Results: Algorithm of QR Code based Digital Image Watermarking

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Abstract: In daily life Copyright protection and authentication have become increasingly more important. The digital watermark is one of the techniques invented to solve this problem. In this paper, we implement a video watermarking and image watermarking; a digitally invisible watermark was inserted in a QR code image by means of wavelet transform. In the embedding process, a binary image, logo, was transformed into a corresponding watermark and then embedded into a selected sub band.

Keywords—*QR Code; Image Watermarking; DWT; SVD;*

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I. INTRODUTCION

Digital watermarking is not a new thing to the digital world, it is invent in the year 1979, but it was not in use until 1990.Today's era as computerized, the expanding use of internet and displaying media on the internet has become actively spread. We all know the YouTube, Face book, Torrents such video, audio, image, documents these all are the part of common man especially more popular among young generation. For doing this, it needs a security so watermarking is the best key of the copyright data. The term watermark was probably use for first time from the German term watermark. Digital watermark was a pattern of bits inserted into a digital image, audio or video that identifies the absorbed and authorized information. The goal of watermark technique was to embed the secret information hidden within into original message.

The goal of watermark technique was to embed the secret information aimlessly hidden within into original message, which was robust against attacks. Lot many authors have proposed techniques for watermarking, the watermark can also be added in the original spatial domain of the image. The main drawback of spatial domain was that it easy to be hacked and stroke. The proposed method embedded the absorbed image into the original image using (N, N) secret sharing scheme.

II. BACKGROUND

2.1 Brief of Watermarking

Watermarking is the process of hiding digital information in the carrier signal such as image, audio and video etc... Digital watermarking techniques can be classified into two categories with respect to operational domains, which are, Spatial domain watermarking, the inserting process is done by directly modifying the pixel values. Frequency domain watermarking, the depositing process is done by embedding the information in the transform space by modifying for example the frequency coefficient.

2.2 Process of Watermarking

The process of embedding this watermark has performed on a QR code image on its frequency domain. The QR code image has first decomposed by a two-level-two-dimensional wavelet transform. The subsequent watermark extraction has covered in a sense that it did not require the original QR code image in order to offset the embedding watermark.

2.3 Quick Response code (QR):

As shown in Fig. 2.1 QR code, it is the trademark for a sample of two-dimensional bar code. A bar code is an optically machine-readable label that has attached to an item and that records related information. The information indeed by a QR code may be made of four graded types ("modes") of data (numeric, alphanumeric, byte / binary) or, through promoted expansion, virtually any type of data. .

Fig 2.1: QR Code

III. WAVELET TRANSFORM

Wavelet is the answer to multiresolution problem. A wavelet has the important property of not having a fixed width-sampling window.

Types of wavelet

- Continuous wavelet transform: For long signal, continuous WT can be time consuming since it needs to integrate over all time.
- Discrete wavelet transform: To overcome the time complexity, discrete wavelet transform has introduced. DWT implemented over sub band coding. The dwt is useful in image processing because it can simultaneously localize the signals in time & scale, DFT or DCT can localize signals only in frequency domain.

The DWT obtained by filtering the signal through a list of digital filters at other scales. The scaling operation is done by changing dwt can be computed using one of two convolution based or lifting based procedures. In both methods the input sequence is decomposed into low pass & high pass sub bands, each responding the half of the number of sample in original sequence.

IV. Singular Value Decomposition (SVD)

This method is a factorization of a real or complex matrix, with many helpful applications in signal processing and demography. Formally, the singular value decomposition of an m×n real or complex matrix M is factorizations of the form proceed from in this equation 4.1.

$$M = U\Sigma V' \quad \ldots (4.1)$$

Where U is an m × m real or complex unitary matrix, Σ is an m × n long diagonal matrix with non negative real numbers on the transversal, and V* is an n × n real or complex unitary matrix. A non-negative real number σ is a singular value for M if and one if there exist unit-length vectors u in Km and v in Kn such that show as equation 4.2.

$$M = U\Sigma V' \quad \ldots (4.2)$$

Where U is an m × m real or complex unitary matrix, Σ is an m × n rectangular transversal matrix with non negative real numbers on the transversal, and V* is an n × n real or complex unitary matrix. A non-negative real number σ is a singular value for M if and one & only if there lie unit-length vectors u in Km and v in Kn such that show as equation4.3 & 4.4.

$$M\,v = \sigma\,u \quad \ldots\ldots (4.3)$$

$$M^*\,u = \sigma\,v \quad \ldots\ldots (4.4)$$

The vectors u and v known as left singular and right singular vectors for σ, respectively.

V. PROPOSED METHODOLOGY

In this dissertation work, image watermarking and video watermarking were by using QR code & it explains by following steps:

5.1 Watermark embedding Step

The two-level DWT of MxM image (ti) has computed for QR code image.

- A watermark then inserted in sub band LH2 or HL2 or HH2. According to the rule:
  ti'=ti+α. pi.si,i=1,2,…..N
  …..(5.1)
  Where ti was input image. ti' is out-put image with watermark. α is a magnitude factor, which is a constant, determining the watermark strength.
- After that, the inverse DWT (IDWT) then applied to obtain the watermarked image.
- Compute PSNR

5.2 Watermark Extraction Step

- The predicted image $\widehat{ti}$ could be obtained by smoothing the input image ti* with a spatial convolution mask. The divination of the initial value can be representing as:

$$\widehat{ti} = \frac{1}{cXc}\sum_{i}^{cXc} ti^* \quad \ldots\ldots (5.2)$$

Where, c is size of the convolution mask. The watermarked image and the concluded image were DWT transformed freely.

- The estimate of the watermark $\widehat{Si}$ is indicated by the difference between ti* and $\widehat{tI}$ as:
  δ = ti* - $\widehat{ti}$ = α.pi .$\widehat{sI}$ …… (5.3)
- The sign of the difference between the predicted and the certain value is the value of the inserted bit:
  sgn (δi)= pi .$\widehat{si}$ …..(5.4)
- Compute NC
- The watermark then predicted by multiplying pseudo-random number to the embedded bit. If an incorrect pseudo random sequence were to be use, the scheme would not work.

VI. VIDEO WATERMARKING

6.1 Algorithm for Embedding Process

- Read the video file and extract RGB P-frame, B-frame, and I-frame.
- Read the I-frame image as a cover image.
- Apply SVD to I frame and get three singular coefficients as
  u, Σ v'.
- Add logo with components of an SVD image to get an SVD cover image.
- Apply DWT on both SVD cover image and QR code image to get combined image.
- Take the inverse DWT on the combined image to be Watermarked I frame. Finally watermarked I frame image to get the watermarked video files.

6.2 Algorithm for Decoding Process

- Read the watermarked video files and extract Watermarked I frame.
- Read the original video file and extract original Video I frame.
- Apply DWT on both videos I frame.
- Subtract watermarked video I frame coefficient with original video I frame coefficient and take Inverse DWT to get a QR code image.
- Apply SVD on watermarked I frame to recover the logo by using the singular value component.

VII. EXPERIMENTAL RESULTS

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TABLE 1
PSNR and NC of QR Code Image

α	PSNR	NC
5	**46.1926**	**0.9798**
10	40.1720	0.9928
15	36.6502	0.9957
20	34.1514	0.9971
25	32.2132	0.9985
30	30.6296	0.9989
35	29.2906	0.9994
40	28.1308	0.9995
45	27.1078	0.9995
50	26.1926	0.9997

Table 1 shows that QR code image with different magnitude factor. When magnitude factor value was, lower it gave maximum PSNR or better quality image, also NC has less as compare to other.

7.1 Result of Image Watermarking

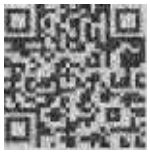
Fig. 7.1 output of Image watermarking

- The output window figure 7.1 shows in GUI when we run the code then GUI was open here two push button and two panels were used, push button 1 used for Image watermarking by click on Image watermarking button it selects QR code and logo.
- At panel we got 5, images first image is an input QR image, second image was a input logo, third image is a watermark QR image these all are the input images.
- Last two images i.e. fourth image was predicted image and fifth image was extracted watermark.
- These all are the output images.
- Panel has display images in 2X3 matrix form.

TABLE 2
Various kinds of Attacks

Attack Type	PSNR	MSE
No Attack	15.0517	0.0312
Salt and pepper noise (0.1)	15.0557	0.0312
Salt and pepper noise (0.5)	15.0533	0.0312
Gaussian (0.2)	15.0483	0.0313
Gaussian (0.8)	15.0502	0.0313
Speckle noise (0.01)	15.0536	0.0312
Poisson noise	15.0517	0.0312
Salt and pepper noise (1)	15.0511	0.0313

Table 2 shows various kinds of attack means any image having noise but their percentage of interference was varying, when we add different noise with different values then it affect image quality so PSNR and MSE gave the mathematical parameter of image.

Attack Type	QR code Image with watermark	Watermark Extraction
Salt and pepper noise (0.1)		
Salt and pepper noise (0.5)		
Gaussian (0.2)		
Gaussian (0.8)		

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Speckle noise (0.01)		
Poisson noise		
Salt and pepper noise (1)		

Fig.7.2 Attack of Watermark Extraction

As noise addition affect the image quality Fig.7.2 shows diagrammatical results of different noise with different value and how it affect image quality.

Fig.7.3 watermarking results

Fig. 7.3 shows output window of GUI. In figure, there were two panel which has output images & two push button shows. First panel shows result of Image watermarking. Second panel displayed the result of video watermarking. From GUI window, we got result combined.

VIII. CONCLUSION

This paper presented a digital watermarking technique, in which an image watermarking and video watermarking have done with QR code. Any data we want to keep confidential so it can hide in image or video. In image watermarking first it took one text image as a logo and it hide in a QR code or we can hide it any image the embedding process has presented in a different sub band based on wavelet transform. The experimental results demonstrated that the algorithm could be recovering the watermark with an acceptable visual quality. The objective measures such as PSNR, MSE and NC were subject to magnitude factor. Image watermarking was very useful method for providing security to the digital media on the internet technology.

For video watermarking, it took one image as a logo then hide into QR code then it watermark in video. This method has achieved the improved imperceptibility and security watermarking. Experimental results show that our method can achieve acceptable certain heftiness to video processing.

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