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ANALYSIS OF FREQUENCY BASED DIGITAL WATERMARKING TECHNIQUE IN CLOUD COMPUTING

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Abstract: - Watermarking has been considered as a technique that provides copyright security, authentication protection to digital data. This technique is an emerging technique in terms of data security. Many techniques and algorithms have been developed for data security. It includes spatial domain or covered domain for data acquisition, in which their various properties are mainly useful for data acquisition, such as robustness, anonymity, and fidelity, etc. Also, it is also seen that covered frequency domain technique gives an excellent result; it is easy to obtain data through this technique from any other domain such as local domain etc., so at present this technique is mostly being used. Data can be strengthened through technology and good digital watermarking can be planned. Nowadays, there are various types of attacks in digital data such as data being stolen unintentionally or intentionally, for which an important plan can be made through this technique, which can include image processing attacks such as compression, frame dropping, theft, Geometric distortion, loss of speaker quality, etc. In this research paper, an in-depth research has been done on various techniques available for watermarking based on frequency domain to find out a secure technique that can withstand any type of attack involving all types of digital content.

Keyword: - *Watermarking, Frequency Domain,(DWT) Discrete wavelet transform (DFT) Discrete Fourier transform (DCT) Deseret cosine transform , Data security*.

I. Introduction

Today's era of technology in which multimedia is also being widely used like (picture, audio, video) which are being used as data. In today's date, thousands of data are uploaded and downloaded in the server through the Internet. The facility of securing the data is provided through watermark technology, by which it is ensured that on any digital content whose There is ownership, many times data is downloaded from the server by many users with a view to gain some knowledge, but many times these data are manipulated or those data are told as their data, in this situation the ownership of the data It is necessary to give importance to security. In watermark technique, a mark is put on any digital content, through which the ownership of that data remains and it cannot be used without any permission. Many works have been done in this field and many things have been achieved in the result.

II. Analysis of digital water marking:

There are three types of digital watermarking technique which is analysis of based on frequency based.

i. Discrete Cosine Transform

It is like Fourier Transform. This method defines any type of data in terms of instance space rather than a particular location. This method has more benefits because the way humans perceive light, in the same way this method works. The part which is not useful in this is identified and removed. DCT based watermark technology is considered to be better than spatial domain technology as it is more powerful against processing operations such as low pass filtering, brightness and contrast adjustment, blurring etc. By which it provides protection from external attack very easily. However, they are complex and expensive in many respects and are also weak against geometric attacks such as rotation, scaling, cropping, etc.

- **Scaling and Embedding Factors**

In this section, a detailed overview of the existing techniques available for the analysis of scaling and embedding factors is presented. Many visible watermarking techniques discussed earlier are based on mathematical model for the use in HVS (Sever et al 2004). In the visible watermarking process, the grey value of the original data content is modified and is dependent on the local and global data. As a result, the quality or visibility of digital content changes. To avoid the above mentioned problem, choice of scaling and embedding factors are important (Mohanty et al 2000).

Here the implications of the calculation of values in the context of the use of the watermarking resource are presented. A new technique has been developed to avoid the calculations involved in scaling and embedding factors. In literary review, visual watermarking techniques have focused on the block-based method, where 2D-DCT coefficients of 8x8 blocks in the original material and Equation (3.1) are used in the watermarked material:

$$R_{ij}(n) = \alpha_n C_{ij}(n) + \beta_n W_{ij}(n) \quad (1)$$

In the above equation, $R_{ij}(n)$ is a resultant DCT coefficient, corresponding to the n^{th} block. $C_{ij}(n)$ is the DCT coefficient of the n^{th} block of the original data material. The DCT coefficient of the n^{th} block of $W_{ij}(n)$ is α_n and β_n are the scaling and embedding factors, respectively, in the watermark material. There are scaling and embedding factors as parameters for embedding a watermark, which are limited by the distorting of the content due to the process of watermarking. For the n^{th} block the scaling factor and the embedding factor are calculated equitinely:

$$\alpha_n = \sigma_n{}' \exp(-(\mu_n{}' - \mu')^2) \quad (2)$$

$$\beta_n = (1/\sigma_n{}')(1-\exp(-(\mu_n{}' - \mu')^2)) \quad (3)$$

The criterion to choose from (α_n and β_n) is usually based on the difference between the block's mean grey value (μ_n) and the overall value (μ) for any given block. Specifically, in particular, these values are chosen based on the normalized mean grey value and variance of the 2D-DCT coefficients of the block (Mohanty et al 1999). Here, both μ_n and μ' are the normalized values of μ_n and u respectively, the variance of the current discrete cosine transform (AC-DCT) coefficient and σ_n' is the normalized algorithm. Similarly, the values of scaling (α_n) and embedding (β_n) factors selected for the nth block are increased from α_{min} to α_{max} and β_{min} to β_{max} respectively. α_{min} and α_{max} are the minimum and maximum values of the embedding factor. The values of α_{min}, α_{max}, β_{min} and β_{max} for a visible digital content are 0.95, 0.98, 0.02 and 0.07, respectively.

- DCT Module

The DCT module is used for the purpose of computing the coefficients of 1D-DCT of the original and embedded watermarked digital content. DCT Module Diagram and Internal Block Diagram are shown in Figure No. 3.2(a) and 3.2. (b). the following equation is used to define n points 1D-DCT:

$$y(k) = w(k)\sum_{n=1}^{N} x(n)\cos\frac{\pi(2n-1)(k-1)}{2N}, \qquad (3.7)$$

where,

$$w(k) = \begin{cases} \frac{1}{\sqrt{N}}, k = 1 \\ \sqrt{\frac{2}{N}}, 2 \le k \le N \end{cases}$$

for k =1, 2 ….., N

To perform the order of 10 point 1D-DCT in the above equation, the value of n is fixed as 10. Hence, the matrix of cosine value becomes a constant 10x10 matrix.

$$C(n)(k) = \sum_{n-1}^{10}\left(\cos\frac{\pi(2n-1)(k-1)}{2x10}\right) \qquad 4$$

Where, n=1,2,3…..10 and k=1,2,3,….10.

The cosine matrix is represented by the letter C(n)(k) in the design and the Equation (3.7) is redefined as Equation (3.4).

$$C(n)(k)=\begin{pmatrix}
1.0000 & 1.0000 & 1.0000 & 1.0000 & 1.0000 & 1.0000 & 1.0000 & 1.0000 & 1.0000 & 1.0000 \\
0.9806 & 0.8235 & 0.6543 & 0.1952 & -0.1851 & -0.4556 & -0.8215 & -0.9808 & -0.9080 & -0.9120 \\
0.9234 & 0.3298 & -0.3427 & -0.9114 & -0.9439 & 0.3826 & 0.3827 & 0.9293 & 0.9113 & -0.8234 \\
0.8545 & -0.1767 & -0.9453 & -0.5446 & 0.5564 & 0.9707 & 0.1591 & -0.8214 & -0.8213 & 0.7498 \\
0.8012 & -0.1634 & -0.4535 & 0.7278 & 0.7071 & -0.7071 & -0.7017 & 0.7071 & 0.7183 & 0.6939 \\
0.7649 & -0.7598 & -0.3421 & 0.8251 & -0.8315 & -0.1851 & 0.9707 & -0.5556 & -0.5556 & -0.5434 \\
0.6064 & -0.8756 & -0.2134 & -0.3827 & -0.3872 & 0.9239 & -0.9339 & 0.3827 & 0.3616 & -0.4210 \\
0.4056 & -0.9026 & 0.1967 & -0.9280 & 0.9202 & -0.8415 & 0.5556 & -0.1850 & -0.1923 & 0.1850 \\
0.3453 & -0.9834 & 0.9677 & 0.9102 & 0.9808 & -0.7423 & -0.8292 & 0.2872 & 0.2272 & 0.2191 \\
0.1776 & -0.5554 & 0.8342 & 0.9820 & -0.2898 & 0.9093 & 0.4226 & -0.1120 & -0.1020 & -0.1101
\end{pmatrix}$$

With the help of Equation 3.4 described above, the 10 point 1D-DCT module first calculates the DCT coefficient of x1, which is y1. To get the result of y1, nine multipliers and seven adders are required. All multiplier and end stage connectors are registered to provide balanced pipeline.

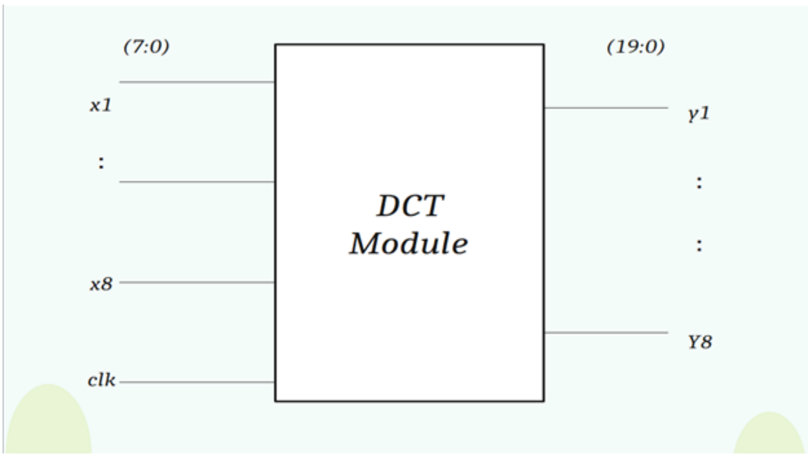

Figure (a) RTL schematic pin diagram of the DCT module

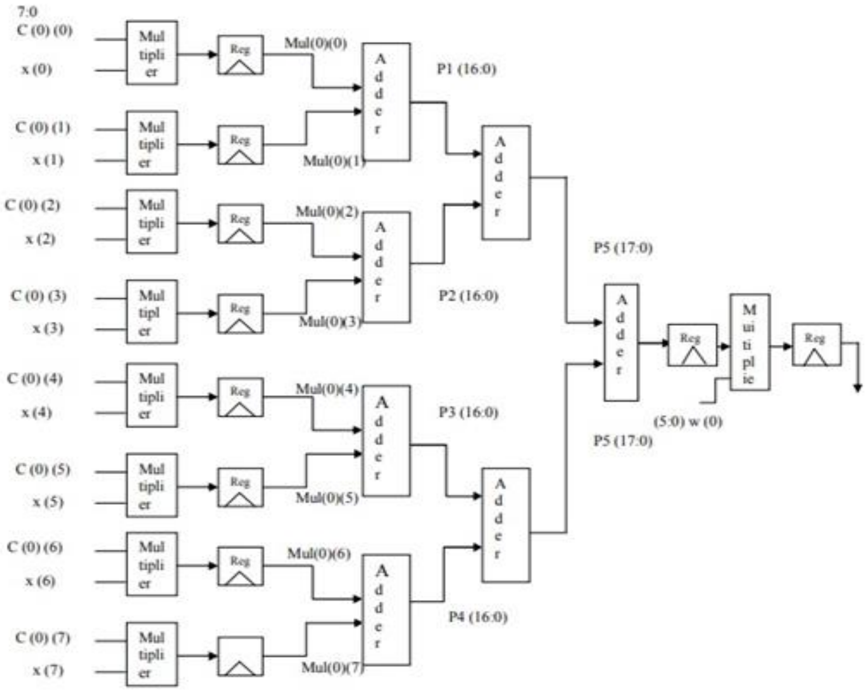

Figure: internal diagram of DCT module

ii. Discrete Wavelet Transform

The proposed work is a DWT based algorithm, which demonstrates self-insertion watermark technology using contrast networks inside digital content. Cubic addition is used to test for watermarks in digital content. The proposed function guarantees self-installing watermarks in unique digital content. The watermark strengthens the unique two-level decay scheme for embedding the data. The strategy of this research work is structured in two parts: the first part introduces the parameters of cubic interference and the second part introduces the watermark installation and watermark extraction.

- **Wavelet Cubic Interpolation**

Various types of resampling are accomplished by interpolate operations in the watermarked material. Here a normal potential is an assumed potential, which generates a new point within a specified range. An estimated capacity limit should be so fixed as to match the additional hubbed test information. As the interpolation attribute assigns a value to the created watermark, the weighting of the 16 closest pixels to the input determines the normal pixel estimate. The one-dimensional introduction capacity is attached to both bearings for two-dimensional insertion. Finally, if g is the relating interjection capacity and f is an inspected work, then $g(x_k) = f(x_k)$ at whatever point X_k is an addition hub.

Numerous introduction capacities can be composed for similarly divided information in the frame:

$$g(x_k) = \sum_k C_k U\left(\frac{X - X_k}{h}\right) \quad (1)$$

Here h represents the increase in samples, u is the interpolation kernel, X_k is the nodes of the interpolation and g is the function of the interpolation. C_k is the parameter, based on the sample data, which satisfy the interpolation condition, $g(x_k) = f(x_k)$.

$$U(s)=\begin{cases} \left(\frac{3}{2} * |s| * 3 - \frac{5}{2} * |s| * 2\right) + 1 & 0 \le |s| < 1 \\ \left(-\frac{1}{2} * |s| * 3 + \frac{5}{2} * |s| * 2 - 4 * |s|\right) + 2 & 1 \le |s| < 2 \\ 0 & 2 < |s| \end{cases} \quad (2)$$

The point of outline of the watermark is being considered by the following equation. `The one-dimensional joint capacity and two-dimensional insertion capacity are both combined into a single bearing. It is a disjoint augmentation of the one-dimensional introduction work. For adding a point (x, y), where xk< x < xk+1 and yk< y < yk+1, the two-dimensional cubic interpolation function is.

$$g(x,y)= \sum_{I=-1}^{2} \sum_{M=-1}^{2} C(J+I, K+M)U(dis\tan ceX)U(dis\tan ceY) \quad (3)$$

In Eq.2, u ( ) is an insertion capacity and is a distance X in which X is separated by four points and of course each distance is y separations from four matrices. For non-limit focuses, the interjection coefficients, c_{jk}'s are given thru $c_{jk} = f(x_j, y_k)$.

- **Proposed Algorithm**

The proposed algorithm comes under the self-implantation watermarking system in digital content. This is imperceptible watermarking technology. Its subtle elements have been displayed in several parts.

A. The following are the major steps of a self-embedded watermark:

I. First the singular I (N×N×3) was divided into three color RGB.

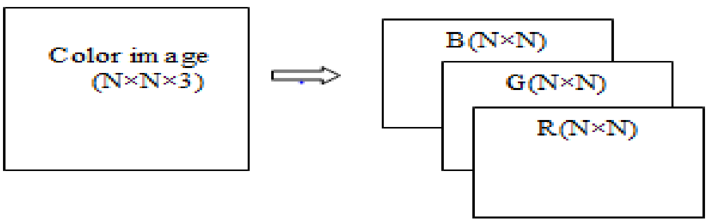

Figure: Separating image planes

The image was divided for all discrete wavelet changes (DWT) of each surface. It uses 2-level DWT. In Figure3.6 delineate the ordering of sub-groups in two-level wavelet disintegration.

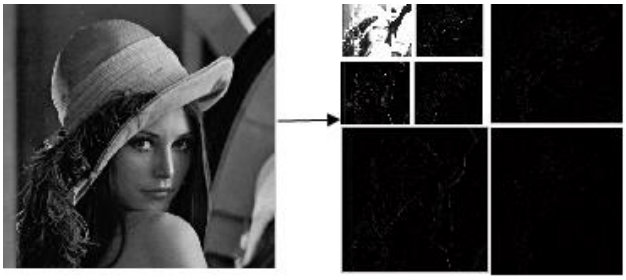

Figure: The indexing of sub-bands in two-level wavelet decomposition

II. The average number of channels presented for RGB color in the original watermarked digital content. The mean distinction lattices will then be found for each channel and cubic insertion is applied to scale these networks and is used as a watermark. Scaling measurement that is controlled by specific instructions via watermarking data. An appropriate rate of scaling variable 0.25 is chosen keeping in mind the final target to preserve the quality of the image. Let's say here is an image of N×N×3. Its RGB surface was separated. This process is started for each MR, MG and MB. Each cell currently in use i.e. Xij-MR, Yij-MG, Zij-MB. Where Xij is pixel in R plane, Yij is pixel in G plane, Zij is pixel in plane.

X_{11}	X_{12}	X_{13}	X_{14}	…
X_{21}	X_{22}	X_{23}	X_{24}	…
X_{31}	X_{32}	X_{33}	X_{34}	…
X_{41}	X_{42}	X_{43}	X_{44}	…
…	…	…	…	…

X_{ij}- M_{R}.

X'_{11}	X'_{12}	X'_{13}	X'_{14}	..
X'_{21}	X'_{22}	X'_{23}	X'_{24}	..
X'_{31}	X'_{32}	X'_{33}	X'_{34}	..
X'_{41}	X'_{42}	X'_{43}	X'_{44}	..
…	…	…	…	..

Figure 7 representing mean contrast frameworks for R plane with esteem XijM_R.same process will be taken after for G and B plane separately.

The cubic introduction of the scaling variable 0.25 is implemented as watermarked data.

III. A 2-level discrete wavelet change (DWT) data is established in the surface of the original digital material.

IV. The changed digital material is reproduced under discrete wavelet change (IDWT). The watermark image W (N×N×3) was added by joining the three surfaces. The diagram of the watermark era and inserting procedure is outlined in figure.3.8.

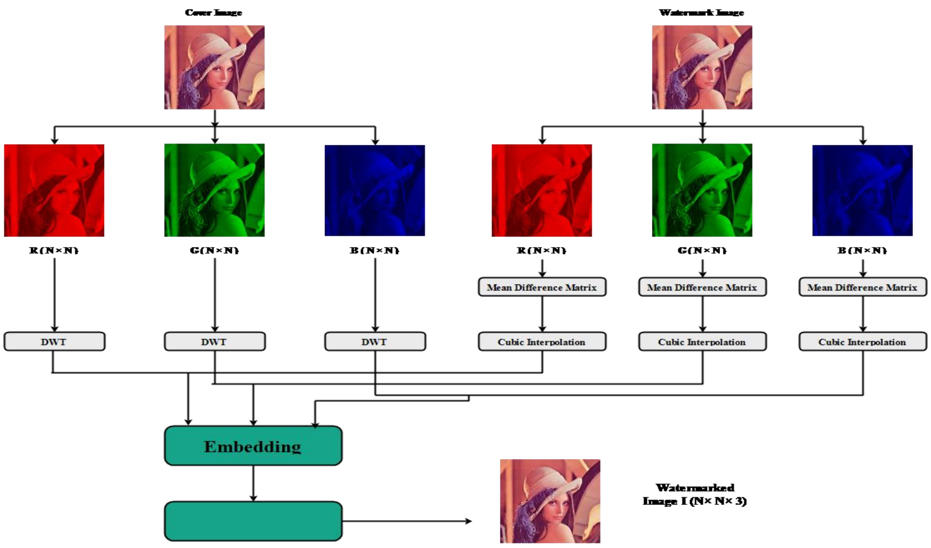

Figure: Embedding process of color image

iii. Discrete Fourier transform

The matrix ø(n) corresponding to the discrete Fourier transform (DFT) of size n is defined by the formula

$$\phi_{jk}(n) = \frac{1}{\sqrt{n}} q^{jk}, j, k = 0, \dots, n-1 q = e^{\frac{2\pi i}{n}} \quad (4)$$

clearly $\phi_{jk} = \phi_{kj}$, also

$$(\phi\phi *)_{jk} = \frac{1}{n}\sum_{r=0}^{n-1} q^{-(j-k)r}\, \overline{q^{rk}} = \frac{1}{n}\sum_{r=0}^{n-1} q^{-(j-k)r} = \delta_{jk}.$$

Thus, ϕ is unitary and symmentric at the same time. Hence inverse of ϕ is obtained by the complex conjugation.

Definition: for $(f = f_0, \dots., f_{n-1})^t \in C^n$ we define the DFT $\tilde{f} \in C^n$ by $f = \phi f = (\tilde{f}_0, \dots, \tilde{f}_{n-1})$, where

$$\tilde{f}_k = \frac{1}{\sqrt{n}} \sum_{j=0}^{n-1} f_j\, e^{\frac{2\pi ijk}{n}}. \quad (5)$$

This immediately gives the Parse values equality, namely

$$\sum_{k=0}^{n-1} |\tilde{f}_k|^2 = \|\tilde{f}\|^2 = \|f\|^2.$$

The sequence f_j is an fact periodic i.e. $f_{j+n}=f_j$. The sequence f_j can also be extended periodically with same period n. We will now onwards consider f and f to be extended periodically in this manner. Clearly $\tilde{f} = \phi f \Longrightarrow \phi^{-1}\tilde{f} = \phi * f$ that is

$$f_j = \frac{1}{\sqrt{n}} \sum_{k=0}^{n-1} \tilde{f}_k\, e^{\frac{-2\pi ijk}{n}} \; or\; f = \phi^{-1}\tilde{f} \quad (6)$$

Also,

$$(\phi^2)_{ij} = \frac{1}{n}\sum_{k=0}^{n-1} q^{(i+j)k}$$

$$= 1 \; if \; i + j \equiv 0 \; (mod \; n)$$

$$= 0 \; otherwise.$$

This shows that

$$\phi^2 = \begin{pmatrix} 1 & 0 & \cdots 0 & 0 \\ 0 & 0 & \cdots 0 & 1 \\ 0 & 0 & \cdots 1 & 0 \\ \vdots & \vdots & \cdots 0 & 0 \\ 0 & 1 & 0 \cdots & 0 \end{pmatrix}$$

In otherwords, we find that

$$\phi^2_{jm} = \phi^2_{mj}, (\phi^2 f)_j = f_{n-j}, \phi^4 = I, \phi^3 = \phi^{-1} = \phi *. \qquad (7)$$

Trace of ϕ^2 , Tr ϕ^2 takes only two values 1 or 2, according as whether n is odd or even. This can be summarized as,

$$Tr\phi^2 = \frac{3+(-1)^n}{2} \qquad (8)$$

The quantity

$$G(n) = \sqrt{n}Tr\phi = \sum_{s=0}^{n-1} q^{s2} \qquad (9)$$

Is the well-known gauss sum.

A celebrated result of the Gauss is that

$$G(n) = \frac{1+(-i)^2}{1-i}. \qquad (10)$$

There are many proofs of Gauss sum available in the literature. Schur has given a proof using discrete Fourier transform. The analytic proofs have also been given in [1].

III. Conclusion

In This research paper presents an in-depth analysis of the various watermark methods available. Frequency based method: DWT, DCT, DFT and Spatial based method have been presented in this analysis. It has been clarified in the above that the frequency based method has proved to be more useful and stronger than the Spatial based method, offers in-depth study and analysis of both the above types of original and watermarked digital content through algorithms, equations, graphs, diagrams, etc. for hardware implementation. MATLAB software has been used for the authentication of all the above methods, with the help of which the data has been represented.

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