VIDEO WATERMARKING USING DISCRETE WAVELET TRANSFORM AND SPIHT COMPRESSION

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ABSTRACT
Ubiquitous use of real-time video communication on the Internet requires adaptive applications that can provide different levels of quality depending on the amount of resources available. For video coding this means that the algorithms must be designed to be efficient in bandwidth usage, processing requirements and quality of the reconstructed signal. A comprehensive approach for watermarking digital video is introduced, and a hybrid digital video watermarking scheme based on Discrete Wavelet Transform (2D DDWT) and Principal Component Analysis (PCA). PCA helps in reducing correlation among the wavelet coefficients obtained from wavelet decomposition of each video frame thereby dispersing the watermark bits into the uncorrelated coefficients. The video frames are first decomposing using 2D DDWT and also the binary watermark is embedded in the principal components of the low frequency wavelet coefficients. In order to have efficient utilization of disk space and transmission rate, Videos/frames need to be compressed. Video compression is the technique of reducing the file size of a Video without compromising with the Video quality at acceptable level. Now–a-days, video compression is one of the demanding and vast researches because high Quality Video requires larger bandwidth, raw videos need larger memory space. But these methods have been replaced by digital wavelet transform based compression method as these methods have high speed, low memory requirements and complete reversibility. This work presents a novel technique for embedding a binary logo watermark into video frames. The proposed scheme is an imperceptible and a robust hybrid video watermarking scheme.pca is applied to each block of the two bands (LL– HH) which result from discrete wavelet transform of every video frame. The watermark is embedded into the principal components of the LL blocks and HH blocks in different ways. Combining the two transforms improved the performance of the watermark algorithm. This reduction in file size saves disk memory space and allows faster transmission of Videos over a medium. In this project we are considering modified (Set Partitioning in Hierarchical Trees algorithm) as a placement for wavelet compression methods. The modified SPIHT compression technique accompanies the Huffman coding algorithm. In this project, the Huffman coding is applied with the SPIHT algorithm to improve the compression ratio.

KEYWORDS:2D DDWT(2 dimensional double density wavelet transform),watermarking, Modified SPHIT ,

I.INTRODUCTION

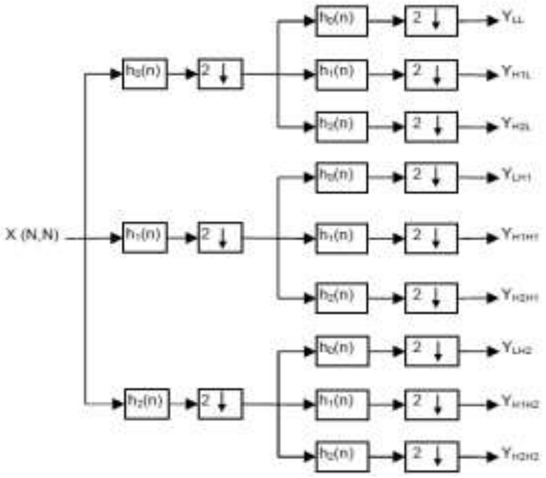
Information watermarking in digital environment has drawn far more attractions to itself in that it is able to cover different purposes or a wide range of purposes. These days' video media is the center of attentions with regard to the high volume of its products. Information watermarking is the embedment of a hidden message within another signal. This signal, named "cover signal" can be a text, digital image, audio or video file.
Watermarking follows different aims such as authentication, protecting the rights of the author, copy right and control of data spreading.

II . 2D DDWT

In case of two-dimensional image, after a 2D DDWT transform, the image is divided into four corners, upper left corner of the original image, lower left corner of the vertical details, upper right corner of the horizontal details, lower right corner of the component of the original image detail (high frequency). You can then continue to the low frequency components of the same upper left corner of the 2nd, 3rd inferior wavelet transform.

Wavelets are very similar to wavelets but have some important differences. With frame, we can achieve better time-frequency localization than is possible with bases. Some wavelet frames are shift invariant while wavelet cannot be. For example, an undecimated 2D DDWT can be implemented by removing the down-sampling operations in the usual 2D DDWT implementation. The undecimated 2D DDWT is a shift-invariant form of the 2D D2D DDWT. The CWT is implemented by performing two 2D D2D DDWTs in parallel on the same data. The CWT is nearly shift-invariant and is expansive by a factor of two independent of the number of stages implemented. The 2D D2D DDWT and the CWT both provide significant performance gains in some signal processing application. An expansive 2D D2D DDWT implemented using an oversampled filter bank gives wavelet coefficients corresponding to the representation of a signal in a wavelet frame.

For the discrete-time signals the 1-D Wavelet transform is implemented by recursively using the over sampled 3-channel analysis filter bank to the lowpass subband. Conversely, the inverse double-density 2D D2D DDWT is obtained by iteratively applying the synthesis filter bank. The filter bank proposed in Fig 1 illustrates the basic design of the double density 2D D2D DDWT.



To use the double-density discrete wavelet transform for 2D signal processing, we must implement a two dimensional analysis and synthesis filter bank structure. This can simply be done by alternatively applying the transform first to the rows then to the columns of an image. This gives rise to nine 2D subbands, one of which is the coarse (or low frequency) subband, and the other eight of which make up the eight detailed (or high frequency). subbands as shown in figure. It is possible to embed multiple watermarks on to these eight detailed subbands. The analysis filters and the synthesis filters bank are taken.

III. WATERMARKING

A watermark is the hidden information within a digital signal (such as image, video, audio, polygonal model...).It is integrated into the content of host signal itself, and requires no additional file header or conversion of data format as well. Moreover, it is designed to permanently reside in the host data .Finally, unlike encryption; it does not restrict access to the host data.

Also referred to as simply watermarking, a pattern of bits inserted into a digital image, audio or video file that identifies the file's copyright information (author, rights, etc.). The name comes from the faintly visible watermarks imprinted on stationery that identify the manufacturer of the stationery.

The purpose of digital watermarks is to provide copyright protection for intellectual property that's in digital format. Unlike printed watermarks, which are intended to be somewhat visible, digital watermarks are designed to be completely invisible, or in the case of audio clips, inaudible. Moreover, the actual bits representing the watermark must be scattered throughout the file in such a way that they cannot be identified and manipulated. And finally, the digital watermark must be robust enough so that it can withstand normal changes to the file, such as reductions from lossy compression algorithms.

Satisfying all these requirements is no easy feat, but there are a number of companies offering competing technologies. All of them work by making the watermark appear as noise - that is, random data that exists in most digital files anyway. To view a watermark, you need a special program that knows how to extract the watermark data. Watermarking is also called **data embedding and information hiding.**

Approaches of watermarking

Spatial Domain Approach

The earliest watermarking techniques are mainly this kind and the simplest example is to embed the watermark into least significant bits (LSBs) of the image pixels. However, this technique has relatively low information hiding capacity and can be easily erased by lossy image compression.

Frequency Domain Approach

Another way to produce high quality watermarked image is by first transforming the original image into the frequency domain by the use of Fourier, Discrete Cosine or Wavelet transforms for example. And it can embed more information bits and is relatively robust to attack. With this technique, the marks are not added to the intensities of the image but to the values of its transform coefficients. Then inverse-transforming the marked coefficient forms the watermarked image. The use of frequency based transforms allows the direct understanding of the content of the image; therefore, characteristics of the human visual system (HVS) can be taken into account more easily when it is time to decide the intensity and position of the watermarks to be applied to a given image.

Examples of Implementation

1. Cox et al. used the spread spectrum communication for digital multimedia watermark.

2. Hsu and Wu embedded an image watermark into selectively modified middle frequency of discrete cosine transform (DCT) coefficients of container image.

Watermark Embedding

Wavelet-based image watermark embedding consists of three phases: (a) watermark preprocessing, (b) image preprocessing, and (c) watermark embedding, as shown in Figure. First, vector SC of the details wavelet coefficients are obtained for the original image by carrying out 2D D2D DDWT. Secondly, A set of the details wavelet coefficients are selected if their magnitudes are larger than their corresponding JND thresholds and the table-lookup of selected wavelet coefficients was built. The watermark-embedding algorithm then uses the selected large 2D D2D DDWT detail coefficients and data of the watermark to generate the watermarked image.

APPLICATIONS

- Copyright protection
  - Most prominent application
  - Embed information about the owner to prevent others from claiming copyright
  - Require very high level of robustness
- Copy protection
  - Embed watermark to disallow unauthorized copying of the cover
  - For example, a compliant DVD player will not playback or data that carry a "copy never" watermark
- Content Authentication
  - Embed a watermark to detect modifications to the cover
  - The watermark in this case has low robustness, "fragile"

Image Encryption

Recently, the transmission of data through network is increasing rapidly, which provides instant access or distribution of digital data. Visual cryptography is the technique using in the latest technology to transmit the secret information in images i.e., called secret image. Secret image sharing is the important subject in the field of communication technology, information security and production. However security can be introduced in many ways like transmitting password, image hiding, watermarking technique, authentication and identification. But the drawback of these methods is that the secret images can be protected in single information carrier. If it lost once, the information carrier is either damaged or destroyed. To overcome this problem, VCS secret sharing scheme was introduced by Naor and shamir, the secret image is split up into number of shares and transmit to the number of participants. A visual secret sharing scheme is a technique used to encrypt the secret image by splitting the shares into several piece and distribute it into the corresponding participants. A set of qualified participants can be able to retrieve the secret image by overlapping the shares in correct order. A traditional VCS takes the secret image as input and number of shares as output, it satisfies two conditions 1) secret images can be recover by any qualified subset of shares; 2) any forbidden subset of shares cannot gain any information about the secret image

Visual cryptography is one of the techniques used to encrypt the images by dividing the original image into transparencies. The transparencies can be sent to the intended person, and at the other end the transparencies received person can decrypt the transparencies using our tool, thus gets the original image. Our proposed Visual cryptography provides the demonstration to the users to show how encryption and decryption can be done to the images. In this technology, the end user identifies an image, which is not the correct image. That is, while transmitting the image the sender will encrypt the image using our application here sender gets the two or more transparencies of the same image. Our application provides an option to the end user of encryption. The end user can divide the original image into number of different images. Using our application we can send encrypted images that are in the format of GIF and PNG. The encrypted transparencies can be saved in the machine and can be sent to the intended person by other means [source].

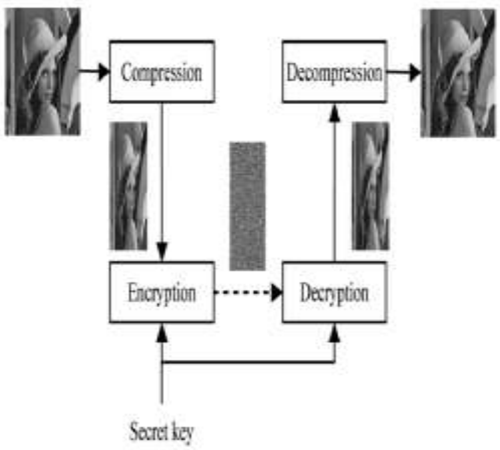
Image

An image is essentially a 2-D signal processed by the human visual system. The signals representing images are usually in analog form. However, for image processing, storage and transmission, they are converted from analog to digital form. A digital image is basically a 2-D array of pixels.

Pixel

In digital image, a pixel is a single point in a raster image. It is the smallest unit of picture that can be controlled, and is the smallest addressable screen element .Each pixel has its own address. The address of a pixel corresponds to its coordinates. They are usually arranged in a 2-D grid, and are often represented with dots or squares.

IV.EXISTING SYSTEM



The first is an operation of encryption, which aims to modify the compressed information to make them unreadable to whoever does not have the necessary authorization to see them the second is an operation of compression which consists in reducing the size of information to be transmitted, by removing redundant information of them. However, these two operations are often carried out separately, although they are strongly bound and one influences on the other. In the existing system, to carry out these two operations (compression and encryption) together with a new system able to amalgamate spectral information.. This system is based on one hand on the rarity of similitude in two different images and on the second hand on the Discrete Cosine Transformation "DCT", a transformation used for a long time in JPEG compression.

V.PROPOSED SYSTEM

MODIFIED SPIHT

MODIFIED SPIHT is a widely used compression algorithm for wavelet transformed images. Though MODIFIED SPIHT is much simpler and efficient than many existing compression techniques as it’s a fully embedded codec , provides good image quality, high PSNR, optimized for progressive image transmission, efficient combination with error protection, sort information on demand and hence requirement of powerful error correction decreases from beginning to end but still it has some drawbacks which need to be removed for its better use so since its evolution it has undergone many changes in its original version.

This project presents MODIFIED SPIHT implementation because these are the lossy techniques and also introduce Huffman encoding technique which is lossless.

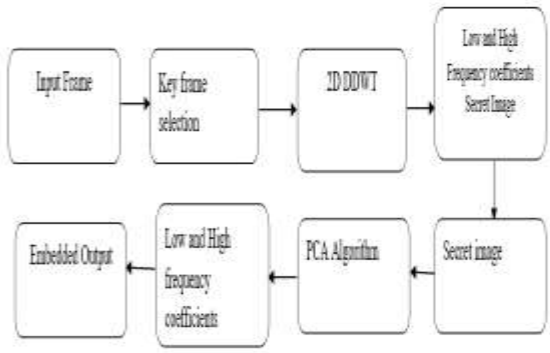
MODIFIED SPIHT codes the individual bits of the image wavelet transform coefficients following a bit-plane sequence. Thus, it is capable of recovering the image perfectly (every single bit of it) by coding all bits of the transform. However, the wavelet transform yields perfect reconstruction only if its numbers are stored as infinite-precision numbers. In practice it is frequently possible to recover the image perfectly using rounding after recovery, but this is not the most efficient approach.for lossless compression we proposed an integer multiresolution transformation, similar to the wavelet transform, which we called S+P transform. It solves the finite-precision problem by carefully truncating the transform coefficients *during* the transformation (instead of after).

ADVANTAGES OF PROPOSED SYSTEM

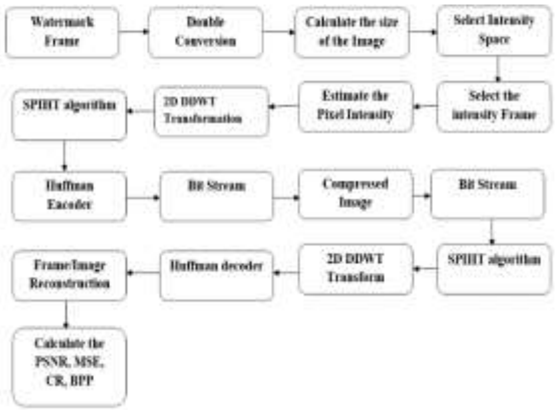
- MODIFIED SPIHT algorithm is the lossless compression algorithms reduce file size with no loss in image quality. When the file is saved it is compressed, when it is decompressed (opened) the original data is retrieved. The file data is only temporarily 'thrown away', so that the file can be transferred.
- This type of compression can be applied not just to graphics but to any kind of computer data such as spreadsheets, text documents and software applications. If you need to send files as an email attachment, then you may be best to compress it first. A common format which is used to do this is the compressed format. If you've downloaded a software program from the Internet it may have been in this or another compressed format. When you open the file up all the original data is retrieved. Think of it like this: if you compress a word document with a lossless algorithm it looks for repeated letters and temporarily discards them. When the document is decompressed, the letters are retrieved. If they weren't then the document wouldn't make sense.

VI.BLOCK DIAGRAM

VIDEO WATERMARKING



COMPRESSION



Input Image

2D imaging is a process to render a three-dimensional image on a two-dimensional surface by creating the optic illusion of depth. Generally, 2D imaging uses two still or motion camera lenses a slight distance apart to photograph a three-dimensional object. The process effectively duplicates the stereoscopic vision of human eyes. The image is reproduced as two flat images that viewers' eyes see separately, creating a visual illusion of depth as their brains combine the images into a single one.

- **Double Conversion**
  The given input image is the uint8 data type. The MATLAB will accept the double precision matrix for algorithm development. So we convert uint8 to double.
- **Calculate the size of the Image**
  Calculate the number of row and column and dimension of the give double precision image.
- **Select Intensity Space**

  Each of the pixels that represent an image store inside a computer has a *pixel value* which describes how bright that pixel is, and/or what color it should be. In the simplest case of binary images, the pixel value is a 1-bit number indicating either foreground or background. For a grayscale images, the pixel value is a single number that represents the brightness of the pixel.

- **Select the intensity Image**

  To represent color images, separate red, green and blue components must be specified for each pixel (assuming an RGB colorspace), and so the pixel `value' is actually a vector of three numbers. Often the three different components are stored as three separate `grayscale' images known as *color planes* (one for each of red, green and blue), which have to be recombined when displaying or processing.

- **Estimate the Pixel Intensity**
  Calculate the total number of pixels present in the image.
- **Wavelet Coefficients**

  Wavelet coefficients are used to convert the spatial domain image into the frequency domain image to estimate the image low and high frequency coefficients.

- **2D D2D DDWT Decomposition**
  The 2D discrete wavelet transform (2d DDWT) is an implementation of the wavelet transform using a discrete set of the wavelet scales and translations obeying some defined rules. In other words, this transform decomposes the signal into mutually orthogonal set of wavelets, which is the main difference from the continuous wavelet transform (CWT), or its implementation for the discrete time series sometimes called discrete-time continuous wavelet transform (DT-CWT).
- **SPIHT Encoder**
  Set partitioning in hierarchical trees (**SPIHT**) is an image compression **algorithm** that exploits the inherent similarities across the subbands in a wavelet decomposition of an image. SPIHT encoder is used to encode the 2D image in wavelet domain.

- **Bit Stream**
  Conversion of gray scale image into binary stream.

- **Compressed Image**

- **Image compression** is an application of data **compression** that SPIHT encodes the original **image** with few bits. The objective of proposed **image compression** is to reduce the redundancy of the **image** and to store image in an efficient form.

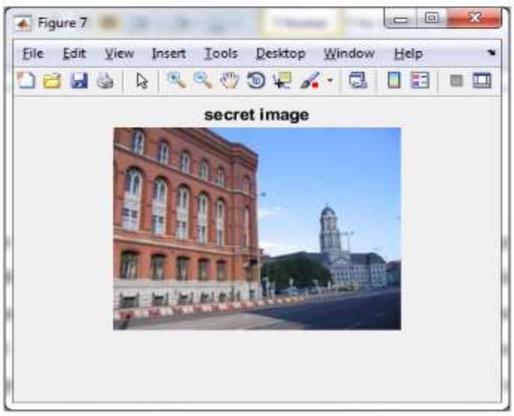
- **SPIHT Decoder**

- **SPIHT decoding** is the process to reconstruct the image.
- **Inverse 2D D2D DDWT**
- Convert the frequency domain image into the spatial domain image.
- **Image Reconstruction**
- Convert the image from double precision format to uint8 data type.
- **PSNR and MSE**
- PSNR and MSE are the measure of quality of the image between input and compressed version.

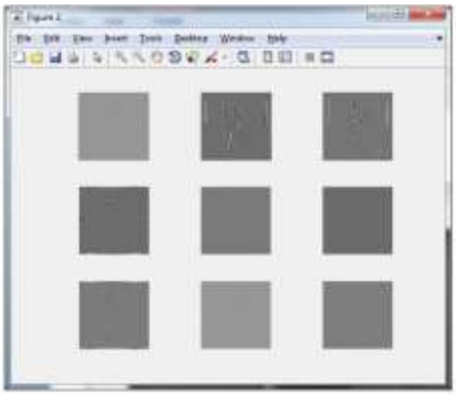
VII.RESULT

INPUT FRAME

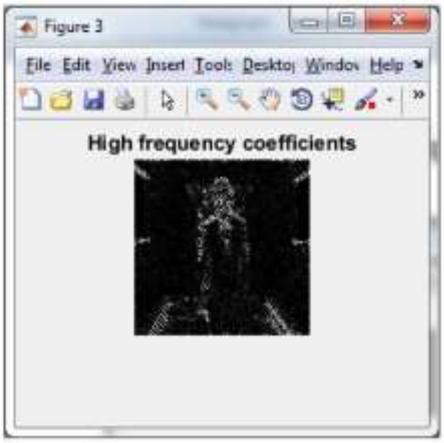
SECRET IMAGE



2D DDWT TRANSFORMATION



HIGH FREQUENCY COEFFICIENT



OUTPUT

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VIII.CONCLUSION AND FUTURE WORK

2D modified SPIHT algorithm can be used for any image size. When the size of the color image increases, the time required for compression and reconstruction of the image also increases. The algorithm was tested using two color image dataset. The results show that we obtained improvement using 2D SPIHT Huffman algorithm in terms of compression ratio, mean squared error, and Peak signal to noise ratio, correlation coefficient and multi-scale structural similarity index. In future we can propose enhancements to the 2D lossless image compression method embodied. The enhanced version of Vedic obtained better compression. This benchmark suite includes medical, natural, and man-made images. We can propose a lossless compression method for 2d images. Our method employs motion estimation and obtained better compression than competing wavelet-based lossless compression methods on all images in our benchmark suite.

Future work

Digital watermarking involves embedding copyright marks (watermarks), often imperceptibly, in multimedia objects to enhance or protect their value. In this paper we describe a novel watermarking algorithm suitable for video coding techniques such as MPEG-4 and H.263/H.324 and we test it in a wireless environment. The proposed algorithm satisfies critical properties not all of which are available in previous solutions. These properties include: resistance (robustness) of the embedded watermark to the error-prone nature of wireless channels as well as to video frame loss or misplacement, negligible probability of reading a non-embedded watermark, non-degradation of the marked video sequence and the possibility to mark video objects (e.g., MPEG-4 objects) in a single frame separately.

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