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Information Capacity and BER Improvement Using Haar Transform in DWT-CDMA Water Marking Based on Pseudorandom Sub Space Projection

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Abstract

In this paper we remove the host image correlation with the a orthogonal sequence during extracting phase is proposed in high capacity CDMA watermarking which improves the BER, message capacity, and robustness of watermarking scheme .this elimination is implemented in steps using projections and different noises are added and filtered. Finally BER is improved compared to existing scheme

Keywords: DWT technique, BER , robustness, orthogonal projections

Introduction

The technique used for protection and security of data is watermarking which can be used for data security, monitoring of data, and safety of .medical. it is used to protect from unauthorised usage .this method contains a binary data which is embedded into a host signal with the help of secret key .Then process imposes small signal changes, determined by the key and the watermark, to obtain the required signal.

Digital watermarking involves embedding a structure in a host signal to "mark" its ownership. Spatial Domain, Frequency Domain and Wavelet Domain are different watermarking method. The simplest approach is spatial approach in which modification of the least significant bits (*LSBs*) of image pixels takes place .hence method protect it from losing of data.

The secure way for watermarking Is the Code Division Multiple Access (CDMA) which divides out the watermark information to the some sequences i.e.., m and by using orthogonal codes embedd the given data into the frequency domain. The previous CDMA watermarking techniques have a setback because of increase of BER. The main cause for increase of BER is due to interference of original image content. In this paper we propose a improvement of BER takes place using orthogonal sub space projection and hence original image contents cannot be interfered. we proposed wavelet domain CDMA watermarking schemes, in order to improve the BER, which divides the given image into different sub bands such as LL ,HH, etc and one of them is chosen for embedding process .hence the BER improvement and robustness can be seen in the result.

The main aim of this paper is that we proposed an orthogonal projection method in order to extract out involvement of original image data and improve the watermarkparameter(λ) Then an inverse wavelet transform is performed to obtain the watermarked image.

In digital watermarking for images, the watermark can be embedded on pixel domain or on frequency domain, which is usually realize by using 2D transforms. The discrete wavelet transform (DWT) provides an intrinsic framework for multi resolution analysis of signals. Due to this reason and its ability to compact energy into a small number of coefficients, past years have seen the emergence of the wavelet transform domain watermarking algorithms.

They have shown great improvements in data capacity and high imperceptibility compared to the previous watermark embedding techniques .

Due to the fact that the DWT is widely used in image compression, wavelet based watermarkingenablesjointwatermarkincompressionby addressingframe work. **gaussian Noise Attack:**in this process generate binary watermarks of capacity then embedd them into the 7 test images and then add

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Gaussian noise and filtered out from watermarked image.the noise rate is given below.

$$RI = \frac{\sigma}{R}, \qquad (15)$$

Where σ is the deviation parameter of the noise,R is the pixel range , i.e.,

$$R = \max_{x,y} I(x,y) - \min_{x,y} I(x,y). \qquad (16)$$

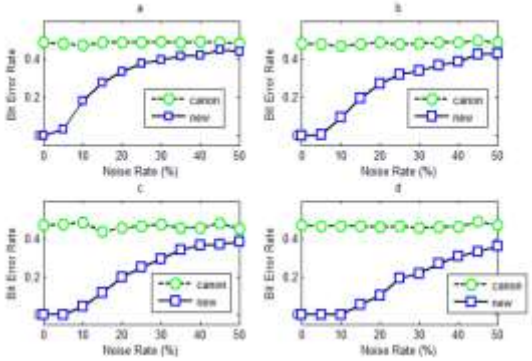

Fig. 1 BER-NOISE RATE PLOT

JPEG compression Attacks

In this method watermark image is compressed with different quality factor.

Improvement of Bit Error Rate (BER) The bit error rate (BER) can be found by

$$BER = \frac{1}{mn}\sum_{i=1}^{m}\sum_{j=1}^{n}\left|W(i,j) - EXW(i,j)\right|, \qquad (14)$$

the main reason for the test is measurement of watermark parameter so that the peak signal to noise ratio (PSNR) can be improved.then BER can be reduced to zero to some extent.

EXISTING CDMA based Watermarking Scheme

while compairing with other methods the discrete wavelet transform (DWT) is more accurate method for CDMA based watermarking schemes,

by using bi orthogonal wavelets the image is divided in to sub band images which contains coefficients . from this one is selected represented as $b = (b_1, b_2, \ldots, b_L)$, where $b_i \in \{0,1\}$.

$$m_i = 1 - 2b_i, \qquad i = 1,2,\ldots,L.$$

By using pseudo sequences $\{s_1, s_2, \ldots, s_L\}$ generated by a secrete key

The message m can be encoded

$$\langle s_i, s_j \rangle = \delta_{i,j} = \begin{cases} 0, & i \neq j, \\ 1, & i = j. \end{cases} \quad i,j = 1,2,\ldots,L, \qquad (2)$$

The noise can be obtained

$$W = \sum_{i=1}^{L} m_i s_i, \qquad (3)$$

pseudorandom noise pattern is embedded in the In the sub band image I , and given below

$$I_W = I + \lambda W, \qquad (4)$$

by applying IDWT we can obtain the water marked image. Get watermark message from $\widehat{I_W}$ from below

$$\widehat{I_W} = I + \lambda W + n, \qquad (5)$$

where n is distortion parameter. the orthogonal pseudo sequences $\{s_1, s_2, \ldots, s_L\}$ are obtained using the key and product calculation between this s_i and $\widehat{I_W}$ takes place

$$\langle s_i, \widehat{I_W} \rangle = \langle s_i, I \rangle + \lambda m_i + \langle s_i, n \rangle. \qquad (6)$$

The sign of m is based on the above equation .by applying CDMA methods we have

$$\widehat{m_i} = \begin{cases} 1, & \text{if } \langle s_i, \widehat{I_W} \rangle > 0, \\ -1, & \text{otherwise}, \end{cases} \qquad (7)$$

m_i obtains estimated value from $\widehat{m_i}$. Then s_i and the host image I relation,can be neglected and eliminated from eq(6)

$$\langle s_i, \widehat{I_W} \rangle = \langle s_i, I \rangle + \lambda m_i. \qquad (8)$$

the watermark parameter λ becomes smaller and insertion of original image data takes place.now we have to improve the CDMA watermarking capacity and improve BER and reduce interference original image data considerably.

Improvization of BER CDMA watermarking method: From the above analysis we came to know that how the image contents effect the watermarking. Now we have to avoid it by projecting theimage in to subspace S we have

$$P_S(I) = \sum_{i=1}^{L} \langle s_i, I \rangle s_i. \qquad (9)$$

from the watermarked image I before extraction process we can subtract $P_S(I)$, while orthogonal coefficients $\{c_i = \langle s_i, I \rangle : i = 1,\ldots,L\}$ behaves as secret key

$$\langle s_i, \widehat{I_W} - P_S(I) \rangle \approx \langle s_i, I + \lambda W - P_S(I) \rangle = \lambda \langle s_i, W \rangle = \lambda m_i, \qquad (10)$$

hence it does not influence image contents and hence

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it shows in the improvement in the watermarking process

Processing steps of embedding:

The onlydifference between new and existing system is calculation of projection coefficients $\{c_i = \langle s_i, I \rangle : i = 1, \ldots, L\}$, which are act as key procedure steps:

i. choose one sub image which are obtained by applying DWT

ii. by using the secret key generate the orthogonal pseudorandom sequences $\{s_1, s_2, \ldots, s_L\}$

iii. by this $\{s_1, s_2, \ldots, s_L\}$, projection of images I in the subspace Scan be obtained and consider the coefficients $\{c_i = \langle s_i, I \rangle : i = 1, \ldots, L\}$ as the secondary key and can be used for later stage

iv. to obtain pseudorandom noise W encoding takes place on watermark data by eq (1) and (3)

v. by the eq (4) in the sub band image I, the pseudorandom noise W will be embedded.

Step6: in order to obtain the watermarked image perform inverse discrete wavelet transform (IDWT).

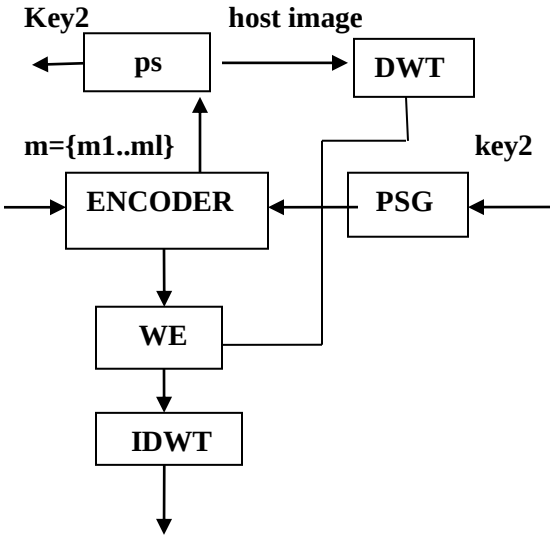

Fig. Embedding process of new method

pseudo sequence generator is PSG; projection operator is PS.WE is watermark embedding.

Processing steps of extracting:

1. by applying IDWT, in which image is divide into sub band images and choose the one $\widehat{I_W}$ for extraction;

2 by using the (key1) the o sequences $\{s_1, s_2, \ldots, s_L\}$ can be generated

3. projection component can be removed by

$$\widetilde{I_W} = \widehat{I_W} \quad P_S(I) = \widehat{I_W} \quad \sum_{j=1}^{L} c_j s_j, \qquad (11)$$

Where c_i are orthogonal coefficients held in key2

4 by correlation detection obtain the embedding message $m = (m_1, \cdots, m_L)$

$$\widehat{m_i} = \begin{cases} 1, & \text{if } \langle s_i, \widetilde{I_W} \rangle > 0, \\ -1, & \text{otherwise.} \end{cases} \qquad (12)$$

5.the original watermark $b = (b_1, b_2, \ldots, b_L)$ can be obtained by transforming the extract message using the following formula

$$b_i = (1 - m_i)/2, \quad i = 1, 2, \ldots, L. \qquad (13)$$

Experimental results

A no of experiments have been done to know how improvement takes place in the proposed method

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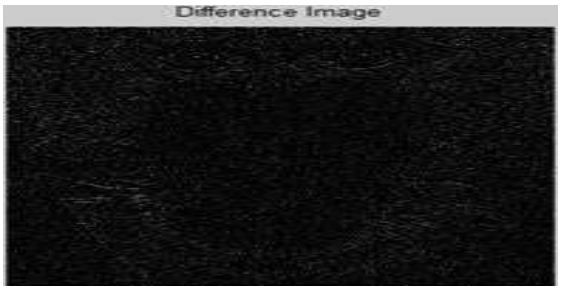

Conclusion

Finally inthis paper we suggested elimination of correlation between the host image and orthogonal pseudorandom sequence during extracting phasetakes placewhich improves the BER ,message capacity, and robustness of watermarkingand different noises are added and filtered.finally,BER is improved and highly robustness compared to existing method.

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