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QR Code Hiding Using Histogram Shifting Method

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***Abstract* –A Special case of information hiding is digital watermarking. Digital watermarking is the process of embedding information into digital multimedia content such that the information can later be extracted or detected for variety of purposes including copy prevention. Among numerous methods proposed in the past few years secret sharing schemes have been found sufficiently. In this paper, a new watermarking algorithm is developed using, histogram shifting. This technique is a high quality reversible method for data embedding. The proposed technique had low image quality degradation. In which all pixels between the peak and minimum point have to be shifted one unit for data embedding and choose between the locations for shifting histograms to embedded data. Here QR Code is watermarked with original image. QR code is 2D bar code used to store large amount of information. This is mainly used for secure data transmission.**

***Keywords* – QR Code, Watermark, Histogram, Security.**

I. INTRODUCTION

The objective of increasing the security level in data hiding and recover the information without any distortion after the hidden messages are extracted. The expansion of QR code is quick response code [1]. It has more accuracy and superior functionality. It contains the information in both the vertical and horizontal direction. QR code holds considerable greater volume of information. It can encode in much type of characters, numeric, alphabetic character, kanji, kana, symbols, Binary and control codes maximum capacity 7089 characters can be encoded in one symbol. In the previous method the QR Code is simply embedded in visible manner. It is used for mobile application. But QR code having the capacity of encoding text messages, contacts, URL into a single group of code. Hiding the secret image in the greyscale image is also called as steganography [2]. Steganography is the art and science of hiding information by embedding message within other ,seemingly harmless message .Watermarking is a pattern of bits inserted into a digital image , that identifies the files copyright information (author, rights, etc..,).The purpose of digital watermark is to provide copyright protection for the intellectual property that is in digital format. QR code is a trade mark for a type of MATRIX BAR CODE first designed for the automotive industry. It becomes popular due to the fast readability, large storage capacity compared to standard bar code. It consists of black modules (square dots).arranged in a square pattern on a white background. So first generate the QR CODE according to our text. Software for QR CODE generation is available through many websites, simply we type information in the software, it generate the QR CODE to the corresponding information, then save QR CODE image in any formats like JPG,PNG,TIFF,GIF etc.., .Now the information are available in single QR code image. Instead of hiding the information directly, convert the information into an image and hide the converted image with the original image. Quality of cover image degradation is also less when compare to the direct hiding of text information.

II. PROPOSED METHOD

A. Watermark Algorithm

Watermark embedding procedure is to generate the unique watermark by a secret key, which is different from all others. A common watermark is either a binary pseudo-random sequence or a binary image. There are varieties of watermark embedding methods proposed in the literature. These techniques usually embed watermarks in either a spatial domain or a frequency domain. Early watermarking techniques directly embed.

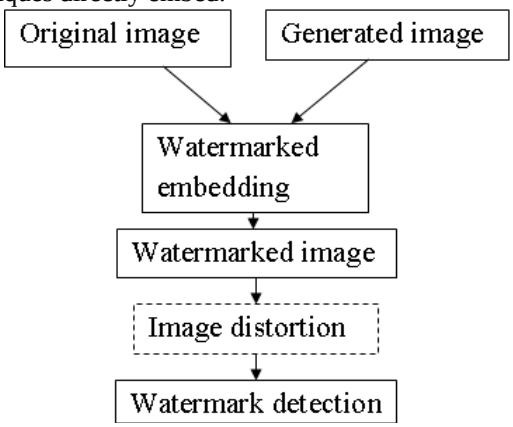


Fig.1. Example of watermarking framework

Watermark into the image (the spatial domain) by interpolating the intensity value of the original pixels in the image. These spatial domain-based watermarking embedding techniques can embed relatively large amounts of data into the image. However, they generally are not robust to image distortions. Consequently, recent watermarking techniques do not directly change the pixel values in the image. Instead, they first transform the image into another frequency domain by applying any of several methods like difference expansion, histogram based method. The figure (1) shows the general framework of watermarking technique.

B. Generate the QR Code

Generating QR code is one of the simplest method, many websites and softwares are used to generate the QR code according to the text.www.kaywa.com is one of the website used to get the QR pattern according to the information.

C. Histogram-Based Watermarking Techniques

Histogram-based watermarking techniques utilize histograms to solve the geometric invariance problem. The histogram distribution of an image is approximately invariant under geometric attacks. For this reason, some histogram-based watermarking schemes have been presented for the purpose of robust watermarking. An invariant image watermarking in the low-frequency domain by using the histogram shape and mean in the Gaussian filtered low-frequency component of images. A histogram specification based robust watermarking scheme to embed watermarks in images. A class of watermarks is selected such that the presence of certain groups of consecutive gray levels is considerably reduced with no visual degradation of images. Apply the histogram specification method to chromatic histograms and colour histograms based on segmentation of the XYZ colour space for embedding watermark in colour images. A histogram oriented blind watermarking algorithm based on the three-dimensional colour histogram to resist geometric attacks and common image processing operations. The major limitation of these methods is their incapacity to resist local transformations. As a result, a geometrically robust image watermarking scheme by using a histogram in a certain range to embed a watermark in circular regions centred on the feature points.

III. EMBEDDING PROCESS

Embedding: Here, we proposed a method to solve the major drawback of their scheme. Instead of shifting all the pixels between the peak and minimum point before embedding, we combine the shifting and embedding processes together so that just amount of pixels is shifted for a given payload. Therefore, no extra amount of pixels will be shifted. The detailed embedding procedure is given below: Input: Original 8-bit gray scale image I with MxN pixels and the secret data S. Output: Stego image Is, the peak point a, the minimum point b, length of secret data |S| and the location map L .

Step1: Scan the cover image I and constructed its histogram H1(x), x [0,255]. In the histogram, obtain the peak point ‘a’ and the minimum point b. Without loss the generality, we assume a<b.

Step2: Set P = 0. The variable k is used to indicate the amount of embedded data bits.

Step3: Scan the cover image I again. If the scanned pixel value is equal to a, a data bit s is extracted from S, set P = P+1 and go to step 4 to embed the data bit s; otherwise, go to step 5.

Step4: If the data bit s is 1, then the value of scanned pixel is set to a+1; otherwise no change has to be made for this pixel. Go to step 3 to continue the embedding processes.

Step5: If the scanned pixel value is within the range (a,b), then the pixel value is add by one. Record the Position of pixels whose pixel values is equal to b.

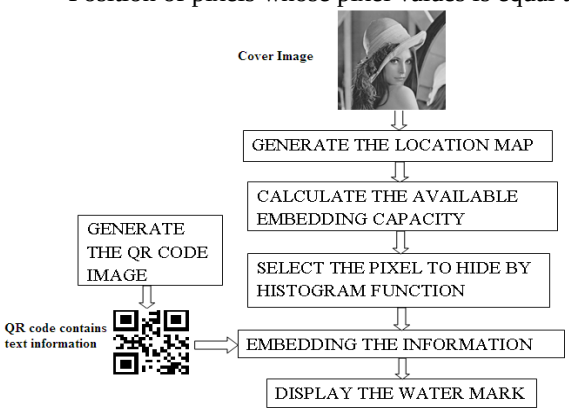


Fig.1. Block diagram of QR code Hiding

The figure (3) given below shows that pixel information of the image and its corresponding histogram.

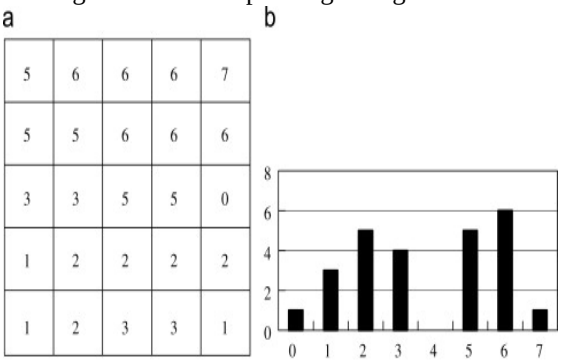


Fig.3. Example of histogram based data hiding (a) cover image pixel value and (b) histogram of the pixel value

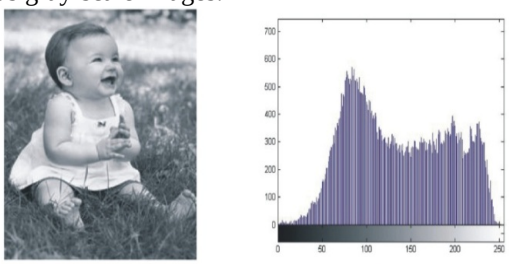
B. Histogram

In digital image processing, a simple and effective tool is histogram. Histogram is an important overall feature of the digital image, which reflects areas corresponding to the different gray values or the percentage of image [3]. Histogram has nothing to do with the location of pixels, and not involves the shape problem of the image. In theory, each gray value has equal probability in the image, but for a specific image, the emergence probabilities of all gray values are not the same. Some ones are too small to 0, while others’ frequency is very high. The statistics results show that the probability of gray values at the two ends in the interval [0 255] is often less than the probability of gray values between [0 255], so it can be said that the image histogram describes the process from the average gray value images to the ends of gray values. Making full use of the pixels with the highest and lowest frequency can hide some information to achieve to embed

watermark aim. Image histogram is a statistical expression. For an image, its gray histogram reflects the different gray-scale map. Strictly speaking, the gray-scale image statistical Histogram is a 1-D discrete function, which can be written:

$H(K) = n_k \quad k = 0,1,\ldots L-1$

Here, n_k denotes the pixels number with value k of the gray image $f(x, y)$. Image histogram provides the distribution of gray value in a variety of circumstances, but also it can be said that all give an overall description of a gray value image [5]. For example, an image is showed in Figure (i), while its gray histogram can be expressed as Figure (ii), the horizontal axis represents different gray class, and the vertical axis represents the pixel number of various gray-scale images.



(I) (ii)

Fig.4. Histogram based data hiding
(i) cover image and (ii) image histogram

C. *Location Map*

Divide Pixel Pairs into different sets initialize various indexes like S1, S2, S3, S4, S5, S6 values. Set S1 contains all pixel pairs that satisfy the difference value condition. Set S2 contains all expandable pixel pairs that are not in S1. Set S3 contains all pixel pairs whose difference value is less than threshold. Set S4 contains all pixel pairs whose difference value is greater than threshold. Set S5 contains all changeable pixel pairs embedding is performed in set S5.set s6 contains all non changeable pixel pairs. Calculate the available embedding capacity. Select the pixel to hide by histogram function.

IV. Extraction Process

Extraction and restoration: The extraction and restoration detailed procedure is listed below: Input: Stego image Is, the peak point a, the minimum point b, the location map L and the length of the secret data |S| [4]. Output: Original 8-bit gray scale image I and the secret data S. the steps involved in extraction process are given as

Step1: Set P = 0.

Step2: Scanned the image in the same order as in the embedding phase. If the scanned value is 'a', let P = P+1 and a bit 0 is extracted. If the scanned value is a+1, let P = a+1 and a bit 1 is extracted. If the scanned value is within the range (a, b) then subtract one from the scanned pixel values. Then position of the scanned pixel is recorded in L, then the value of scanned pixel is set to b.

Step3: Repeat step 2 until P = |S|.

Fig (5) shows the extraction process.

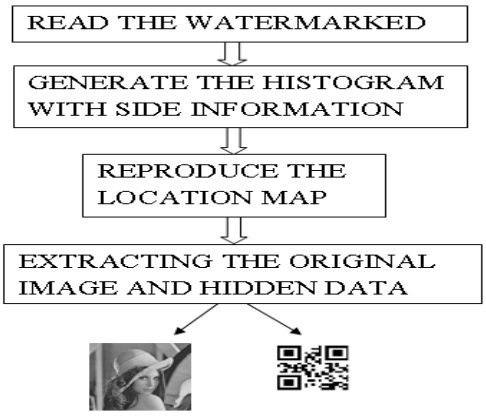


Fig.5. Block diagram of QR code Extracting

V. Experimental Results

In the histogram method the location maps are used to find the pixel of the image where the secret image has to be embedded [7], from which the secret images has to be embedded in the invisible manner. After the location map finding, the water mark of the image is obtained, then according to the side information the water marked image is recovered.

VI. Conclusion

In this paper, we have described the use of QR code for the security purposes. Instead hiding the text behind the cover image, QR code is generated according to the information is hided gives low degradation of the original image. Advantage of this method is we have to store the lot of data and degradation of the quality of the original image is also less.

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