A Contrast Enhancement Approach for Reversible Image Data Hiding

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Abstract – *Information in images, people used to hide for assurance of security and integrity of image. These modifications generally use in digital water marking in multimedia applications. Stenography is the method preferred by researchers to hide information in images. But this process is irreversible. We propose a reversible process of reversible data hiding using contrast enhancement technique. This paper reviews some existing techniques for reversible data hiding.*

Key Words: **Digital Watermark, Data Hiding, stenography, Histogram equalization, RDH, Contrast Enhancement**

1. INTRODUCTION

A reversible data hiding (RDH) is the concept of signal processing where retrieval of image at destination side should be irreversible & lossless process [1]. Host signal pixels embedded with information signal pixels to generate marked signal pixels. These marked signal pixels when recovered, it should be appears as original image.

When these images decrypted retrieval of original image is not possible. It is necessary to ensure a technique that will manages a reversible data hiding (RDH) to solve such problems. A RDH process should achieve goal of reversibility, separate data extraction and image quality improvement.[2]

Contrast enhancement technique deals with change of intensity of image pixels so that utilizes maximum possible bins. Generally contrast enhancement achieved by performing histogram equalization. [3]

1.1 Digital Watermarking

Water marking performs on the images by embedding extracted data with encrypted data images. When these encrypted images restored in multimedia applications, image extraction at . The technique of embedding while extracting and data hiding is lossy process.[1,2]

Digital Watermarking is a process of hiding carrier image signal with information signal. Information always relates to the digital watermark image. Application of digital water marking found in broadcasting, copyright protection, contain management & source tracking [3,4]

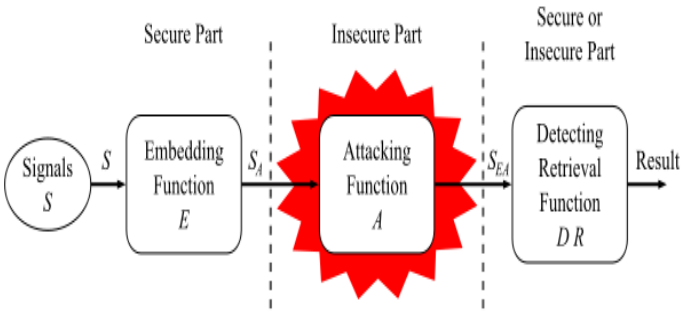

Fig. 1 Digital watermark process

When watermarked digital image signal transmitted from one person on multimedia resources, this is attacked by some external noisy functions. In retrieval of original images at destination side these should be detected & original transmitted image must be matched with retrieved image.

1.2 Reversible data hiding (RDH)

RDH technique authenticates a watermarked image into restored original form. Data hiding techniques used to improve PSNR values of retrieved image but contrast Enhancement technique improves contrast of the image. Problem arises in RDH when the image taken in dark conditions. Conditions like medical imaging used to improve PSNR values. Too much change in PSNR values degrades the conditions in which it is taken. Retrieval of such images is not possible compared with original one. Process of reversible data hiding is similar to the steganography. Fallowing section describes steganography process. [1,3]

1.3 Steganography

It is process of concealing a data into another data. This data may be any text, image or video. This process is performed along with the security protection such that original data can be retrieved any time using any suitable method. Steganography process uses the key for encryption & decyption of image or data pixels.[6]

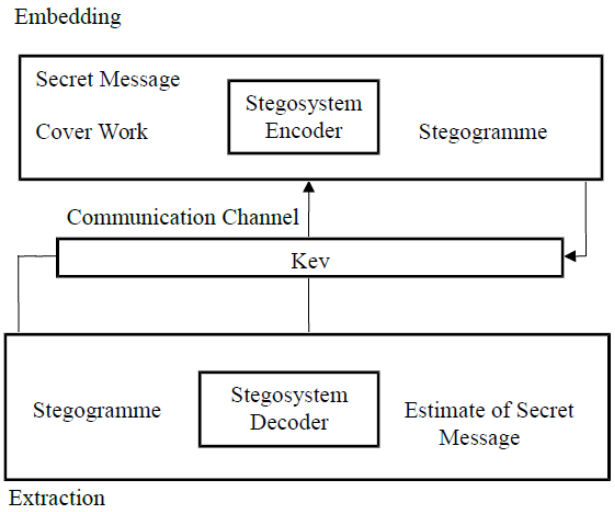

Fig. 2 Steganography process

1.4 Contrast Enhancement:-

It is a technique in which image histogram adjustment done by redistributing the pixel intensities in between lightest & darkest intensities. Method is applicable to both gray scale as well as color images. Histogram equalization plays vital role in contrast enhancement process. It is performed by cumulative distribution of the histogram. A binary location map prepared repeatedly to visualize the effects. [6,7]

For a color image it is performed on separate RGB color space. This may probably results in destroy of original color component balance. A luminance channel used to overcome this drawback but still original image is non recoverable. [7,8]

Results published below by one of the site researchers show that original image PSNR is much different than that of the contrast enhancement processed PSNR for gray scale images. Also there is normalized color difference (NCD) in case of color or RGB images or HSL images. [9]

Instead of using C, C++ compilers MATLAB functions used produces more recovered & promising results. Original gray scale image can be prominently shown by the contrast Enhancement technique. PSNR calculation of such images is high. When any user tries to recover such images, it is impossible to obtain original image with data missing. Some un useful information can be hide in the image with data hiding techniques. The key challenge is to extract original image with hided data. Proposed method here proposed a reversible data hiding technique with contrast enhancement.

Fig. 3 Original gray scale image before Contrast Enhancement

Fig. 4 Gray scale image after Contrast Enhancement

Fig. 4 Original Color image before Contrast Enhancement

Fig. 5 Color image after Contrast Enhancement on RGB channel

Fig. 5 Color image after Contrast Enhancement on HSL channel

2. Proposed method:-

Proposed method in RDH process includes fallowing steps.

1] Original image taken for embedding the signals

2] Embedding Process

a. Pre-processing with generation of location map

b. Histogram pixel values calculation

c. Perform embedding on last pairs of bin values

3] Watermark image generation

4] Extraction & Recovery process

a. Retrieval of last pairs of bin values

b. Extraction & Decompression generated location map

c. Restoration process

5] Obtain original image

Two highest peak valued signal taken for reference of embedding. Making these two bins as reference other small bins are shifted towards outward to found out two adjacent bins. Highest bins are chosen to split unless & until satisfactory results obtained.

Boundary detection & location map generation done to avoid underflow & overflow of histogram equalization. Location map also helps to extraction & recovery process.

Consider an image with N pixel values & having h bins of histogram. From h bins two highest valued bins chose corresponding to smaller & higher values. The boundary limit should be 255 pixels. If it is not then preprocessing for digitized binary values required. Equation 1 below suggests the binary embedding process.

$$i' = \begin{cases} i-1, & \text{for } i < I_S \\ I_S - b_k, & \text{for } i = I_S \\ i, & \text{for } I_S < i < I_R \\ I_R + b_k, & \text{for } i = I_R \\ i+1, & \text{for } i > I_R, \end{cases} \quad (1)$$

Binary k number of bits selected output modified image will be I'. This equation is applied over every pixel in the image & location map prepared. Is & I_R are the two Boundary Peak values. One can take 16 pixels at a time detecting processing capacity. The LSB collected values are hidden in images. Binary mapped equation is as fallows.

$$b'_k = \begin{cases} 1, & \text{if } i' = I_S - 1 \\ 0, & \text{if } i' = I_S \\ 0, & \text{if } i' = I_R \\ 1, & \text{if } i' = I_R + 1, \end{cases} \quad (2)$$

At the time of recovery original image equation will be

$$i = \begin{cases} i'+1, & \text{for } i' < I_S - 1 \\ I_S, & \text{for } i' = I_S - 1 \text{ or } i' = I_S \\ I_R, & \text{for } i' = I_R \text{ or } i' = I_R + 1 \\ i'-1, & \text{for } i' > I_R + 1 \end{cases}. \quad (3)$$

Proposed mapping & retrieval methods will be efficiently work on reversible data hiding of color images also if applied on the R, G & B channels separately. If chromo color conversion done from RGB

images, it can also efficiently used for different medical purposes.

3. CONCLUSION

Proposed RDH algorithm introduces use of contrast enhancement property for original image retrieval from data hided or watermarked image. Histogram calculation depends on two highest bins selected for embedding. Contrast enhancement splits number of histogram pairs. Some special MATLAB functions improve quality of enhanced images especially with high PSNR values.

REFERENCES

[1] J. Tian, "Reversible data embedding using a difference expansion, "IEEE Trans. Circuits Syst. Video Technol., vol. 13, no. 8, pp. 890–896, Aug. 2003

[2] Z. Ni, Y. Q. Shi, N. Ansari, and W. Su, "Reversible data hiding," IEEE Trans. Circuits Syst. Video Technol., vol. 16, no. 3, pp. 354–362, Mar. 2006.

[3] D.M. Thodi and J. J. Rodriguez, "Expansion embedding techniques for reversible watermarking," IEEE Trans. Image Process., vol. 16, no. 3, pp. 721–730, Mar. 2007.

[4] D. Coltuc and J.-M. Chassery, "Very fast watermarking by reversible contrast mapping," IEEE Signal Process. Lett., vol. 14, no. 4, pp. 255–258, Apr. 2007.

[5] V. Sachnev, H. J. Kim, J. Nam, S. Suresh, and Y. Q. Shi, "Reversible watermarking algorithm using sorting and prediction," IEEE Trans. Circuits Syst. Video Technol., vol. 19, no. 7, pp. 989–999, Jul. 2009.

[6] X. Li, B. Yang, and T. Zeng, "Efficient reversible watermarking based on adaptive prediction-error expansion and pixel selection," IEEE Trans. Image Process., vol. 20, no. 12, pp. 3524–3533, Jan. 2011.

[7] Z. Zhao,H.Luo,Z.-M. Lu, and J.-S. Pan, "Reversible data hiding based on multilevel histogram modification and sequential recovery," Int. J. Electron. Commun. (AEÜ), vol. 65, pp. 814–826, 2011.

[8] H. T.Wu and J. Huang, "Reversible image watermarking on prediction error by efficient histogram modification," Signal Process., vol. 92, no. 12, pp. 3000–3009, Dec. 2012.

[9] Y. Yang, X. Sun, H. Yang, C.-T. Li, and R. Xiao, "A contrast-sensitive reversible visible image watermarking technique," IEEE Trans. Circuits Syst. Video Technol., vol. 19, no. 5, pp. 656–667, May 2009.

[10] J. A. Stark, "image contrast enhancement using generalizations of histogram equalization," IEEE Trans. Image Process., vol. 9, no. 5, pp. 889– 896, May 2000

BIOGRAPHIES

Basappa Birajdar currently pursuing M. E. in YTIET Karjat, Maharastra (India) in computer Engineering. He has 5 years of programming experience in Java & Advanced Java level.

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