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An Approach for Embedding and Extracting Logo Watermarking

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ABSTRACT:

Watermarking plays a vital role in the field of image process as well as digital signal processing. One of the important applications of digital watermarking technology is copyright protection and ownership identification for digital images. Grayscale logo watermarking is a quite well-developed area of digital image watermarking which seeks to embed into the host image another smaller logo image. The key advantage of such an approach is the ability to visually analyze the extracted logo for rapid visual authentication and other visual tasks. However, logos pose new challenges for invisible watermarking applications which need to keep the watermark imperceptible within the host image while simultaneously maintaining robustness to attacks. This report presents an algorithm for invisible grayscale logo watermarking that operates via adaptive texturization of the logo. The central idea of our approach is to recast the watermarking task into a texture similarity task.We demonstrate that the watermarks generated with the proposed algorithm are invisible and visible and the quality of watermarked image and the recovered image are improved. The proposed method is compared with the 1-level and 2-level DWT based image watermarking methods by using statistical parameters such as peak-signal-to-noise-ratio (PSNR) and normalized cross-correlation coefficient (NCC).

INTRODUCTION

Watermarking has been widely used for proof of ownership and copyright protection; however, it has also been applied to applications such as broadcast monitoring, data integrity verification, and image indexing and labeling. Digital watermarking has been investigated for the last several decades and is a mature field of research. However, current efforts try to improve its performance, as new requirements and challenges posed by new applications motivate the need for continued research in this area.

One new requirement is the ability of a watermark to survive multiple, consecutive attacks. Over the last five years, MMS and online sharing of digital imagery on sites such as Facebook, Twitter, and other social and traditional media outlets, have become standard ways of disseminating photos.

Typically, the original image is subjected to various forms of manual and/or automated processing before being posted, particularly when using popular sharing software such as Instagram. Such photos are typically resized (resulting in slight blurring), then cropped, then contrast-adjusted, then rotated (e.g., to make horizon lines horizontal), and then compressed via JPEG (resulting in blurring and blocking). Furthermore, if the images are transmitted over lossy communication channels, further degradation may result from transcoding, packet loss, and/or attempted corrections for such loss. The ability to survive multiple consecutive attacks was not a mainstream requirement 10-15 years ago, but it is clearly important today.

Logo watermarking

One popular thrust in digital image watermarking is logo watermarking, in which the watermark is itself an image, typically a small and user-specified image

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representing a symbol or a trademark. There has been significant research devoted to logo watermarking over the last 15 years. Invisible logo watermarking further requires that the watermark is visually imperceptible when placed within the host image, yet is visually recognizable when extracted. The primary advantage of logo watermarking is the ability to visually compare the extracted logo with the original logo during verification. It is well-known that the human visual system is unmatched in its ability to perform visual recognition, even for small thumbnail-sized images. Thus, even an untrained viewer can often effortlessly determine whether the extracted logo matches the original logo.

Logo watermarking has to overcome multiple challenges. One challenge is that the extracted watermark must be visually meaningful in order to facilitate a visual comparison, as opposed to simply catering to a present/not-present decision. Thus, the watermark must be able to survive attacks such that the visual quality of the extracted logo gracefully degrades as the attack intensity increases.

Another challenge to logo watermarking and some other non-logo watermarking algorithms, such as copy protection codes, stems from the fact that the logo (or watermark in general) is specified by the end-user and not by the watermarking algorithm; thus, the algorithm designer cannot choose which data to embed. A successful logo watermarking algorithm must be able to handle a variety of logos, which largely restricts the algorithm from employing approaches which are tailored to particular data pattern.

Applications of watermarking

Invisible logo watermarking is particularly useful for more recent applications, such as watermarking for automated quality monitoring of multimedia transmission for embedding QR codes in images and for embedding hospital and/or calibration logos in medical imagery. In particular, watermarking has recently emerged as a promising approach to no-reference image and video quality assessment. No-reference quality assessment algorithms seek to estimate the quality of an image/video without having access to the original, undistorted image/video, which is a challenging research area that has traditionally relied on the use of statistical image features. Watermarking has shown recent promise for this task, and further improvements could be realized via the use of logo watermarking, which would allow the use of a full- reference quality assessment algorithm applied to the original and extracted logos.

Properties of Watermarks

There are a number of desirable characteristics that a watermark should exhibit. These include that it be difficult to notice, robust to common distortions of the signal, resistant to malicious attempts to remove the watermark, Support a sufficient data rate commensurate with the application, and allow multiple watermarks to be added and that the decoder be scalable. Difficult to notice the watermark should not be noticeable to the viewer nor should the watermark degrade the Quality of the content. We had used the term imperceptible" and this is certainly the ideal.

Steganography

Steganography is the art and science of hiding messages. Steganography and cryptology are similar in the way that they both are used to protect important information. The difference between the two is that Steganography involves hiding information so it appears that no information is hidden at all. If a person views the digital object that the information is hidden inside, he or she will have no idea that there is any hidden information, therefore the person will not attempt to decrypt the information, this is the main objective behind steganography. Steganography comes from the Greek words Steganos (Covered) and Graptos (Writing), these days the sense of the word "steganography" usually refers to information or a file that has been concealed inside a digital Picture, Video or Audio file. What Steganography technically does is to make use of human awareness; human senses are

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not trained to look for files that have information hidden inside of them, although there are programs available that can do what is called Steganalysis (Detecting use of Steganography.) The most common use of Steganography is to hide a file inside another file. When information or a file is hidden inside a carrier file, the data is usually encrypted with a password.

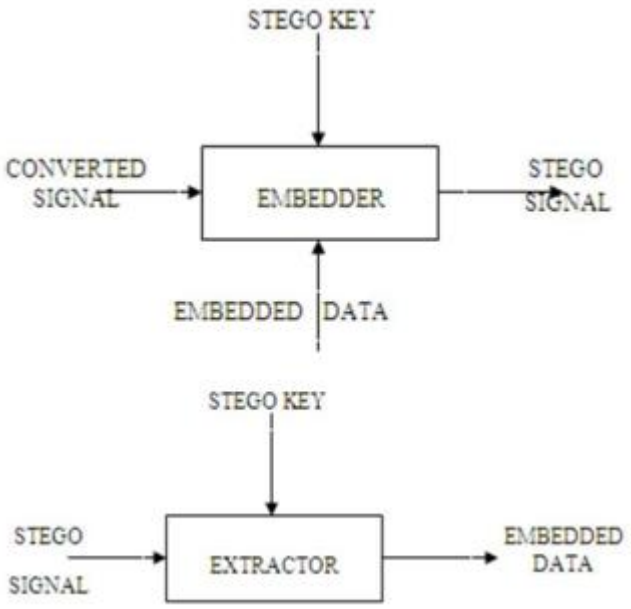

Fig 1: Basic block diagram of steganography.

Classification of Steganography Techniques

Over the past few years, numerous steganography techniques that embed hidden messages in multimedia objects have been proposed. There have been many techniques for hiding information or messages in images in such a manner that the alterations made to the image are perceptually indiscernible.

Common approaches are including:

- Least significant bit insertion (LSB).
- Masking and filtering.
- Transform techniques.

EXISTING SYSTEM

- The visible watermarking was implemented in early stages.
- Pixel addition based techniques such that the pixel values of the original image and the watermark are combined.

In existing papers, Watermarking was done in spatial domain. The spatial domain is the normal image space, in which a change in position in image directly projects to a change in position in space. Ex.-Least Significant bit (LSB) method.

Disadvantages of Existing System

- Due to the less robustness of existing watermarking algorithms, the watermarked image looks in different color, so the people can easily identify that some kind of watermark is added.
- Furthermore, image quality may be degraded by the watermark
- The rate–distortion performance is low, and there is a leakage of statistical information.

The problem in existing scheme is that data is highly sensitive to noise and is easily destroyed.

PROPOSED METHOD

Here in this work, we are going to detect the hidden watermark (i.e.,logo) from the watermarked image. This concept can be achieved using watermarking techniques. We have implemented a robust image watermarking technique for the logo detection based on Discrete Wavelet Transform (DWT). In this technique a multi-bit watermark (the logo) is embedded into the low frequency sub-band of an input image by using alpha blending technique. Then IDWT is applied to combine alpha blended image with the other sub-bands and high frequency coefficients to form the watermarked biometric image. Here we are going to implement invisible watermarking; hence the logo will be added with the input face image to form the watermarked image. Then at the decryption stage, by using Alpha Blending Extraction Technique we are successfully extracting the watermark content (i.e.

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logo) present in the watermarked image. We demonstrate that the watermark generated with the proposed algorithm is invisible and the quality of watermarked image and the recovered image are improved. The quality of the extracted image is analyzed by using statistical parameters such as Peak-Signal-to-Noise-Ratio (PSNR) and Mean Square Error (MSE).

Proposed Technique

- Discrete Wavelet Transformation (DWT) and Inverse DWT
- Alpha Blending Embedding Technique.
- Alpha blending Extraction Technique.

Proposed System Advantages

- Output image quality is high.
- It is not sensitive to noise.
- Performance measurements (PSNR) value is high.

PROPOSED SYSTEM BLOCK DIAGRAM

A. Watermark Embedding

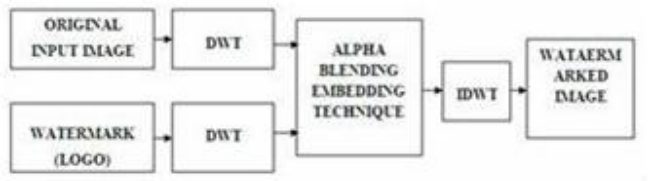

Fig 2a: Embedding of watermark of an image

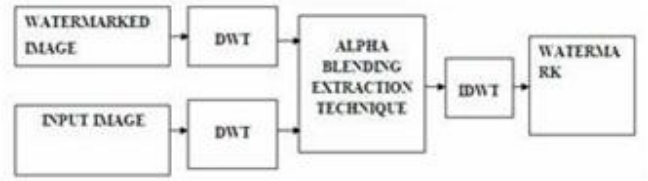

Fig 2b: Extraction of watermarked image

DESIGN

Data Flow Diagram (DFD)

DFD is an illustration carried in a graphical form. It is an illustration concerning the "run" of information all the way through in a sequence, representing its procedure part. Frequently they are a beginning move employed towards building a general idea regarding the method that will be detailed later on. A DFD demonstrates the variety of input data in sequence to with output as of the method, in which the information will approach as of plus exit towards, in addition to in what the information will be accumulated. 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.

Modules concerning Data Flow diagrams:

- Exterior presence
- Procedures
- Storage of information

Exterior presence

Exterior presences are those so as to be identified while wanting towards cooperating through the method in thought. The exterior presences moreover enter in sequence towards the method, production in sequence as of the method or else together. Normally they might correspond to work labels otherwise previous methods which cooperate through the method in the direction to construct. A few illustrations are specified beneath. But the similar exterior presence is exposed other than just the once on top of an illustration (intended for clearness) a slanting contour point out this.

Procedures

Procedures are performances which are approved through the information which runs about the method. A procedure agrees to the key information necessary intended for the procedure in the direction of passing away as well as generates the information which it gets ahead towards a different component regarding the Data Flow Diagram (DFD). The procedures which are identified on top of a mean DFD is being offered within the ultimate object. They might be offered, intended for by means of exceptional panels meant for key as well as productivity otherwise with the condition concerning particular keys or else list of things. Every identifiable procedure should contain a carefully selected procedure name which explains

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what the procedure would perform by means of the in sequence data it employs as well as the amount produced it would generate. Procedure names should live on form selected towards providing an accurate significance towards the accomplishment to be occupied. It is an excellent preparation in the direction of constantly commencing by means of a well-built verb as well as on the way to go after by means of not larger than four or else five expressions.

Storage of information

Information accumulation is spaces in which information perhaps accumulated. These in sequence perhaps accumulated also for the time being or else everlastingly via the user. Within whichever method we would most likely require towards building a few guesses concerning about appropriate information supplies on the way to take account of the amount of information supplies we position on top of a DFD to some extent relies on top of the case learning as well as how far we leave here getting definite concerning the in sequence stored up within them. It is essential in the direction of considering so as to if not you store up the in sequence approaching keen on our method it will be nowhere to be found.

Top-Level Design

Since 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 illustrates 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 illustrates the run regarding information among a variety of pieces concerning the method. Level Zero plan, shown in figure 2b 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.

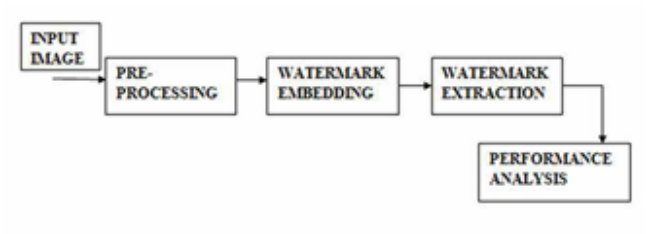

Fig 3: Top Level Design Block diagram

Level 1 DFD

The Level 1 demonstrates how exactly the structure is separated keen on sub-methods (procedures), each one concerning with which agrees through single otherwise other regarding the information as well as direct runs towards otherwise as of an exterior means, in addition to which collectively supply each and every one concerning the meaning about the structure like a complete.

Once measured up to the top level plan, the level 1 planning provides additional secondary partition concerning every division through a variety of meanings as well as interior processes. The level 1 plan illustration run provides a variety of direct as well as information run. At this time level 0 course illustration is sub-partitioned keen on three level 1 flow illustration by means of UML details that contains:-

- Level1 DFD for Pre-processing
- Level1 DFD for Watermark embedding
- Level1 DFD for Watermark extraction
- Level1 DFD for Performance analysis

Level 1 DFD for watermark embedding

In this process we propose an approach of hiding the watermark (logo) into the input image and watermarked image/encrypted image is formed.

1.First the host image (original input image) is taken as the input and DWT (Discrete Wavelet Transform) is

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applied to the image which decomposes image into low frequency and high frequency components.
2. Second the watermark image (logo image) is taken as the input and DWT (Discrete Wavelet Transform) is applied to the image which decomposes image into low frequency and high frequency components.
3. The output of the DWT is LL, HL, LH and HH band.
4. LL-Approximation Image, HL-Horizontal Image, LH-Vertical Image and HH-Diagonal Image.
5. The LL part of the watermark is embedded into the LL part of the input image using alpha blending embedding technique.
6. Then IDWT is applied to combine alpha blended image with the other sub-bands and high frequency coefficients to form the watermarked image.

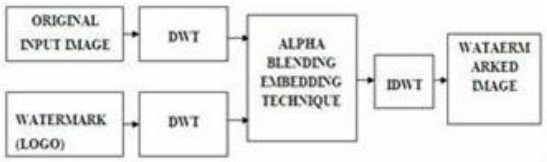

Fig 4: Level1 DFD for Watermark Embedding

Level 1 DFD for Watermark Extraction

In this process we propose an approach of decrypting/extracting the watermark (logo) from the watermarked image/encrypted image.
1. First the watermarked image (combined image) is taken as the input and DWT (Discrete Wavelet Transform) is applied to the image which decomposes image into low frequency and high frequency components.
2. Second the original image is taken as the input and DWT (Discrete Wavelet Transform) is applied to the image which decomposes image into low frequency and high frequency components.
3. The output of the DWT is LL, HL, LH and HH band.
4. LL-Approximation Image, HL-Horizontal Image, LH-Vertical Image and HH-Diagonal Image.
5. The LL part of the watermark is extracted from the LL part of the watermarked image using alpha blending extraction technique.
6. Then IDWT is applied to combine alpha blended image with the other sub-bands and high frequency coefficients to recover the watermark image (logo).

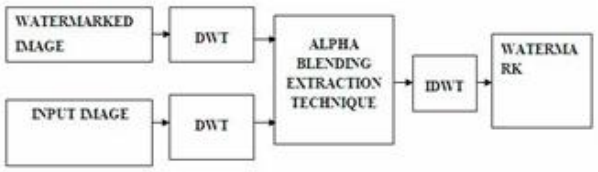

Fig 5: Level1 DFD for Watermark Extraction

Level 1 DFD for Performance Evaluation

1. Experiments were made by comparing original input images and logo images.
2. Finally obtained result (extracted logo) is compared with the actual watermark logo (before embedding).
3. The performance factor for the proposed algorithm is evaluated by PSNR, MSE and NCC values.
4. PSNR-Peak Signal to Noise Ratio.
5. MSE-Mean Squared Error.
6. NCC-Normalized Cross Correlation.

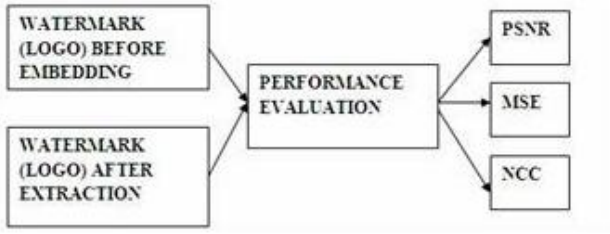

Fig 6: Level 1 DFD for Classification

Detailed design for watermark embedding

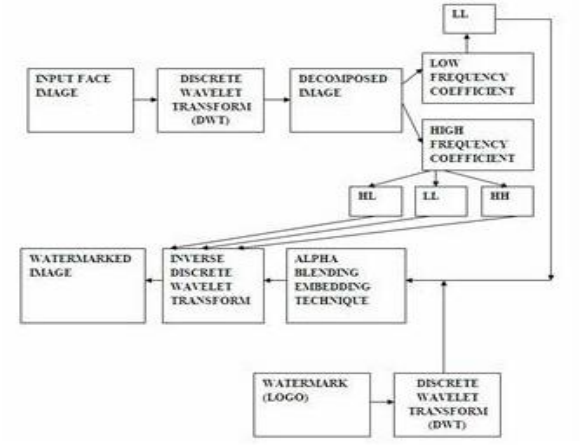

Fig 7: Detailed Block Diagram of Watermarking embedding Discrete Wavelet Transformation.

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The discrete wavelet transform (DWT) is the basic and simplest transform among numerous multi-scale transform and other type of wavelet based fusion schemes are usually similar to the DWT fusion scheme. 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 image 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.

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.

Alpha blending embedding technique

Alpha Blending can be accomplished in image processing by blending each pixel from the first source image with the corresponding pixel in the second source image. According to the formula of the alpha blending the watermarked image is given by

$$WMI=K*LL4 +Q * WM2$$

Where,

WMI = low frequency component of watermarked image

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

WM4 = low frequency component of Watermark image k, q = Scaling factors for the original image and watermark respectively.

Alpha blending extraction technique

According to the formula of the alpha blending the recovered image is given by

$$RW = (WMI - k * LL4)$$

Where

RW= Low frequency approximation of Recovered watermark,

LL4= Low frequency approximation of the original image

WMI= Low frequency approximation of watermarked image.

IMPLEMENTATION

The execution stage regarding the task is that the complete aim is essentially changed keen on running code. Intend regarding the stage is towards interpreting the aim keen on a finest likely result within an appropriate programming language. In this section, it covers up the execution phase concerning the task, providing particulars regarding the programming language as well as improvement background employed. It as well provides a general idea about the important sections regarding the task by means of its bit by bit course.

The execution phase involves the following tasks:-

- Cautious scheduling.
- Examination regarding structure as well as constraints.
- Aim concerning the techniques towards accomplishing the conversion.
- Assessment concerning the conversion technique.
- Accurate judgment about the choosing of the proposal.
- Suitable choosing regarding the language intended for function growth.

Module-wise implementation details

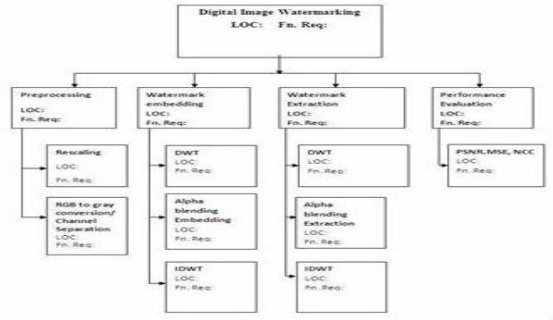

Fig 8: Module Wise Implementation

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RESULTS AND ANALYSIS

The product stage regarding the task is where the method is estimated with conditions concerning performance as well as if or no more the objectives place within the commencement concerning the task is attained. Objective concerning the stage is in the direction of acquiring appropriate statistics so as to be plotted as well as tested meant for validation of performance. This section completes the end results side concerning the project, providing particulars regarding a variety of difficulty phases concerning the project as well as depicting them by means of a graph.

Results for Pre-processing

The figures showed below gives the step by step operational output for our proposed system.

Fig 9: Original Input Image

The original image is resized to a standardized size since size of different images varies as shown in fig 10.

Fig 10: Resized Image

After Resizing image will be transformed as of RGB towards grayscale image evaluated by way of Channel separation as shown in fig 11.

Fig 11: Channel Separation (grayscale image)

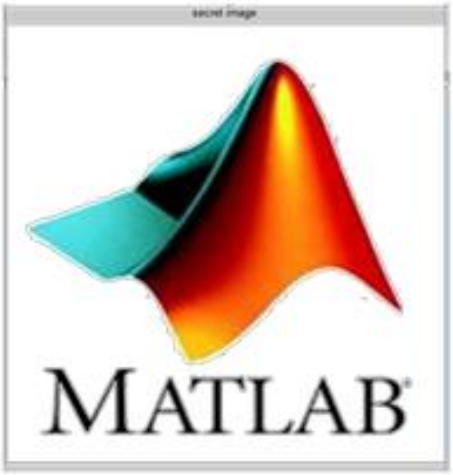

Fig 12: Resized Logo image (secret image)

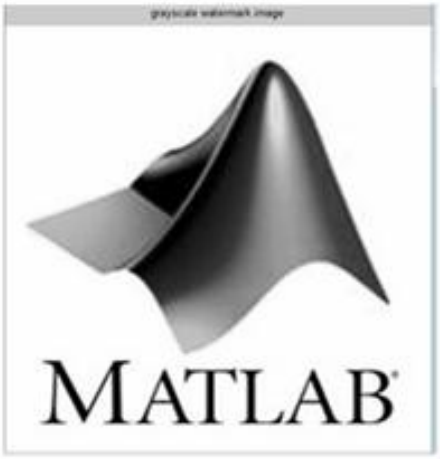

Fig 13: Grayscale logo image

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Results for watermark embedding

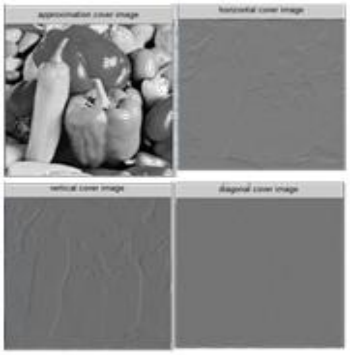

Fig 14: DWT output of Input image

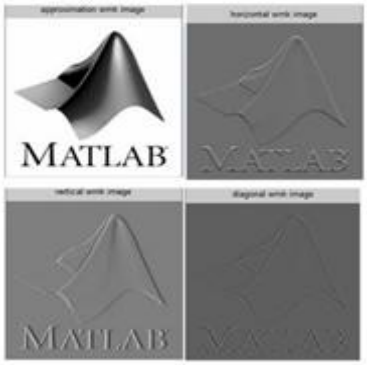

Fig 15: DWT output of watermark image (logo)

Fig 16: Watermarked image

Results for watermark extraction

Fig 17: Extracted logo image

Performance Evaluation

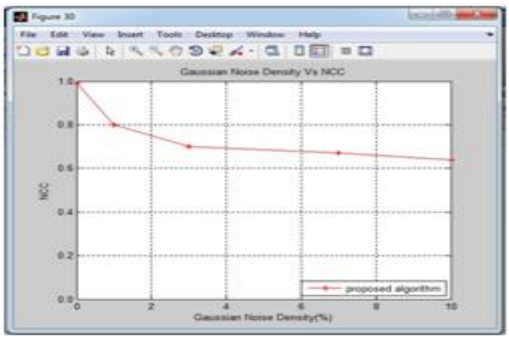

Fig 18: Performance analysis of Gaussian Noise Density verses NCC

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. Results were satisfactory compared to existing method.

CONCLUSION AND FUTURE WORK

This work proposed 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 watermarked image using DWT, Alpha blending Extraction and IDWT algorithm. We demonstrate that the watermarks generated with the proposed algorithm are invisible and can be visible sometimes and the quality of adulterated image and the recovered image are improved. The proposed method is compared with the existing watermarking methods by using statistical parameters such as peak-signal-to-noise-ratio (PSNR), Mean Square Error (MSE) and Normalized Cross Correlation (NCC).

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

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