noise ratio (PSNR) and mean-square error (MSE) for 10 images and plotted their graph. Table 1 shows the values of these metrics for 10 input images.

Table 1: PSNR and MSE of for 10 images

	PSNR value	MSE value
image 1	72.538	7.740
image 2	84.286	7.825
image 3	71.062	6.869
image 4	93.336	7.761
image 5	74.695	7.817
image 6	92.043	7.710
image 7	132.196	6.603
image 8	52.314	7.788
image 9	73.212	7.816
image 10	90.539	8.825

A maximum of 132.19 is obtained for image 7. PSNR value can be considered as a quality measure where a high value indicates the output obtained is of better quality. The lower the value of MSE, the lower the error.

6. CONCLUSION

The watermarking technique based on a 3-level discrete wavelet transform is implemented here, in which DWT transform is performed on both original and watermark image and watermark is embedded the host image with a scaling factor 'a' . Experiment results shows that the quality of the watermarked image and the recovered watermark are dependent on the scaling factor a and also Higher scaling factor results in a visible watermark thus we can use scaling factor to make watermarked image visible or invisible according to the need of media distribution by application.

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