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Review on image watermarking based on LBP transform technique

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ABSTRACT

In this review paper, we describe a digital image watermarking technique applying local binary patterns (LBP). Local binary patterns are best known for their rugged texture defining capabilities and digital watermarking applied in proving the copyright of a multimedia content. In this work, we study a LBP synthesis or inverse LBP identical process and its suitability to the digital image watermarking. The LBP synthesis process varies the near pixels values so that the LBP measured from these pixels is the desired value that we want to synthesize. This procedure takes into account the requisition of a digital image watermarking such as robustness and imperceptibility to watermark removal attacks. Due to the character of LBP synthesis, it is necessary that only a few pixels of a provided block are changed to embed the watermark. The simulation output shows that the technique is rugged to the rotation, JPEG compression, and scaling attacks. This LBP synthesis procedure could also be utilized to watermark sensor data for justifying the ownership. We are positive that this work would progress to a new research direction in the validation of digital content. In this work, a binary watermark is embedded into the image blocks by changing the neighborhood pixels conferred to the LBP pattern. However, various image blocks can have the similar LBP pattern, which can lead to false detection in watermark extraction procedure. In different words, one can change the host image deliberately without affecting its watermark message. In addition, there is no encryption procedure before watermark embedding, which leads to another potential security issue. To explain its weakness, two special copy-paste attacks are suggested in this paper, and several experiments are organized to prove the effectiveness of these attacks. To solve these issues, an enhanced semi-fragile watermarking based on LBP operators is conferred.

Keywords: *LBP; local binary pattern; digital image watermarking; LBP synthesis*

1. INTRODUCTION

With the comprehensive utilization of the digital technology, digital media (especially digital images) has come to play a very important role in day to day lives. However, the increasing utilization of image and video editing tools lead to a serious threat. Ownerships and the content of the digital media are being severely shattered. As an adequate way of addressing this issue, the digital watermarking scheme has developed at a historic moment. Generally, digital watermarks can be divided into three categories consisting robust watermarks, fragile watermarks, and semi-fragile watermarks [1]. As the name refers, robust watermarks are rugged against general image processing operations and malicious threats. Because of this property, robust watermarks are extensively used in the copyright protection [2]. Conversely, fragile watermarks are susceptible to any improvement, which are typically used in an image content authentication [3]. A Semi-fragile watermark destroys the advantages of the above two watermarks. It is exempted to the general image processing operations and sensitive to malicious threats. Therefore, semi-fragile watermarks have attained more attention from the researchers.

Local binary patterns (LBP) are normally used as texture labels in different applications [4]. Local binary patterns are very simple but very potent texture operators. Local binary patterns in general measured by verging the neighborhood of each pixel and the comparison outputs are produced as a binary pattern to explain the relative differences or the texture. The neighborhood topology can also be selected based upon the problem indicating its flexibility. Rotational invariance can be attained by uniform LBP. A complementary LBP can be utilized to calculate not only the texture patterns but also their spatial and contrast strength.

Especially in the facial recognition, histograms of the LBP codes of individual facial elements are mixed to form a global face descriptor. These histograms are related to the similarity for the face recognition. An LBP has also been utilized in preprocessing step for the facial detection [5], [6]. An LBP has been applied for watermarking by Chang et.al. [7]. Chang et. al. applied LBP methods for watermark embedding and detection. In their work, LBP is only used to generate the watermark bits to be embedded. In the past few years, a large number of semi-fragile watermarking techniques have been showed for the image authentication [8]. In [9], Zhang and Shih suggested a novel semi-fragile watermarking technique based upon the local binary pattern (LBP). Although this technique is computationally forthright and can locate the tampered region to a certain quantity, it suffers from a major fault that various image blocks may have the same LBP pattern, which will output in the detection errors during the watermark extraction. Lim, Lee et. al applied an invertible watermark for detecting tampering of the biometric images[10]. Ghulam et. al. measured LBP histograms on steerable pyramid transform based to appear in a feature vector which can analyze an image forgery[11].

2. LITERATURE SURVEY

There are various algorithms utilizing original data, such as audio, video, image and text, to hide specific information like logos or personal signatures in the spatial domain. In other words, if the original data is an image, then processing would be into the pixel values without modifying the data into another domain. The widest and simplest technique in the spatial domain is Least Significant Bit (LSB), which replaced the first bit in each pixel by information that goals to hide [12].

LOCAL BINARY PATTERNS (LBP)

Ojala suggested about the LBP operator which acknowledge the 3x3 neighborhood of each pixel in the given image, and every neighboring pixel is a threshold with respect to the center pixel value *Ic*(*x, y*) and finally, the output is taken in the binary form [7]. The center pixel value is recouped by the decimal equivalent of that binary number to generate the LBP image. An LBP operator is by definition invariant against to any monotonic conversion of the gray scale, because the order of the gray pixel values in the image remains the same, the output of the *LBPR* operator remains same.

LBP Operator

The LBP operator is a very simple texture descriptor that was first suggested by Ojala et al. in [13]. It reflects the local contrast between the central pixel value and the value of its neighborhood pixel, and this spatial relationship is finally illustrated in a binary pattern. With continuous improvements to the algorithm of LBP, many modified LBP operators have been introduced, such as uniform LBP and rotation invariant LBP. The definition of LBP operator depends on a circularly symmetric model. Given a radius *r*, a circularly symmetric neighborhood *p* can be obtained by:

$$p = (2r+1)^2 - 1 \tag{1}$$

For a local region (p, r), the LBP pattern of the central pixel is defined as:

$$LBP(x_c, y_c) = \sum_{i=0}^{p-1} 2^i \times S(g_i - g_c) \tag{2}$$

where g_c is the pixel value in the central pixel (x_c , y_c) and g_i (i= 0,1,….. ,p- 1) represents to the pixel value in the neighborhood. *S*(*x*) is a sign function given as:

$$S(x) = \begin{cases} 1, & x \geq 0, \\ 0, & \text{otherwise.} \end{cases} \tag{3}$$

LBP SYNTHESIS

An LBP synthesis or inverse LBP mapping is the reverse of the LBP calculation process. Given an LBP bit pattern to be embedded into the data or in an image, the surrounding pixels of the center pixel is changed such that the calculation of LBP on the changed block results in the similar pattern synthesized. For the image processing applications the main objective is to synthesize a given bit pattern, for each bit of the LBP changed the corresponding pixel values of the image such that the thresholding condition should be satisfied.

If one of the bits in a bit pattern which is to be synthesized is ’1’ then the corresponding neighborhood pixel value of the image is changed such that it is bigger than the center pixel by an amount equal to the threshold value to satisfy the thresholding criterion. For an embedded bit ’0’ the value of the neighborhood pixels is reduced by the threshold values so that during the calculation of the LBP it output ’0’ after magnification.

If *wm*_bit = = 1

$I_n = I_c + \Delta$

else.,

$I_n = I_c - \Delta$

The threshold value is selected to satisfy the imperceptibility criterion of an image watermarking. A larger threshold means large changes in the neighboring pixels, output in the degradation in the image quality but the cost increase in the watermark extraction errors.

IMAGE WATERMARKING BY USING LBP

The Digital image watermarking process includes embedding or hiding a set of bits that shows the owner of the content in a given image with negligible impact on the image quality. For a better user experience, the modification must not be perceptible to the end user. These embedded watermark bits are again obtained from the image to confirm the right owner of the content. This extraction must be rugged to several intended and unintended calculations that happen on the watermarked image.

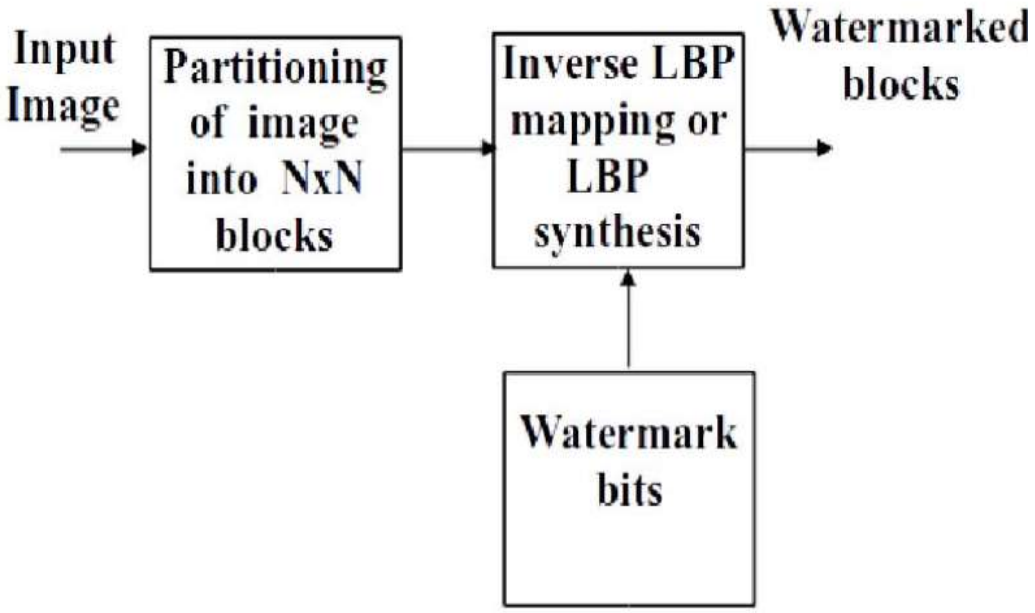

Fig1. General Watermark embedding process[14]

3. CONCLUSION

Due to increase in an exchange of the digital information, there is a high need for the data security. The different multimedia documents such as audio, video, images get effected because of data transmission through various media. The users are expecting more adequate solutions which can confirm copyright protection and authenticity of the documents to be maintained. In this review paper, we showed an image watermarking scheme, that uses inverse LBP mapping or LBP synthesis. In this review paper of watermarking scheme describes a new advancement in the digital image watermarking for 256×256 which will extend to 512×512 in which the watermarking method will be considered with the help of LBP(local binary operate) algorithm and it will be better than the existing system.

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