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A Robust Reversible Technique for Watermarking Non Numerical Data in Distributed Environment

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ABSTRACT

In some applications such as the law enforcement, medical and military image system, it is difficult to restore the original image without any distortions.Water marking is the process of hiding digital information in a carrier signal.It provides ownership protection over the digital content by marking the data with watermark unique to owner.Reversible watermarking is used to recover the watermark and original data.The Reversible watermarking techniques satisfies the above requirements. Reversible watermarking is designed so that it can be removed to completely restore the original image. Our proposed scheme is to watermark shared databases in distributed environments where different members share their data in various proportions and to extend RRW for non-numeric data stores from which original image is obtained thoroughly.

***Index Terms*—Reversible Watermarking, Compression, Difference-Expansion, Histogram Bin Shifting, Data Distributed.**

I. INTRODUCTION:

Watermarking techniques have historically been used to ensure security in terms of ownership protection and tamper proofing for a wide variety of data formats. This includes images, audio, video, natural language processing software, relational databases and more. Reversible watermarking techniques can ensure data recovery along with ownership protection. Fingerprinting, data hashing, serial codes are some other techniques used for ownership protection. Fingerprints also called transactional watermarks, are used to monitor and identify digital ownership by watermarking all the copies of contents with different watermarks for different recipients.Embedding images into other images has applications in data hiding and digital watermarking. During the last few years, much progress has been made in developing watermarking techniques that are robust to signal processing operations, such as compression. Image encryption schemes have been increasingly studied to meet the demand for real-time secure image transmission over the Internet and through wireless networks. Traditional image encryption algorithm such as data encryption standard has the weakness of low-level efficiency when the image is large. The advantage of steganography, over cryptography alone, is that messages do not attract attention to themselves. Plainly visible encrypted messages are not unbreakable. These requirements of a good steganography algorithm will be discussed below. In watermarking all of the instances of an object are "marked" in the same way. The kind of information hidden in objects when using watermarking is usually a signature to signify origin or ownership for the purpose of copyright protection.

The technique makes use of curve let transform which represents the latest research result on multi-resolution analysis. By combining the advantages of the two methods, image edge information is captured more accurately than conventional spectral methods such as wavelet and Gabor filters. Curve let was originally proposed for image demolishing and has shown

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promising performance. As it captures edge and linear information accurately, it has also shown promising results in character recognition recently. Ni and Length attempted an initial application of curvelet on color image retrieval, but it was not implemented properly and no meaningful result was reported. In their work, no benchmark image database is used, no retrieval accuracy was reported and there was no comparison with other techniques.

Image hiding using natural images is a very interesting research topic since a lot of information hiding has various kinds of shortcomings. The robust schemes are very welcome in secret transmission implicitly. Using the public software of image editing or displaying such as Microsoft Windows Paint, Internet Explorer Browser etc. to robustly recover the secret is extremely fun in entertainment.

Currently, one of efficient ways to hide image into natural images is typically employing visual cryptography based on halftone. Visual cryptography is a robust and powerful scheme to share visual secret. The perfect scheme is extremely practical and can reveal secret without participation of computers. The state- of-the-art visual cryptography can share color images using halftone. Dynamic image sequence or animation can be restored from it.

In this paper, we introduce the transparent mechanism in Microsoft Windows at beginning, especially that of the select function of IE adopted. Based on this, we introduce a very interesting image hiding instance using IE software by simultaneously pressing keys <Ctrl> and <A> on keyboard for the select operation. The software will show viewers a very amazing image which has been . If the select state is cancelled, the original image will be restored. In another words, the original image and hidden image can be toggled using select function of IE.

The original image and the hidden image have the same resolution, but the content is completely different. This interesting application can achieve an amazing effect in entertainment. Although it is not secure, but the improved version based on this will absolutely be attractive for users.

Since changes in histogram result for the given image, it could be suspected. Image edge information is not captured more accurately highly not secured. Embedding images into other images has applications in data hiding and digital watermarking.

This paper presents about image hiding techniques are watermarking, Steganography and Curvelet transform. Since histogram result for the given image is similar, it could not be suspected.

II. LITERATURE SURVEY:

A. CONSTRUCTION OF HVS MODEL:

Most HVS models in image processing use three basic properties of human vision: frequency sensitivity, luminance sensitivity and masking effects. Frequency sensitivity determines the human's eye sensitivity to various spatial frequencies.

Luminance sensitivity measures the effect of the detectable threshold of noise on a constant background. It is the correction of frequency sensitivity according to the change of background luminance. Masking refers to the effect of decreasing visibility of one signal in the presence of another signal called masker. We can distinguish Self-masking and neighborhood masking. Self-masking is when masking and masked signal have the same spatial frequencies, orientation and location in an image. Neighborhood masking refers to the masking where these signals have close spatial frequencies, orientation or location in an image.

B. DISCRETE WAVELET TRANSFORM

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(DWT)

Gabor in 1945 introduced the basic idea of wavelet theory. Considerable part has been made further improve on Discrete Wavelet transformation (DWT). The greatest contribution in DWT development has come from signal and image processing. DWT has the ability to express the local characteristics of the signal both spatial and temporal domains.

These wavelets enable us to decompose an image in both spatial and temporal domains. It not only can better match the human visual system characteristics, and also JPEG2000 standard, the embedded watermark in DWT domain is of great significance. As we all know, using wavelet transform, an image can be decomposed into the low frequency component and three high-frequency components along different directions (horizontal, vertical and diagonal direction).

The low-frequency component contains the average information and most of the energy of the image, while the high-frequency components contain the details of the images. The fundamental idea behind wavelet is to analyze according to scale and time. It is well known that Fourier Transform can transform a signal from spatial domain to a frequency domain. One big disadvantage of Fourier Transform is that one can only represent a signal with frequency resolution without any time resolution or spatial information.

In wavelet analysis, temporal analysis is performed with a contracted, high-frequency basis function, and frequency analysis is performed with a dilated, low-frequency basis function.

Haar wavelet (Daubechies-1) is one of Daubechies wavelets members that is very popular because of its simple interpolation schema. Haar wavelet uses two typesfolders. One is a low-pass filter and the other is a high-pass filter.

The output of the low-pass filter is obtained by averaging the input, while the output of high-pass filter is obtained from the deference of the inputs. One can easily conclude that the low-pass filter contains more information than high-pass filter because most of the signal energy is concentrated in low-pass filter. Daubechies-4 wavelet, on the other hand, splits the input signal by using four kinds of filters (LL, LH, HL, HH) with most of the energy concentrating in LL sub-band (L stands for low, while H stands for high).It has slightly computational overhead and is more complex than Haar wavelet, but it is capable of including more details than Haar wavelet algorithm.

The wavelet transform is a mathematical tool for Decomposing. We briefly review the DWT model (Fig.1), which shows a schematic diagram of wavelet transform. The image is first decomposed into four sub-bands denoting LL1, LH1, HL1 and HH1. LH1,HL1 and HH1 contain the finest scale detailed wavelet coefficients, that is to say ,the higher frequency detailed information.LL1,the coarse overall shape, is the low frequency component containing most of the energy in the image.

The wavelet transform is then applied to obtain the next coarser scale by further decomposing LL1 into LL2, LH2, HL2 and HH2, if the process is repeated t times, we can obtain the sub-band LLt through t-scale level wavelet transform. In the human visual system, people are more sensitive to low frequency components than high frequency components.

The LL sub-band is realistic sub-band, contains important information not suitable for the embedded watermark, or gives rise to distortion of the image and perception by the human eye.

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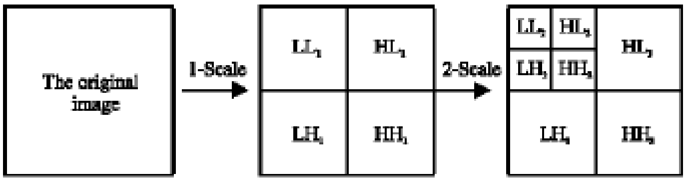

Fig.1. 2-scale level Wavelet transformation

C. HVS MODEL IN DWT DOMAIN

Mostly in HVS-based DWT domain digital watermarking algorithm, the watermark is embedded in the wavelet sub-band frequency, here, in the watermarking algorithm proposed in this paper, the watermark is embedded in high-frequency part of the wavelet coefficients, so not only increases the intensity of the embedded watermark, At the same time maintain the invisibility of the embedded watermark 14-15. Visibility thresholds of frequency sensitivity $l,\Omega T$, in various sub-bands for 9/7 biorthogonal wavelets were determined via psychological experiments and can be expressed by the following equation 1.

$$T_{L,\Omega} = \frac{T_{\min}}{A_{L,\Omega}} 10^{S\left(\log\frac{r}{2^L f_0 g_\Omega}\right)^2}$$ →(1)

Where $L,\Omega A$, are the basis function amplitudes, min T is the minimum threshold occurs at spatial frequency Ω Ωg f , l f is the spatial frequency of decomposition level L and Ω g shifts the minimum thresholds by an amount that is a function of orientation. Similarly as in the case of DCT domain, thresholds of frequency sensitivity are weighted by HVS model based on ROI according to the equation 2.

$$T^f(L,\Omega,m,n) = T_{L,\Omega}\cdot\left(1+\frac{\beta T_{ROI}^{L,\Omega}(m,n)}{100.\max\left(T_{ROI}^{L,\Omega}\right)}\right)$$ →(2)

Where T L, (m, n) ROI Ω are ROI T thresholds in sub-band L,Ω. An example of HVS model based on weighted frequency sensitivity thresholds is shown in Fig. 2.

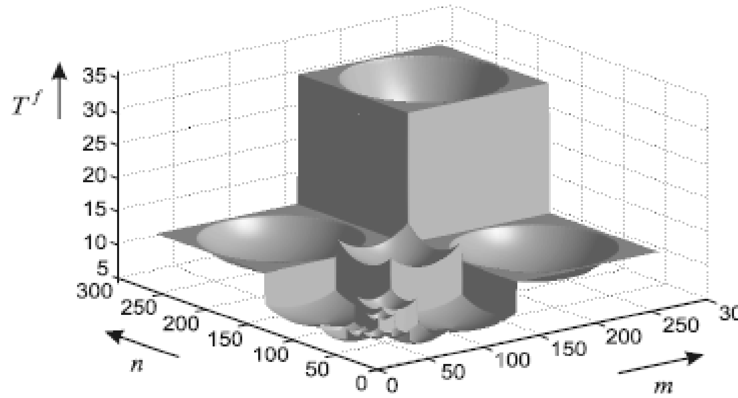

Fig . 2 weighted frequency sensitivity thresholds of
HVS model in DWT domain.

In this paper, the linear-phase 9/7 bi-orthogonal filters are used for DWT, and the watermark is embedded into LL1, LH1, HL1, and HH1 frequency band for robustness. We 494 C.-R.Piaoet al. also use HVS to decide the watermarking strength of DWT coefficients. The HVS presented by Watson et al. for bi-orthogonal wavelet basis 9/7, gained the value of quantization matrix. From the quantization matrix, the maximal values of quantization error in LL1, LH1, HL1, and HH1 band is about 7. So the random sequence value should be resisted in the range of |wi|<7 in this paper.

III.PROPOSED STRUCTURE:

In last few years, lots of progress has been made in developing watermarking techniques that are

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robust to signal processing. Image encryption schemes have been increasingly studied to meet the demand for real-time secure image transmission over the Internet and through wireless networks. Traditional image encryption algorithm such as data encryption standard has the weakness of low-level efficiency when the image is large. And also change happens in the histogram result.

Since changes in histogram result for the given image, it could be suspected. Image edge information is not captured more accurately.

Our upcoming scheme is to watermark shared database in distributed environment. The proposed one presents about image hiding techniques are watermarking, steganography and curve let transform. The techniques are used to hide the image

Firstly, apply the curve let transform to original image to change the resolution of the given image. Secondly, apply the histogram technique is for a graphical representation of original image.

Transform to the original image and the open image, gaining their curve let coefficients. Thirdly, interpolate their curve let coefficients; finally, reconstruct the image by using Inverse curve let Transform, to get the resultant image

IV. ALGORITHM STEPS

A. Curvelet Transform

- Step1. Input original image, open image (a) and the times of iteration times;
- Step2. Apply Arnold transform to original image (ORI), and gain the image (0RIA)
- Step3. Apply curvelet Transform to the image (ORIA) and the open image (0PI), gaining their curvelet coefficients,
- Step4. Interpolating curvelet coefficient gained through step3 by using fusion parameter (a); go to step2 until times;
- Step5. Reconstruct the image by using Inverse curve let Transform, and thus get the result image (RI).

B. Discrete Curvelet Transform

- Step 1. Input end image , open image (a), (t) and the times of iteration ;
- Step2. Apply Discrete Curvelet Transform to the end image (EI) and the open image (0PI) , gaining the Curvelet coefficient of the original image and the Curvelet coefficient of the open image (OPI);
- Step3. Interpolating curvelet coefficient gained throng step3 by using fusion parameter (a); go to step2 until times;
- Step4. Reconstruct the image by using Inverse Curvelet Transform, and thus get the Resuming image (RIA).
- Step5. Apply inverse Arnold transform to the image (RIA), and gain Resuming image (RI).

C. Architecture Diagram

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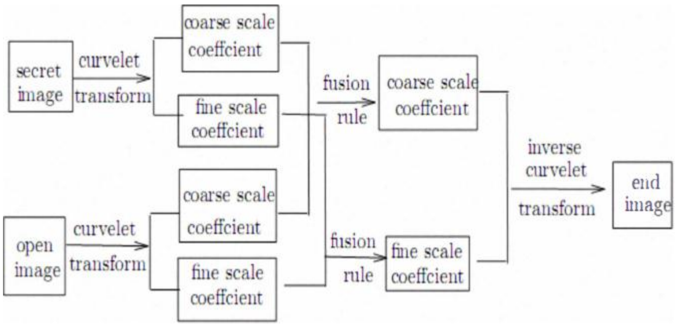


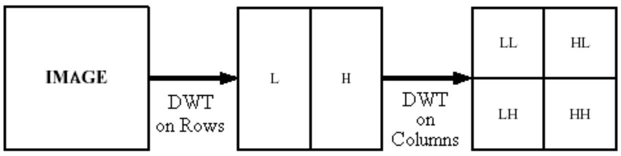
V. BACKGROUND & RELATED WORKS

A. Discrete Wavelet Transform

The Fourier transform, which provides a representation of the transformed signal in the frequency domain, is widely used in signal processing. However, the loss of time information in a signal by Fourier transform willleads to the difficulty in processing. The wavelet transform is an excellent time-frequency analysis method, which can be well adapted for extracting the information content of the image. A brief introduction to wavelet is as follows.

B. Multiple-Level Decomposition

Applying a 1-D wavelet transform to all the rows of the Image and then repeating on all of the columns can compute the 2-D wavelet transform. When one-level 2-D DWT is applied to an Image, four transform coefficient sets are created. The four sets are LL, HL, LH, and HH, where the first letter corresponds to applying either a low pass frequency operation or high pass frequency operation to the rows, and the second letter refers to the filter applied to the columns. Which is shown below Fig.



DWT Decomposition of image

Wavelet analysis of an original image can be divided into an approximate image LL and three detail images LH, HL and HH. , the approximate image hold most of the information of the original image, while the others contain some details such as the edge and textures will be represented by large coefficients in the high frequency sub-bands. The reconstruction of the image is achieved by the inverse discrete wavelet transform (IDWT).

C. Spread spectrum Watermarking

To overcome the limitations in watermarking due to methods like LSB (least significant bit) substitution and to make the system more robust against someattacks, the watermark can be spread across the cover object by using more number of bits than the minimum required. This scheme of hiding the data signifies the survival of watermark under various attacks due to redundancy.

Commonly the message used to watermark is a narrow band signal compared to the wide band of the original image. Spread spectrum technique also offer the possibility of protecting the watermark privacy using a secrete key to control a pseudo noise generator.

Pseudo noise sequences are used for watermarking because of their very good correlation properties, noise like characteristics, easier to generate and resistance to interference**.**

Pseudorandom sequences are used as the spreading sequences. Pseudo noise is generated by using mat-lab function rand with initial seed and round therandom numbers to its nearest integer and thus generating 0 and 1.

If the quality factor greater, the better quality of the watermark recovery, the better the quality of the image. Table 1 lists the similarity (NC) between the watermark taken out and the original watermark and PSNR of watermarked image under different compression ratio. The results prove that the algorithm has good anti-JPEG.

Table1: the experiment result of JPEG compression

Quality factor	Compressi ratio	PNRS	similari (NC)	Retrieved watermark
10	1.4	34.72	0.9995	Fig.7(a)
9	3.6	32.65	0.9340	Fig.7(b)
8	5.4	30.89	0.8253	Fig.7(c)

Table 2 shows the experiment result of the image noising.

Table 2 : The experiment result after adding different noise.

Noise type	Noise density	PNR	similarit (NC)	Retrieve waterma
Gaussian noise	1%	30.81	0.9910	Fig.8(a)
	5%	29.32	0.9184	Fig.8(b)
	10%	27.54	0.7823	Fig.8(c)
Salt & Pepper noise	1%	30.76	0.9765	Fig.9(a)
	5%	28.13	0.9028	Fig.9(b)
	10%	26.83	0.8264	Fig.9(c)

VI. CONCLUSION:

In this paper, a robust and reversible technique for watermarking non-relational data is presented.The main contribution of this watermarking work is that it allows recovery of a large portion of the data even after being subjected to malicious attacks.An image hiding scheme by using Curve let Transform is proposed. From the experimental results, it is concluded that it outperforms existing schemes, both in terms of speed and security. Having a high through put, the proposed system is ready to be applied I fast real time hiding applications.

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