Effective Technique for Data Hiding In Encrypted Image with Public Key Cryptography

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Abstract- **A main setback for computer networks in these days is to avert vital data or information from being disclosed to illegitimate users. For this motive, encryption techniques were introduced. Many methods like Digital image water-marking and data hiding have also been recommended as a mode to accomplish digital fortification. The aim of the digital water-marking is to put in the secret data into the image without radically affecting the visual excellence of the image. In this proposed work, the concealed water-mark which is obtained from the water-marked image is detected and strong image water-marking technique for logo detection based on Discrete Wavelet Transform (DWT) is implemented and Alpha Merging Technique is used to insert data. The water-mark generated from the image with the proposed algorithm is invisible and the quality of water-marked image1 and the recovered image are enhanced. The quality of the extracted image is analyzed by using statistical parameters such1as Peak-Signal-to-Noise-Ratio (PSNR) and Mean Square Error (MSE).**

***Keywords*— Digital water-marking, Discrete Wavelet Transforms (DWT), Alpha merging, Data Flow Diagram (DFD)**

I. INTRODUCTION

Water-marking has been extensively used in these days for evidence of ownership and copyright fortification;on the other hand, it has also been functional to many applications such as broadcast monitoring, data integrity Verification, and image indexing and labelling. Digital water-marking has been investigated for the last numerous decades and now is a mature field of research. On the other hand, present efforts are trying to boost in its act, as more many new applications and their needs, challenges lined a way for recent inventions which led to the raise in researching in this area.

The internet is scattering rapidly and is accompanied by the ample development of digital technologies and easily reproduced digital media, all these has increased the reputation of such media. The current dare for us is how to guard the ownership of digital products by using the resources of internet fully. Cryptography gives an answer for this issue. The best way to safeguard the rights of the authors and make certain effortless and rapid way in to internet is digital water-marking. Digital water-marking is the method of perpetually embedding data into digital multimedia content without degradation, such that this water-mark can deny any irrelevant operation. The water-mark can be visible or invisible; invisible water-marks are the most frequently in use.

Steganography is the fine art of hiding messages. Steganography and cryptology are analogous in the means that they both are used to protect significant information. Steganography involves hiding information so it appears that no information is hidden at all. The information is hidden inside which is difficult for a person to identify that, therefore the person will not attempt to decrypt the information; this is the main goal behind steganography.

The embedding and extraction of logo image invisibly into the original input image is very essential in the water-marking aspects. Embedding and extraction of logo image into the original input image and the water-marked image respectively, helps the user to shield their personal data's and other authenticated devices from the hackers. Use of well-organized and enhanced robust algorithm such as Discrete Wavelet Transform (DWT) gives accurate classification results.

II. DATA FLOW DIAGRAM

The input image contains different levels and distributions of quality to demonstrate the potential for invisible watermarking. Detailed design of water-mark embedding is shown in figure 1.

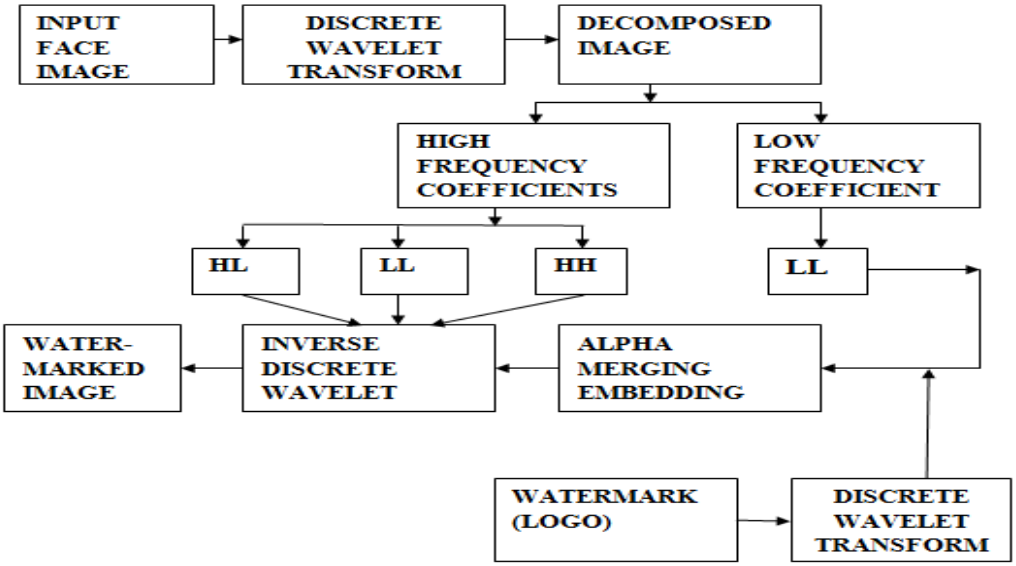


Figure 1 Detailed data flow diagram of the system

III. DESIGN AND IMPLEMENTATION

In this work, we have developed a different method to hide the data inside an image.Data Flow Diagram is an illustration carried in a graphical form. It is a demonstration concerning the "run" of information all the way through in a sequence, representing its procedure part. A DFD support the variety of input data in sequence with the output of the method, in which the assembly will approach as of plus exit towards, in addition to in what the information will be congregate. It doesn't demonstrate in sequence regarding the instance of procedures, or else in sequence regarding whether the procedures will work sequentially or else separately.

A. TOP-LEVEL DESIGN

The given name point towards the top level plan provides the general idea of method, putting out of sight the particulars regarding each one module. The top level plan is as well recognized as stage 0 design plan, that explains the on the whole procedure as well as modules concerned. Top level plan exemplify how the entire method is separated keen on sub methods (procedures), each regarding what compacts among single or else other regarding the information otherwise direct runs towards otherwise as of every former, as well as which jointly offer each and every one regarding the meaning concerning the method like a complete.

It as well classifies interior information supplies which should be there within direct meant for the method in the direction of doing its work, in addition to elaborate the run regarding information among a variety of pieces concerning the method. Level Zero plan provides a concise as well as a total replica concerning the aim towards attaining the extracted feature set and classification of the given input image.

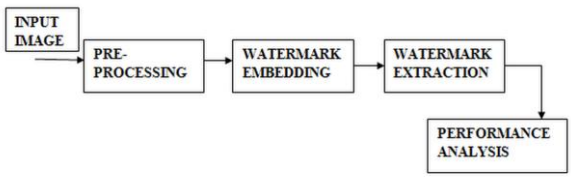


Figure.2General Block Diagram

B. Discrete Wavelet Transform

The discrete wavelet transform (DWT) is the crucial and simplest transform amid frequent multi-scale transform and other type of wavele based fusion schemes.

DWT is the multi-resolution portrayal of an image. The decoding can be processed in succession from a low resolution to the higher resolution. The DWT splits the image into high and low frequency parts. The high frequency part contains information about the edge components, while the low frequency part is splits into high and low frequency parts. The high frequency components are usually used for water-marking since the human eye is less sensitive to changes in edges.

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 putrefaction, there are 4 sub-bands: LL1, LH1, HL1, and HH1.

The used frequency-domain transforms consist of Discrete Wavelet Transform (DWT), the Discrete Cosine Transform (DCT) and Discrete Fourier Transform (DFT). The DWT has been used in digital image water-marking more often due to its exceptional spatial localization and multi-resolution uniqueness, which are analogous to the theoretical models of the human visual system. Further efficient improvements in DWT-based digital image water-marking algorithms could be obtained by increasing the level of DWT.

C. ALPHA MERGER EMBEDDING TECHNIQUE

Alpha merger method is used to embed the data into the original image chosen. It uses image processing techniques by merging each pixel from the source image with the comparable pixel of the second source image. According to the formula of the alpha merging of water-marked image is given by

Water-Marked-Image= (K*LL4) + (Q * WM2)

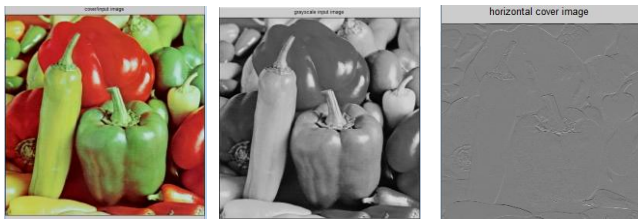
Where,

WMI = low band frequency constituent of water-marked image

LL4 = low band frequency constituent of the original image obtained by 4-level DWT

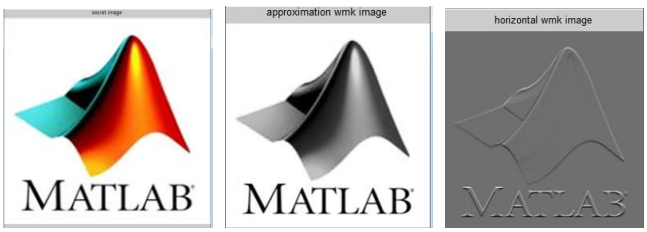
WM4 = low band frequency constituent of Watermark image

K and q = Scaling factors for the primary image and water-mark respectively.



(a) (b) (c)

Figure.3 Cover Image Encryption Process



(a) (b) (c)

Figure.4 Secret Watermark Image

D. Inverse wavelet transform

At the receiver, the combination of low sub-band frequency (LS) with different frequency sub-bands by applying IDWT, The output signal image will enclose sharper fine edges than the watermarked image obtained. This is owed to the fact that, the computation of isolated high frequency constituents in high frequency sub-bandsand using the corrections obtained by adding high frequency sub-bands of DWT of the input imagewill preserve more high frequency components after the interpolation than interpolating input image instantly.

E. ALPHA BLENDING EXTRACTION TECHNIQUE

According to the formula of the extraction technique, the recovered image is given by

RI = ((WMI - k) * LL4)

Where

RI= Low frequency inference of Recovered watermark image,

LL4= Low frequency inference of the Original image

WMI= Low frequency inference of Water-marked image.

Mean Square Error (MSE)

Mean Square Error (MSE) can be used to analyze the measure of the average of the squares of the total errors or deviations i.e the difference between the different parameters that are being estimated.

Peak Signal to Noise Ratio (PSNR)

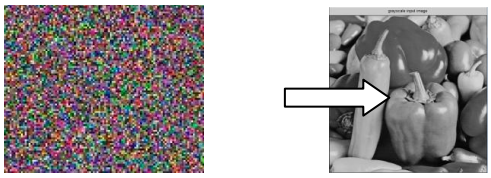
Peak Signal to Noise Ratio (PSNR) is generally used to analyze the choice of image and video files in dB(decibels).P SNR calculation of two images, one original and an distorted image, describes how far two images are equal.

Normalized Cross Correlation (NCC)

The NCC is a method to calculate the similarity between the primary and extracted images, and is given by:

$$NCC = \frac{\sigma_{W,\widehat{W}}}{\sigma_W \sigma_{\widehat{W}}}$$

Where W and Wcap denote the original and extracted images, respectively ; and where σW, σWcap, and σW,,Wcap denote the sample stock deviant and covariance. NCC values near to unity indicate high correlation and high robustness.



(a) Hidden Encrypted Image At the transmitter output

(b) Extracted Original Image at the receiver

Figure 5

IV. RESULT

The analysis is done for 4 to 6 images which are present default in MATLAB. Performance measure such as PSNR, MSE and NCC is determined.At the receiver side, the opposite of the described process takes place to get back the hidden content. The result of the method is as follows

	PSNR	MSE	NCC
Proposed method (DWT)	74.6862	0.0022	0.993

In this method, Bit error Rate is reduced considerably and a more clear hidden data is obtained. Essentially the output is only obtained when the two keys entered at the input and the output side matches.

V. CONCLUSION AND FUTURE WORK

This work projects an approach of combining the watermark (logo) into the input image using DWT and Alpha blending Embedding algorithm. The watermarked image/encrypted image is formed. Then we need to decrypt/extract the logo image from the water-marked image using DWT, Alpha merger Extraction and IDWT algorithm. We demonstrate that the water-marks generated with this algorithm are invisible and can be visible sometimes and the quality of debased and the recovered image are improved. The above proposed method is compared with the existing water-marking methods by using arithmetical parameters such as peak- signal to noise -ratio (PSNR), Mean-Square Error(MSE) and Normalized-Cross- Correlation (NCC).

In future work, experiments with more images were carried out and tested by considering various phenomenon's such as elision of low resolution images and including the calculation of some more statistical parameters.

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