An Advanced Method of Fragile Watermarking Using Local Binary Pattern (LBP)

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Abstract
This Paper Proposes a Modified method of fragile watermarking. The watermarked era is based on Local Binay Pattern (LBP). The proposed method is having recovering capacity with full detection capability. LBP is an operation which portrays the surroundings of a pixel by creating a LBP code.LBP is generally utilized for face identification, texture classification, pattern recognition and image classification. In this method, we have utilised the spacial data to create watermarking. The watermark is inserted in the image block of 3X3 pixel size and this validation information is utilised for image tamper detection and recovery. Recover data of tampered block is figured by using mean of the block. The watermark information and the recovered data is inserted into 2 LSB of the pixel.The experimental consequences of this method is superior than previous LBP based watermarking methods based on the tamper detection rate, recover ability and picture quality.

Keywords
Fragile watermarking; Least Significant Bit (LSB);Local Binary Pattern (LBP); Tampering; Texture.

I. Introduction
Today's general public and day by day life is significantly changed because of the real commitment of web and computerized gadgets. Computerized information like sound, video and pictures are anything but difficult to store and transmit with the assistance of advanced gadgets and web. Advanced information is anything but difficult to duplicate and change over the web. This progressions in computerized information by unapproved changes the honesty of information and offering ascend to numerous issues. This unapproved change is getting to be risky issue in numerous regions, for example, copyright security, content validation and data stowing away. There are some different issues like responsibility for, video and archives. To tackle such issues we can utilize an advanced mark or watermark. Digital image watermarking is the procedure of inserting an undetectable advanced watermark into another advanced picture. F. A. P. Petitcolas et al.[2]studied diverse data concealing systems as appeared in Figure 1.Watermarking has been utilized from last numerous years. Watermarks have been utilized for postage stamps, coin and other government records.
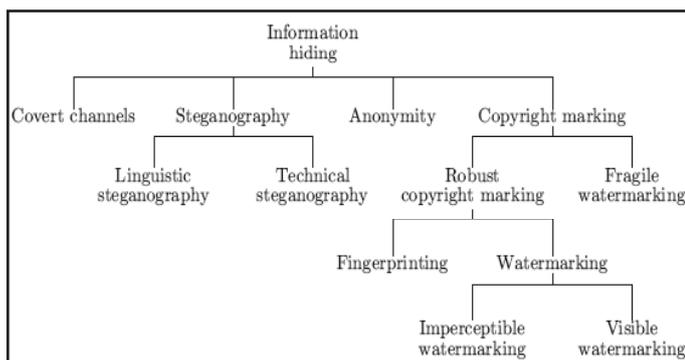

Fig. 1: An Overview of Information Hiding Techniques

In the event that ten rupee banknote is held against the light, it will demonstrate the watermark. Numerous watermarking calculations were created to take care of the issue of unapproved change of advanced information. These calculations or techniques are having its own particular leeway and burden. As of late some watermarking calculations have utilized Local Binary Pattern is for the most part utilized for face recognition and texture classification. Local Binary Pattern (LBP) was initially said by Harwood et al.. The Local Binary Pattern example (LBP) administrator is a sort of composition descriptors proposed by Ojala, M. Pietikainen, and D. Harwood [4-5]. The neighborhood relationship inside the pixel is measured by ascertaining the nearby difference of the pixel and it appeared by the LBP administrator.

The watermarking strategies created by utilizing the idea of Local Binary Pattern are having great alter discovery and recuperation. The different element of LBP are utilized for creating watermark. LBP can be utilized with various range and distinctive examining focuses.

II. Literature Survey
Watermarking is the process of embedding digital signal in the digital data. Lots of works have been in the field of watermarking and in this section we will discuss about watermarking. I. J. Cox and Matt L. Miller outlined some desirable characteristics of digital watermarks. The characteristics are as Robustness; Watermark should be difficult to notice, Tamper resistance, Bit rate, Modification and multiple watermarks and scalability. They introduced a mathematical framework which is used for analyzing somewatermarking techniques. They have made a review of some proposition for watermarking and attempted to discover qualities and shortcomings [1].

F. A. P. Petitcolas , R. Anderson, and M. G. Kuhn performed study on information hiding and steganography. They have considered a scope of utilizations in their review. They portrayed various assaults on data concealing frameworks and a device StirMark [2].

Jun-Dong Chang, Bo-Hung Chen and Chwei-Shyong Tsaiproposed LBP based delicate watermarking method with recuperate capacity. Their method uses the LBP administrator to produce validation information. They figured the watermark from the picture itself. They have computed verification information in view of the rule of LBP. The confirmation information is w1 and w2 bits, S vector and M vector. Which are inserted into every picture obstruct with 3×3 pixels size for alter identification and recuperation. The recuperation data is gotten by ascertaining the mean of piece, and afterward the mean quality is changed over into a double string which is inserted into eight neighboring pixels' LSBs of every picture obstruct for picture recouping. Since the watermark is immethodted into the 2-LSBs of pixels of every picture obstruct, the straightforwardness of watermarked pictures stays better. Jung-Dong's method is having great result for picture alter discovery and recuperation as contrast with Zhang's watermarking scheme[3]. T. Ojala, M. Pietikhenl and D. Harwood dealt with surface grouping. They have assessed the execution of some surface measures. The

composition measure has been effectively utilized as a part of various applications. They have proposed some surface measures like Gray Level Difference Method, Texture Measures, Center-symmetric Covariance Measures and Local Binary Patterns. A composition unit (TU) is spoken to by eight components, and the surface unit is having the qualities like 0 ,1 or 2 and acquired from the square of 3×3 . The aggregate conceivable composition units are 6561 portraying the three level examples in 3×3 piece of pixels. The composition range is only the event of conveyance of surface units figured over a locale.
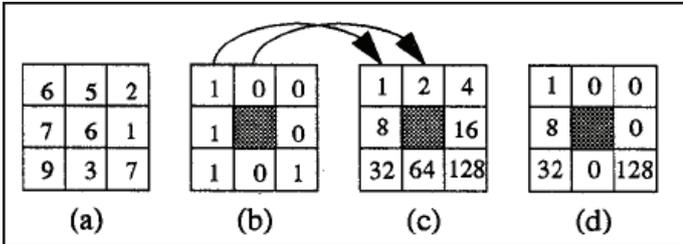

Fig. 2: Representation of the Texture Unit

They have depicted a two-level variant. It gives a decent approach to speaking to nearby parallel examples (LBP) in a surface. Two level form is having just 256 conceivable surface unit and three level variant is having 6561 conceivable composition unit. In parallel case, the first 3×3 neighborhood (Fig. 2.a) is looked at by the quality ofthe focus pixel. The estimations of the pixels in the thresholded neighborhood (Fig. 2.b) are increased by the weights of the separate pixels (Fig. 2.c). The outcome is appeared in Figure 2.d. Finally estimations of these eight pixel are included and we will get the number as 169 of this surface unit [4-5].

Zhang Wenyin and Frank Y. Shih presented LBP in picture watermarking. They have created LBP based semi-delicate watermarking. They have presented single level and multilevel watermarking utilizing LBP. Their proposed strategy is strong against picture preparing operations like shading parity and JPEG pressure. Their strategy has kept up great delicacy to a few operations, for example, sifting, obscuring and has great alter discovery rate [6].

G. Voyatzis and I. Pitas presented toral automorphisms for confused blending of computerized watermark. Their study depends on hypothesis of toral automorphisms which is valuable instrument in computerized copyright insurance. A discrete torus automorphism accomplish better change in the two-dimensional network [7-8].

III. Our Method
In this area we are exhibiting the adjusted technique. In the first place the picture is partitioned in the pieces. At that point we will figure LBP of current picture square and normal of piece, which are installed into the two LSB of the pixels. At that point at long last alter recognition and recuperation technique is clarified.
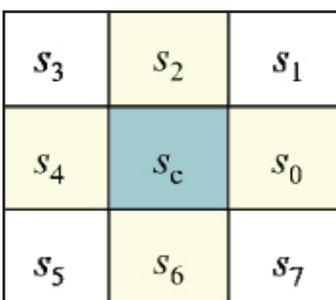

Fig. 3: The (8,1) Local Binary Pattern Used in modified method

The watermark generation and embedding procedure for each image block with 3×3 pixels is described as follows:

Step 1:   Set the two LSBs of each pixel of original image I to $(00)_2$

Step 2:   Convert all pixel values of $P_0, P_1, \ldots, P_7$ to binary.

Step 3:   Calculate the S Vector as,

$S = P0 \oplus P1 \oplus P2 \oplus P3 \oplus P4 \oplus P5 \oplus P6 \oplus P7$

We will get the 8 bit S vector as $s_0, s_1, s_2, s_3, s_4, s_5, s_6,$ and s_7

Step 4:   Calculate the w1 and w2 bits as,

w1=s0⊕s2⊕s4⊕s6   (2)

w2=s1⊕s3⊕s5⊕s7   (3)

Step 4:   Insert watermark bits w1 and w2 into 2-LSBs of the center pixel value.

Step 5:   Calculate pixel mean of the current image block then convert it into the binary format as Mvector.

Step 6:   Embed the Svector and Mvector into the 2-LSBs of the respective image block .

After embedding w1,w2 bits, S and M vector a watermarked image $\bar{I}$ is formed.

B. Image Tamper Detection and Recovery
During the transmission of image from source to destination via internet there may be possibility of tampering of image by various reasons. In such a scenarios tampered region of image should be detected and recovered by the proposed scheme [9]. The procedure for the same is as follows:

Step 1:   Set the values of 2-LSBs of each pixel value for each image block as $(00)_2$.

Step 2:   Generate $\bar{S}$vector of current image block by Eq. (1) and calculate the values of $\overline{w}1$ and $\overline{w}2$ byEq. (2)and Eq. (3) respectively.

Step 3:   Compare $\overline{w}1$and $\overline{w}2$with extracted watermark bits w1 and w2. If they are not the same, then the current image block is denoted as "tampered block".

Step 4:   Compare $\bar{S}$vector with the extracted Svector. Ifthey are not the same, then the current block is denoted as "tampered block".

Step 5:   Compare M vector with the extracted Mvector. If they are not the same, then the current block is denoted as "tampered block".

Step 6:   If Step 3 , Step 4 and Step 5 occur, the current block is judged as "tampered block", and then recover it by the extracted mean with Mvector.

In our approach we detect the tampered blocks are detected by using the number of pixel values changed in the received image by comparing with the previously calculated mean, S and M vectors.

IV. Experimental Results
For experiment we have utilized four distinctive pictures. All the pictures are of size 512×512 pixels. To start with we have made the PSNR examination of watermarked pictures. Table-I demonstrates the PSNR correlation altered strategy with Jun-Dong Chang's method and Zhang's technique. From the PSNR values we can watch that in the wake of including the watermark the picture quality will be great. The progressions made in picture by including the watermark is exceptionally hard to recognize by the human eye.

Table 1: PSNR of Watermarked Images

Watermarked Images Image	Modified Method	Jung-Dong Chang's Scheme	Zhang's Method
Baby	43.5970	44.3285	41.3728
House	43.5476	44.0217	42.6453
Flower	43.6496	43.8853	41.2847
Scenary	43.5313	44.6126	42.5264

In Table 2, the correlation of alter discovery rates between the adjusted method, Jun-Dong Chang's method and Zhang's strategy is appeared. The segment is indicated as (Number of Detected Image Blocks)/(Number of altered picture blocks). We can watch the execution of the adjusted technique is superior to anything Jun-Dong Chang's method and Zhang's strategy. The rate of alter identification in Jun-Dong Chang's method and Zhang's technique is more than 96 % and 52 % separately and the alter discovery rate of our adjusted strategy is 99 % which is nearly great.

Table 2: Comparison of Tamper Detection Rates

Image	Modified Method	Jung-Dong Chang's Scheme	Zhang's Method
Baby	3852/3872	3688/3872	2018/3872
House	1408/1428	1347/1428	679/1428
Flower	450/458	453/458	264/458
Scenary	645/652	631/652	332/652

Presently Table 3 portrays the correlation of recouped picture quality between the proposed method alongside Jun-Dong Chang's method and Zhang's strategy. The nature of recuperated picture is like Jun-Dong Chang's method. It can obviously watch that recouped picture nature of the proposed technique is better that human vision is difficult to investigate the distinctions. We can not effectively discover changes in the recouped picture in contrast with unique picture.

Table 3: PSNR of Recovered Images

Image	Modified Method	Jung-Dong Chang's Scheme	Zhang's Method
Baby	42.8816	46.2182	N/A
House	43.5233	43.3126	N/A
Flower	43.5075	44.5287	N/A
Scenary	43.3747	45.3211	N/A

V. Conclusions and Future Work

In this work we talked about the delicate watermarking method for picture alter recognition and recuperation. Our work depends on the idea of Local Binary Pattern (LBP).The LBP is demonstrating the area data of square. We watched that LBP based delicate watermarking method is having great result for picture alter discovery and recuperation. In the event that the pixel data of picture is changed or adjusted it will influence the LBP of that specific piece and it shifts with the first LBP of the square. Along these lines, in this changed method utilizes LBP as verification information for self-installing. As the verification data is inserted into the 2 LSB of the pixel of every picture hinder the picture nature of watermarked picture stays tasteful. The alter recognition rate of this strategy is superior to anything Jun-Dong Chang's method and Zhang and shih's watermarking technique.

The different component of LBP can be utilized to create watermark. LBP can be utilized with various span and diverse examining focuses in future work.

References

[1] I. Cox, M. L. Miller,"A review of watermarking and the importance of perceptual modeling", Proceedings of SPIE, Human Vision and Electronic Imaging II, Vol. 3016, 1997, pp. 92–99.

[2] F. A. P. Petitcolas, R. Anderson, M. G. Kuhn,"Information hiding - A survey", Proceedings of the IEEE, Vol. 87, No. 7, 1999, pp. 1062– 1077.

[3] Jun-Dong Chang, Bo-Hung Chen, Chwei-Shyong Tsai, "LBP-based fragile watermarking scheme for image tamper detection and recovery", IEEE 2nd International Symposium on Next- Generation Electronics (ISNE), pp. 173-176, February 2013.

[4] T. Ojala, M. Pietikainen, D. Harwood,"Performance evaluation of texture measures with classification based on Kullback discrimination of distributions", Proceedings of the 12th IAPR International Conference on Pattern Recognition (ICPR 1994), Vol. 1, pp. 582 - 585.

[5] T. Ojala, M. Pietikainen, D. Harwood,"A Comparative Study of Texture Measures with Classification Based on Feature Distributions", Pattern Recognition, Vol. 29, pp. 51-59.

[6] Z. Wenyin, Frank Y. Shih,"Semi-fragile Spatial Watermarking Based on Local Binary Pattern Operators," Optics Communications, Vol. 284, Issues 16–17, 2011, pp. 3904-3912.

[7] G. Voyatzis, I. Pitas,"Chaotic Mixing of Digital Images and Applications to Watermarking," Proceedings of European Conference on Multimedia Applications, Services and Techniques (ECMAST '96), Vol. 2, May1996, pp. 687-695.

[8] G. Voyatzis, I. Pitas,"Applications of ToralAutomorphisms in Image Watermarking," Proceedings of the International Conference on Image Processing, Vol. 2,1996, pp. 237-240.

[9] Shakil A. Pinjari, Nitin N. Patil,"A Modified Approach of Fragile Watermarking Using Local Binary Pattern (LBP)", International Conference on Pervasive Computing (ICPC) -1-4799-6272-3/15(c)2015 IEEE.

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