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QR Code Watermarking and Dewater Marking Using Discrete Wavelet Transformation

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Abstract:

Most of digital image watermarking techniques have focused on uncompressed images. However, compressed images more widely used than uncompressed images on the web due to its size. Joint Photographic Experts Group (JPEG) is well known and widely used digital format for compressing images. In this paper, we propose a new robust and invisible digital image watermarking algorithm for JPEG images based on the multiple transform method, discrete wavelet transform (DWT) and discrete fractional random transform (DFRNT). We generate a watermark through a two-dimensional (2D) barcode and scrambling method, and the generated watermark image is embedded into DWT-DFRNT transformed JPEG images using quantization technique in order to ensure the robustness and invisibility of the watermark. Experimental results present that our proposed method has improved the extraction performance of watermark from the compressed JPEG images and ensured the invisibility and robustness of the watermark against image signal processing such as image rotation and noise adding attacks.

INTRODUCTION:

DUE to advances in network and multimedia technologies, the Internet usage and number of digital media contents has continued to increase rapidly. Digital media contents can be used and distributed easily through the Internet. With the rise of digital contents, copyright infringement of digital content is also increasing constantly and it is now recognized as a serious problem. Digital watermarking may be used as an effective method for identifying the copyright ownership of digital content from unauthorized use and distribution. In digital watermarking, a watermark which contains the copyright information is embedded into the digital media content such as images, audio, and video, and may be extracted when the copyright ownership of the digital content needs to be verified .

In the previous researches, many digital watermarking methods have been proposed for images, audio, and video. There are discrete cosine transform (DCT) , DWT , singular value decomposition (SVD) , and DFRNT single domain based watermarking techniques. To complement the limitations of single transform based watermarking, dual transform domain based watermarking techniques such as DWT-DCT and DWT-SVD have also been proposed. In digital image watermarking, most of watermarking methods for images have been proposed based on uncompressed images. However, JPEG compressed images are more widely used on the web than uncompressed images like Bitmap (BMP) or Tagged Image File Format (TIFF). Therefore, some watermarking techniques have been proposed for JPEG images.In this paper, we will propose the blind watermarking algorithm by means of two-level discrete wavelet transform DWT) embedded in a QR code image.

DIGITAL WATERMARKING TECHNIQUE:

A watermarking algorithm embeds watermark in different kind of data like, text, audio, video etc.. The embedding process is done by use of a private key which decided the locations within the multimedia object (image) where the watermark would be embedded. Once the watermark is embedded it can happens several attacks because the online object can be digitally processed. The attacks can be unintentional; hence the watermark has to be very robust against all attacks which is possible. When the owner wants to check the watermarks in the attacked and damage multimedia object, she/he depends on the private key that was used to embed the watermark. Using the secrete key, the embedded watermark can be detected. This detected watermark may or may not combine the original watermark because the image might have been attacked. Hence to validate the presence of watermark, the original data is used to compare and extract the watermark signal

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(non-blind watermarking) or a correlation method is used to detect the strength of the watermark signal from the extracted watermark (blind watermarking). In the correlation, detected watermark from the original data is compared with the extracted watermark.

II. BACKGROUND

A. QR Code

QR code (Quick Response Code) is the trademark for a type of two-dimensional barcode. A barcode is an optically machine-readable label that is attached to an item and that records relevant information. The information encoded by a QR code may be made up of four standardized types ("modes") of data (numeric, alphanumeric, byte / binary,Kanji) or, through supported extensions, virtually any type of data.The QR Code system has become popular outside the automotive industry due to its fast readability and greater storage capacity compared to standard UPC barcodes.Applications include product tracking, item identification, time tracking, document management, general marketing, and much more.

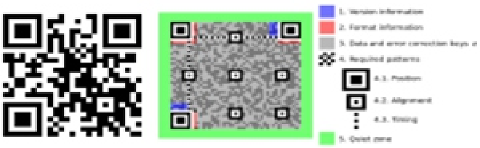

Figure 1 (a) QR code (b) QR code Structure

A QR code consists of black modules (square dots) arranged in a square grid on a white background, which can be read by an imaging device, such as a camera or mobile, and processed using Reed-Solomon error correction until the image can be appropriately interpreted. Data is then extracted from the patterns present in both horizontal and vertical components of the image. Fig. 1(a) shown the example of QR code and the structure of QR code shown in Fig.1(b).

B. Watermark:

A Watermark is the process of hiding digital information in the carrier signal such as voice, image, video etc. It is also found embedded into digital data for identifying ownership of the copyright. Digitalwatermarking techniques can be classified into two categories with respect to operational domains, which are:

Spatial domain watermarking, the embedding process is done by directly modifying the pixel values .

Frequency domain watermarking, the embedding process is done by embedding the information in the transform space by modifying for example the frequency coefficients.

Nevertheless, most signal processing paradigms found in recent literatures can be well characterized as the frequency domain operation. Moreover, several good perceptual models are developed in the frequency domain, with great successes reported.

III. THE PROCESS OF WATERMARKING:

In this study, a binary image of Burapha University logo, is a chosen as the watermark. The process of embedding this watermark was performed on a QR code image on its frequency domain. The QR code image was first decomposed by a two-level two-dimensional wavelet transform as shown inFig.2. The subsequent watermark extraction, are blided in a sense that it did not require the original QR code image in order to recover the embedding watermark. There were two steps in our algorithm: watermark embedding and watermark extraction.Fig.

A. Watermark Embedding:

The step of embedding process are outlined as follows (Fig.3):

Step of watermark image with secret key

i.The watermark image was produced as a bit sequence of watermark S. The data and background values were set to 1 and –1, respectively..

$$S = \{s_i, 1 \le i \le N\}, s_i \in \{-1,1\} \quad (1)$$

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where N is the total number of pixels in the watermark image.
ii. The pseudo-random sequence (P) whose each number can take a value either 1 or –1 was randomly generated with a secret key for embedding and extracting of the watermark.

$$P = \{p_i, 1 \le i \le M\}, p_i \in \{-1, 1\} \qquad (2)$$

Step of QR code image

I.The two-level DWT of MxM image (ti) was computed for QR code image.
II.A watermark was then embedded in subband LH2 or HL2 or HH2. According to the rule:

$$t_i = t_i + \alpha . p_i . s_i, i = 1, 2, \ldots, N \qquad (3)$$

where ti is input image ti' is output image with watermark α is a magnitude factor which is a constant determining the watermark strength.

III. After that, the inverse DWT (IDWT) was then applied to obtain the watermarked image.

III.Compute PSNR

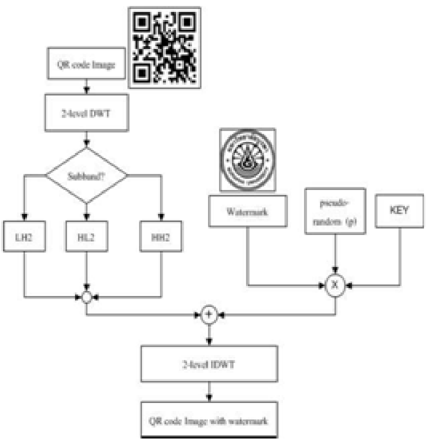

Fig. 3. Watermark Embedding Process

A.Watermark Extraction:

The watermark extraction algorithm did not used the original QR code image. A prediction of the original value ofthe pixels is however needed. Thus, a prediction of theoriginal value of the pixels was performed using noise elimination technique. In this paper, we use an averaging3×3mask whose elements were fixed to 1/9. The extractionprocess are outlined as follows (Fig.4):

1. The predicted image $\hat{t}_i$ could be obtained by smoothing the input image t_i^* with a spatial convolution mask. The prediction of the original value can be defined as:

$$\hat{t}_i = \frac{1}{c \times c} \sum_{i}^{c \times c} t_i^* \qquad (4)$$

where c is the size of the convolution mask. The watermarkedimage and the predicted image were DWT transformed independently.

2. The estimate of the watermark $\hat{s}_i$ is indicated by the difference between t_i^* and $\hat{t}_i$ as:

$$\delta = t_i^* - \hat{t}_i = \alpha . p_i . \hat{s}_i \qquad (5)$$

3. The sign of the difference between the predicted and the actual value is the value of the embedded bit:

$$sgn(\delta_i) = p_i . \hat{s}_i \qquad (6)$$

4.Compute NC

The watermark was then estimated by multiplying pseudo- random number to the embedded bit. If an incorrect pseudo random sequence was to be used, the scheme would not work.

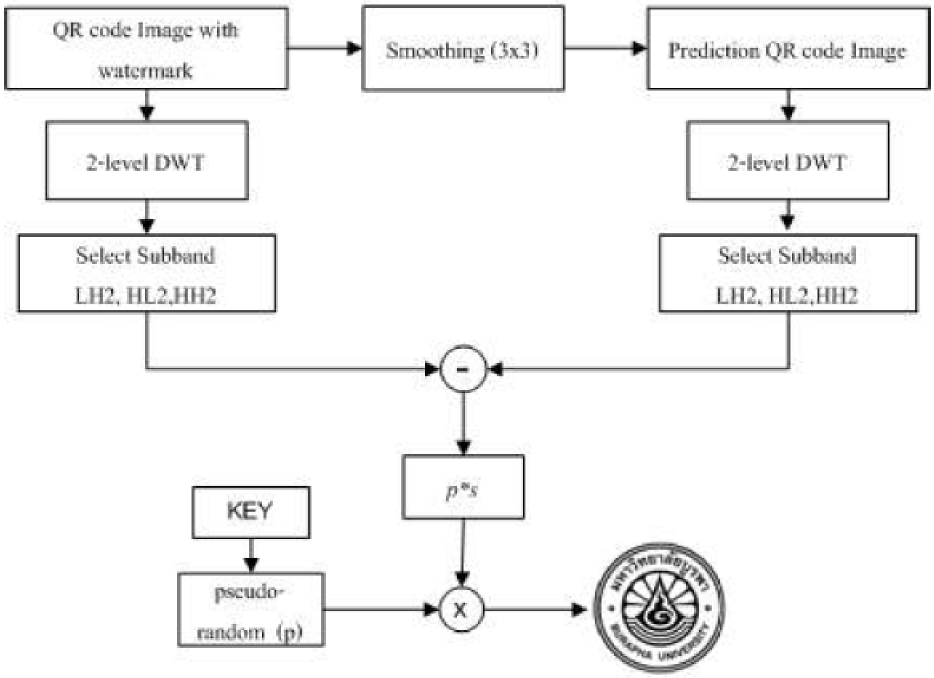

Fig. 4. Watermark Extracting Process

Experimental Results:

A.Performance Evaluation:

To evaluate the performance of the algorithm, a similar measurement between the original watermark (S) and the extract watermark (S′) was computed by using normalized correlation (NC), as in (7)

$$NC = \frac{\sum_{i=1}^{M} S_i S_i'}{\sum_{i=1}^{M} S_i^2} \qquad (7)$$

$$PSNR = 10\log \frac{\left(2^b - 1\right)}{\left(\frac{1}{m \times n}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}\left(O(i,j) - R(i,j)\right)^2\right)} \qquad (8)$$

b is the number of bits used to represent in the pixel. m×n is a size of image.
O(i, j) is the original pixel value. R(i, j) is the reconstructed pixel value.

B.Simulation and Results:

A QR code image, of size 400x400 pixel was used for the experiment in Fig 5(a). The watermark image was a binary image of Burapha University logo, as depicted in Fig 5(b). The watermarking was tested with the following parameters: magnitude factor (α) are 5,10,15,…,50 and the key is 100. In Table 1, the PSNR and NC of the QR code image with difference magnitude factor in HH2 subband. All case can be correct QR code. A high magnitude factor value on one hand could result in low PSNR, and hence significantly distorted watermark image (as shown in Fig 6). On the other hand, it increases NC value in watermark extraction (as shown in Fig 7), thereby lowering the noise. Baring in mind, this trade off between PSNR and NC, we empirically chose the magnitude factor of 25. Subsequently, the watermark subbands were changed to LH2 HL2 and HH2. The comparisons are illustrated in Table 2. It can be noted accordingly that the differences in PSNR are negligible, while the NC value of HH2 yeild the watermark that is most resemblant to the original image. The following experiment is therefore carried out with the watermark embedded in HH2. Once aplied with the DWT, the significant information is aggregate within the low-frequency subband. As a result, embeding the watermark in the higher frequency band does not destroy much of the information, hence resulting in higher NC than otherwise.

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Fig. 7 shows extracted watermark with difference magnitude factors. All extracted watermark images contain some visual noise because of the watermark extracting process did not employed the original QR code image.In practices, the transmission of an image can be corrupted by unpredictable noise comtaminated in the network communication. We therefore tested the robustness of our algorithm with some attacks such as Salt and Pepper noise, Gaussian noise ,JPEG, and cutting in Fig.8. In Table 3, we can see that for all of cases, the watermark could be recovered.

Fig. 5. a) Original QR code Image (b) Watermark Image

Conclusions and Future work:

This paper presented a digital watermarking technique ,whereby a binary image is watermarked an embeded in a QR code image . The embedding process is presented in a LH, HL or HH subband based on wavelet transform. The experimental results demonstrated that the algorithm can be recover the watermark with an acceptable visual quality. The objective measures such as PSNR and NC are subject to magnitude factor. As the future work, we are trying to find more efficient ways to withstand more severe attacks such as stronger noise, high compression, geometric distortion and occlusion etc.

Applications :

•Digital watermarking technology primarily joins the rightful owner of totem to the protected media. Once the media are suspected to be illegally used, an open algorithm can be used to extract the digital watermark, for the purpose of showing the media's ownership.
•A reversible visible watermarking scheme is proposed to satisfy the applications, in which the visible watermark is expected to combat copyright piracy but can be removed to recover the original image without loss.

Advantageous:

•Visible watermarking is an effective technique for preventing unauthorized use of an image, based on the insertion of a translucent mark, which provides immediate claim of ownership.
•QR code is an binary image which is more robust to secure data.
•The system is very simple to design and very fast compared to conventional watermarking techniques.

Dis advantages:

•Water marking capacity is less compared to BPCS methodology.

References:

1.W.N. Cheung, "Digital image watermarking in spatial and transform domains, " Proc. TENCON, pp. 374-378, 2000.

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2.Sushma Yalamanchili, M. Kameswara Rao, "Copyright Protection of Gray Scale Images by Watermarking Technique using (N,N) Secret Sharing Scheme," Journal of Emerging Technologies in Web Intelligence, Vol 2, No 2, pp.101-105, May 2010.

3.Y. Rangsanseri, J. Panyaveraporn and P. Thitimajshima, "PCA/Wavelet Based Watermarking of Multispectral Images," 2005 International Symposium on Remote Sensing (ISRS2005), Korea, 12-14 Oct. 2005

4.Nagaraj V. Dharwadkar and B.B.Amberker, "Watermarking Scheme for Color Images using Wavelet Transform based Texture Properties and Secret Sharing," International Journal of Information and Communication Engineering,Vol 6, No 2,pp 94-101, 2010.

5."QR Code," http://en.wikipedia.org/wiki/QR_code796