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An improved data hiding approach on color images using difference expansion algorithm

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***Abstract*---**Nowadays, the extra focus is compensated to safeguard information sending across network. To confirm protection of cover image, it is encoded and information hiding away is made in encrypted image. In incidental conditions, expect to apply color images as cover image and huge measure of information to hide away in image. In this paper, a clever lossless information concealing procedures produced for color images utilizing pixel assessment strategy and Difference Expansion Algorithm. The Pixel assessment characterizes, the most standard way to deal with gauge class districts from satellite-decided guides. It incorporates concluding the amount of pixels doled out to a specific effective class and expanding it by the pixel district. The information concealing strategy for double images using the weighting worth of Pixel Esteem Differencing. In this procedure, Pixel Estimation plot takes advantage of both the connection between the shading channel and the relationship between the contiguous pixels by assessing the innovative pixel values on shading channel contrasts. Then, at that point, each file esteem is assessed by utilizing the normal of its four point of reference neighbors. On the off chance that the contrast between the list esteem and its prescient worth is liberally proportioned than a limit, the pixel will be skipped. In the event that not, the four point of reference neighbors are utilized to imagine the current file for the time of information installing and recovering. Moreover, the Difference Expansion algorithm is utilized in lossless stowing away for highly classified data into forecast error. The estimate error of the ordered image will likewise be diminished. The speculative outcome that the

proposed technique not exclusively have the option to improve limit in any case, can hold distinction of excellent image. The presentation of the proposed strategy to be improved than those of the current plans in conveyances the best image quality.

***Keywords*---**Encryption, Difference Expansion, Pixel Assessment.

Introduction

The rapid improvement of digital world and the status of the network, security of data transmission across the network are gaining popularity. This information exchanges the secret data to the receiver safety and rapidly is very important (Ching-Hui Huang.,2008). Data hiding means to hide the data into the original image. The application of data hiding divided into two ways. They are watermarking and steganography. The watermarking incomes owner's identification into digital media. The meaning of steganography is message protection by signal embedding (Fridrich.,1999) Reversible Data hiding, this is one of challenging research domain (Y.-Q. Shi.,2016).

The Reversible Data Hiding(RDH) scheme separated into two kinds: Room Reservation Before Encryption (RRBE) and Vacating Room After Encryption (VRAE). The RDH method for encrypted color image inspire by the approach. The framework relies on the correlation between neighboring pixels in the decrypted image for correctly extracting the hidden data and restoring the original image (Ioan Catalin Dragoi.,2013). In the past decade, many lossless data embedding (Fridrich.,2002; Pinho, A.J., 2006; Tian, J., 2003; Fridrich., 2001) has been developed. This paper proposes to hide the data into the color images using the Pixel Estimation scheme. In this scheme, modify the Least Significant Bits (LSBs) and Lossless Data Compression (LDC) technique.

Previous Arts

(Hong.,2012) concentrated the error rate of Zhang's process by entirely exploit the pixels in manipulative the smoothness of each one block and by side match. The extraction and recovery of blocks are performed according to the descending order of the complete ease dissimilarity between two candidate blocks, then enhanced the blocks can more be used to evaluate the efficiency of unrecovered blocks, which is referred to as side match. (Zhang.,2013) alienated the encrypted image into some blocks. By reversing 3 LSBs of the partial of pixels in respective block, room can be removed for the entrenched bit.

(Catalin Dragoi.,2018) focused the pixel prediction scheme, using Vacating Room After Encryption (VRAE), it will give a competent recovery of the original image. But the extraction has been done well technique only in original image; the secret image has some of the problematic and the data is very noisy. (Ching-Hui Huang.,2008) engrossed the lossless data hiding, using the Difference Expansion method applied to the secret image is to keep the good quality after the embedded image. The result of embedding bits is high; however, the values of

Peak Signal Noise Ratio (PSNR) and the entropy of recovered image are very low compare than other methods.

Proposed Method

Propose a novel technique, Data Hiding in RGB images using the Pixel Estimation scheme. This method contains two parts, data hider and the receiver (Fig 1). In the Data Hider section, an original RGB image was taken, then apply the encryption technique using stream cipher encryption is called as the stego-image or encrypted image. After the encryption process, apply the Pixel Estimation Scheme to hide the secret image into the original image. This process is called as the Embedding process.

In this method, takes advantage of both the connection between the shading channel and the relationship between the nearby pixels by assessing the innovative pixel esteems on shading channel contrasts. Then, at that point each list esteem is assessed by utilizing the normal of its four point of reference neighbours. In the event that the distinction between the file worth and its prescient worth is liberally proportioned than a limit, the pixel will be skipped. If not, the four point of reference neighbours are utilized to imagine the current record for the time of information implanting and recovering. In the receiver side holds the Data Extraction and Image Restoration.

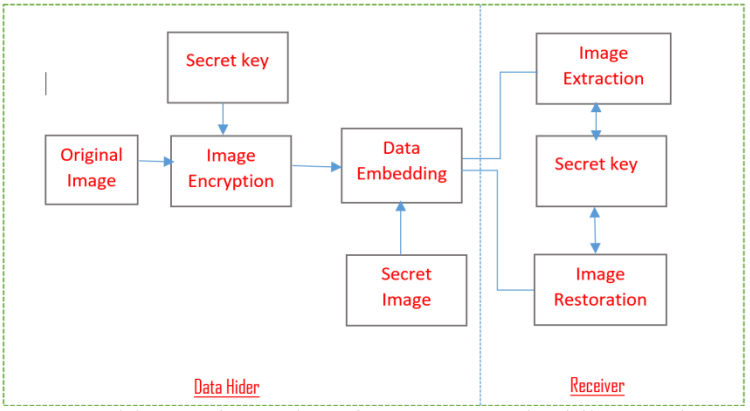

Figure 1. Data Hider and Receiver for Image Embedding and Restoration

Data Encryption

Consider color RGB images pixel is denoted as 'L', for each color plane the value of L is equal to 8. The exclusive-or is used to encrypt the original image based on stream cipher encryption is **C € {R; G; B}.** The pixel of the consistent encrypted channel is computed as,

$$\mathbf{El} = \mathbf{C_l} \oplus \mathbf{r_l} \qquad (1)$$

The current pixel is l €{1,2,….L} ; ⊕ - Exclusive-OR operator ; r – pseudo random bit stream sequence. The value of 'r' is a fixed unique key together with some arbitrarily chosen pixel value from the current image. During the encryption

process and Reversible Data Hiding scheme, the selected bits must not be changed. The data hiding scheme, the first two LSB planes of color channel doesn't alter. The value of l € {1, 2}, but the value l is encrypted. Hence ' r' will be designated for this two planes and the nominated bits are unaffected.

Data Embedding

After the data encryption follow the Data embedding scheme. Here, the data hider to enclosure a secret data in a cluster of 'n' pixels values from an encrypted color channel. The data hider first chooses the value form the corresponding channels: G or RB. The embedding into channel 'G' allows less embedding capacities, that is it requires the smaller value of 'n'. The embedding into channel 'R and B' ensures less embedding distortion, that is it requires a higher value of 'n'. The hidden data is in the pixel l € {3, .. , L-2}, 'l' was selected from the pixel, since the first two Least Significant Bit planes are used by the encryption scheme.

The specific channels are then split into the A; B and C pixel sets (Fig 2). The A and B only contain the hidden data. The pixel in set C is unchanged and will be used to predict the values of the host pixels from A and B.

A	B	A	B	A	B
B	C	B	C	B	C
A	B	A	B	A	B
B	C	B	C	B	C
A	B	A	B	A	B
B	C	B	C	B	C

Figure 2. The distribution of pixels A, B and C

The embedding process Block A is processed. The data hiding scheme is randomly distributing the pixel from A into n pixel. The first channel of G will be used for embedding additional information: a 64-bit identifier. The payload is hidden into the selected channels, one bit per group either into the remaining groups of G or into the ones of R and B.

For the joint method, the hidden data can be read and extracted from the decrypted image. This method inserts a hidden bit p into the current group by keeping pixels unchanged for p=0 or l bit for l=1.

$$E`_i(i) = \{ \sim E_l(i) \text{ , if } p=1 \} \quad ; \qquad E`_i(i) = \{ E_l(i) \text{ , if } p=0 \} \tag{2}$$

The current group of l pixel parity determines the value of s. The group dimension n need be an odd number to eliminate the risk of decoding errors. Reversing the l bit values of all the pixels in the group will also reverse the parity value of s. The bit p replaces the parity s.

$$s=E_l(1) \oplus E_l(1) \oplus +\ldots \oplus E_l(n) \tag{3}$$

$$E`_i(i) = \{ \sim E_l(i) \text{ , if } s \neq b \} \quad ; \qquad E`_i(i) = \{ E_l(i) \text{ , if } s=b \} \tag{4}$$

At the decryption stage the hidden data is read, bit by bit, from the parity value of the l
Encrypted bit plane of each pixel group.

Data Extraction and Image Restoration:

In the receiver the side the first stage is Data extraction and the second one is image restoration using decryption key. The r bit plane is used to encrypt the image. Now the encrypted image is decrypted using the following equation,

$$\mathbf{C`_l = E`_l \oplus r} \quad (5)$$

The decrypted color channel contains the hidden data, c € {R, G, B }. The decrypted image also split into 3 sets A, B and C as same as the encryption stage. The proposed scheme computes the difference value of channels are U` and V`.

$$\mathbf{U` = R- G`} \quad (6)$$
$$\mathbf{V`= B- G`}$$

The 64 bits of the watermark identifier entrenched into the first 64 collections of channel G. The additional information is recovered, if the identifier is found. The first groups at decoding G″ are the revised version of G. The l bit plane of every pixel set in G′ belonging to the A and B sets are overturned. The difference value of G″ is generated,

$$\mathbf{U'' = R- G''} \quad (7)$$
$$\mathbf{V''= B- G''}$$

The Block A is processed first; a single estimation value is determined for each pixel. The proposed scheme calculated two estimated values are,

$$\check{x}_U = \frac{cU_1 + cU_2 + cU_3 + cU_4}{4}$$
$$\check{x}_V = \frac{cV_1 + cV_2 + cV_3 + cV_4}{4} \quad (8)$$

The estimation error value of each pixel is calculated as,

$$\mathbf{e'_U\ (i) = U'\ (i) - \check{x}_U\ (i)}$$
$$\mathbf{e'_V\ (i) = V'\ (i) - \check{x}_V\ (i)}$$
$$\mathbf{e''_U\ (i) = U''\ (i) - \check{x}_U\ (i)}$$
$$\mathbf{e''_V\ (i) = V''\ (i) - \check{x}_V\ (i)} \quad (9)$$

The original value G(i) of a pixel from the current group was either G(i) of pixel from the current group was either G′(i) or G″(i). The original values for the current group are designated [13]. Afterward the pixels in the A set are reestablished, The B set pixels are processed. These pixels use the estimation context, this context is molded from the reference set C and the restored set A.

Experimental Results

In this section, the performance of the proposed lossless data hiding scheme is evaluated in color images using the pixel estimation scheme. Here used four indexed images each sized 256x256 to test both the existing (Ching-Hui Huang.,2008) and proposed methodology. The PSNR bit rate results obtained by the proposed scheme under three error rate restraints are paralleled to those generated by the Vacating Room after Encryption scheme (Y.-S. Kim.,2007). Do not abuse the association between color channels (I.-C Dragoi.,2017), they are not needful on it and all three channels can be used for embedding data.

In the proposed scheme, embed the data into two channels that is R and B preserving G as a position for figuring U and V. Obviously this restriction in remunerated by the superior estimation presented by U and V. The test cover image "Sky" without of fabricating overflow problem (Fig3). The Peak Signal Noise Ratio value also differ compare than existing method. The proposed method to test the different color images as mentioned in graph (Fig4). It will always give the enhanced result relate than prevailing PSNR value.

Figure 3. Embedded Image

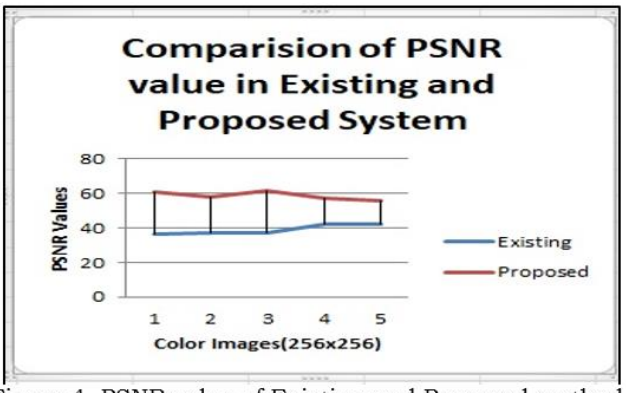

Figure 4. PSNR value of Existing and Proposed method

Conclusion

In this paper proposed an original lossless information concealing plan for shading pictures utilizing the pixel assessment technique. The pixel assessment strategy has been applied to insert the privileged information into unique shading picture. The presentation of the proposed conspire is demonstrated to be superior to those of the current strategy. Furthermore, the distinction development calculation is utilized for lossless concealing highly confidential data into estimate mistake. The prescience blunder of the ordered picture will likewise be dense. The speculative outcomes delineate that the proposed technique not exclusively have the option to improve limit in any case, also can hold greatness of fantastic picture. The presentation of the projected proposition is set up to be improved than those of the current plans in arrangements of transfer and picture quality.

Declarations of Competing Interest
The authors declare no conflict of interests.

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