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A Survey on Reversible Image Data Hiding with Contrast Enhancement

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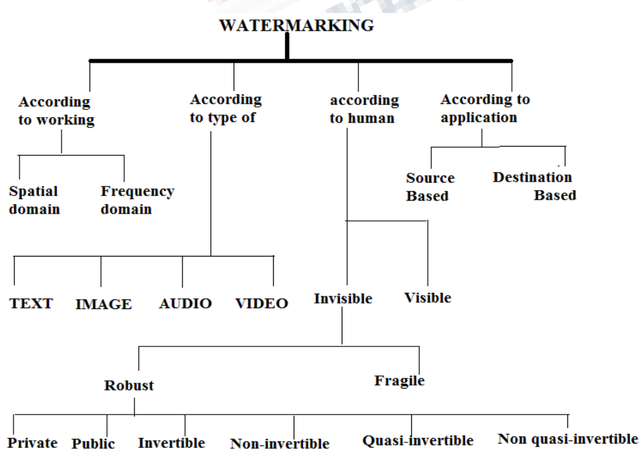
Abstract - **The main aim of this paper is to explain different watermarking techniques. In this paper we will give an overview on different types of techniquesused for preparation ofreversible data hiding and explain the significant growth in reversible watermarking and increase of embedding payload in the host image withoutdistortion in many fields. The paper focus on comparative analysis of different watermarking techniques and explaining their significance briefly .**

Index Terms:— **Information,DataHiding,Distortion, Data Hiding Algorithm**

I. INTRODUCTION

Data hiding is a technique for embedding information into covers such as image, audio, and video files, which can be used for media notation, copyright protection, authentication, etc. Most data hiding approach, is to embed messages into the cover media to generate the marked media. Digital watermarking techniques can classified into two categories, Spatial domain and frequency domain. The spatial domain watermarking embeds the watermark by Customize the intensity and the color value of some selected pixels and in frequency domain watermark is embedded into frequency coefficients of the host image . In spatial techniquewe use Least Significant Bit modification(LSB).Frequency domain we use discrete cosine transform(DCT),Discrete Wavelet Transform (DWT)And combination of DCT and DWT and Discrete Fourier Transform (DFT).



II. REVERSIBLE DATA EMBEDDING

Reversibledatahidingwasfirstproposedfor authentication.Earlyreversiblealgorithmsoftenhave smallembeddingrangeandpoorimagequality.In mostcasesofdatahiding,thecovermediawill experiencesomedistortion duetodatahidingandcannot beobtainbacktotheoriginalcovermedia,because somepermanentdistortionhasoccurredtothecover mediaevenafter thehidden datahavebeenretrievedout. so we propose so many techniques to over come it.

Some of the techniques are

1) ReversibleDataEmbeddingUsingA Difference Expansion
2) Reversible Data Hiding
3) Prediction Errors By Efficient Histogram Modification
4) A Contrast-Sensitive Reversible Visible Image Watermarking Technique
5) Reversible Watermarking Algorithm Using Sorting and Prediction
6) Reversible Contrast Mapping

2.1 Reversible Data Embedding Using A Difference Expansion:

In the difference expansion method differences between two adjacent pixel saredoubled so that a new LSB plane without carrying any information of the originalisgenerated. The hidden message together with acompressed location map derived from the property of each pixel pair, But not the host information itself,is insertedinto the generated LSB plane.

In this technique jun Tain finds extra storage space in image content of repetition bits of an image. Reversible embedding of payload in digital host image is done through DE Technique and keeps the visual quality of

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embedded image which is best and with low computational complexity
Assumewehavetwovaluesx=206,y=201,we wouldliketoreversiblyembedonebitb=1.Firstwe computetheintegeraveragelanddifferencehofxand y .

$$l = \left[\frac{206+201}{2}\right] = \left[\frac{407}{2}\right] = 203,$$
$$h = 206 - 201 = 5$$

Nextwerepresent thedifferencevaluehintoitsbinaryrepresentation h=5=1012.Thenweattach bintothebinary representationofhaftertheleastsignificantbit(LSB), thenewdifferencevalueh'willbeh'=101b2=10112=11.Mathematically, thisiscomparable to $h' = 2 * h + b = 2 * 5 + 1 = 11$ Finallywefigure outthenewvalues,basedonthenew differencevalueandtheoriginal integer average value l h'

$$x' = 203 + \left[\frac{11+1}{2}\right] = 209, y' = 203 - [\frac{11}{2}]=198$$

Fromthe embedded pair(x', y'),we can extractthe insertedbit bandrestoretheoriginal pair (x,y).
Again we compute the integer average and difference.

$$l' = \left[\frac{209+198}{2}\right] = 203,$$
$$y' = 209 - 198 = 11$$

Lookintothebinaryrepresentationofh',h'=11=10112. Extractthe LSB, which is 1in this case, as the inserted bitb,whichleavestheoriginalvalueofthedifferenceas h=1012=5.Mathematically, this is equivalentto$b = LSB(h') = 1, h = \left[\frac{h'}{2}\right] = 5.$
Nowwiththeintegeraveragevaluel'andrestored differencevalueh,wecanrestoreexactlytheoriginal pair(x,y).Inthis example,wehave insertedonebitb byincreasingthevalidbitlengthofthedifferencevalue hfrom3bits(forh=5)to4bits(forh'=11).This reversible data-embedding or insertingoperationis calledthe DE. $h' = 2 * h + b$
DEmethod could easilyembedmorethan1bpp..ThisDifferenceExpansionmethod suffersfromundesirabledistortionatlowembedding capacitiesandlackofcapacitycontrolduetotheneed for embeddinga location map.

2.2 Reversible Data Hiding

The data hiding process links two sets of data, a set of the embedded data and another set of the cover media data.In the procedure some distortion occurs on the cover media set and we require high precision nature images as output.The RDH or marking techniques satisfying this requirement are referred to as distortion-free, reversible, lossless or invertible data hiding techniques such that the cover media can be lossless recovered after the hidden data have been obtained out.Hence widely utilized spread-spectrum based data hiding methods are not for the purpose to prevent the over/under flow.least significant bit plane and quantization-index-modulation are not distortion-free owing to quantization error.The first method is in the spatial domain to embed the hash value of the original image for authentication $Iw = (I + W)mod(256)$,W=W{H(I),K}watermark, where H(I) is hash function.This RDH(reversible data embedding technique), which can insert a large amount of data (5–80 kb for a 512 *512* 8 gray scale image) which keep's a very high visual quality for all natural images, specifically, the PSNR of the marked image versus the original image is assured to be higher than 48 dB. Here embedding algorithm is using one zero point and peak point we first find a zero point, and then a peak point. A zero point corresponds to the gray scale value which no pixel in the given image assumes h(255) 1.Apeak point corresponds to the Gray scale value which the maximum number of pixels in the given image assumes(154) and the Pseudocodeembedding algorithm,Pseudo code Extraction algorithm steps are been followed to perform for better result and capacity of the load is calculated as C= H(A)-0

2.3 Prediction Errors By Efficient Histogram Modification

To increase the embedding rate, multiple pairs of histogram bins are chosen Moreover, all options of choosing a number of histogram bins with the four possible modes are enumerated to obtain the best performance. To extract the embedded data and recover the original image, a pre-computed location map and other overhead information are saved into the watermarked image as well .Compared with the existing algorithms, the image content is better preserved by the title for especially for high pay-load data hiding.

1. New Data Embedding Algorithm By Taking The Efficiency Of Modifying A Pair Of Histogram Bins Into Consideration
2. A New Prediction Scheme Is Designed To Produce A Large Number Of Prediction Errors From The Host Image, And inserting With The Prediction Errors Is Investigated.

$$x' = \begin{cases} x-1 & if x < xl, \\ xl - b if x = xl, \\ x if xl < x < xr, \\ xr + b if x = xr, \\ x+1 & if x > xr, \end{cases}$$

- The inserting Operation can be performed by
- Pre-process to prevent overflow and underflow is done accordingly

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- predicted value is chosen from the above equation and sequential steps be followed to get the vaules p(2i,2j)=$g_1*\frac{\sigma 2}{\sigma 1+\sigma 2}+g_2*\frac{\sigma 1}{\sigma 1+\sigma 2}$

Proposed reversible image watermarking algorithm is used for better embedding and extracting and process continuous

2.4 A Contrast-Sensitive Reversible Visible Image Watermarking Technique

We declare the watermark imagetransparently by overlapping it on a user required region of the host image through adaptively adjusting the pixel values beneath the watermark.To accomplishreversibility, a recovery packet, which is utilized to restore the watermarked area is reversibly inserted into non-visibly-watermarked region. As we considered , there are only three works concentrating on distortion-free visible watermarking as they doesn't considered human visual system (HVS) characteristics in the visible watermark embedding process , in this pixel prediction ensures the original watermark pattern .The embedding process of the scheme mainly consists of two procedures: visible watermark embedding and reversible data hiding .The watermark pattern (W) on the region of interest(ROI) in the host image (I) for watermark (Iw). With visible watermarking, If watermark energy is increased to improve visibility, the degradation in image quality becomes more significant, and vice versa. Embedding visible watermarking by

$$I_N{}^W(i,j)\begin{cases} \text{an} \times \text{In}(i,j) = 1 & \text{if wn}(i,j) = 1 \\ in(i,j), & if wn(i,j) = 0 \end{cases}$$

1≤i,j≤8 and n€s And $I^w{}_n(i,j)=I_n(i,j)$1≤i,j≤8 and n€{1,2,….N}-S

By Visible Watermark Embedding and Approximate Image Generation and Reversible Data Hiding

$$\begin{cases} \delta_1 = [\frac{2}{3}\delta_1' + \frac{1}{3}\delta_2' \\ \delta_2 = [\frac{1}{3}\delta_1' + \frac{2}{3}\delta_2' \end{cases} \begin{cases} 0 \le 2\delta_1 - \delta_2 \le G \\ 0 \le 2\delta_2 - \delta_1 \le G \end{cases}$$

The proposed watermarking algorithm has been execute and tested on a number of grayscale images and different watermark patterns for evaluating its performance

2.5 Prediction Errors By Efficient Histogram Modification

To increase the embedding rate, numerous pairs of histogram bins are chosen Moreover, all options of choosing a number of histogram bins with the four possible modes are specify to obtain the best performance. To extract the embedded data and recover the original image, a pre-computed location map and other overhead information are saved into the watermarked image as well .Compared with the existing algorithms, the image content is better preserved by the algorithm especially for high pay- load data hiding.New Data Embedding Algorithm By Taking The Efficiency Of Modifying A Pair Of Histogram Bins Into Consideration

A New Prediction Scheme Is Designed To Produce A Large Number Of Prediction Errors From The Host Image, And Embedding With The Prediction Errors Is Investigated.

$$x' = \begin{cases} x-1 & if x < xl, \\ xl - b if x = xl, \\ x if xl < x < xr, \\ xr + b if x = xr, \\ x+1 & if x > xr, \end{cases}$$

- The Embedding Operation can be performed by
- Pre-process to prevent overflow and underflow is done accordingly
- predicted value is chosen from the above equation and sequential steps be followed to get the vaules p(2i,2j)=$g_1*\frac{\sigma 2}{\sigma 1+\sigma 2}+g_2*\frac{\sigma 1}{\sigma 1+\sigma 2}$

Proposed reversible image watermarking algorithm is used for better embedding and extracting and process continuous .

2.6Reversible Contrast Mapping

RCM is invertible, even if the least significant bits (LSBs) of the translate pixels are lost. The data space occupied by the LSBs is suitable for data hiding. The embedded information bit-rates of the suggested spatial domain reversible watermarking scheme are close to the highest bit-rates reported so far. Here wet achieves high-capacity data embedding without any additional data compression stage.Reversible Contrast Mapping ,Let be [0,L]image graylevel range (L=255 for eight-bit graylevel images), and let(x,y) be a pair of pixels. The forward RCM transforms pairs of pixels into pairs of pixels x'=2x-y, y'=2y-x.To prevent overflow and underflow, the transform is restricted to a subdomain defined by the 0≤2x-y≤L,0≤2y-x≤ L equations.D is a rhombic domain located along the diagonal[0,L]*[0,L] .

The inverse transform is defined as follows x=$[\frac{2}{3}x'+\frac{1}{3}y']$, y=$[\frac{1}{3}x' + \frac{2}{3}y']$

Reversible watermarking substitutes the lsb of the transformed pairs and marking and detection and original recovery and data hiding capacity followed as process continuous for better resultThe bit-rate provided by the scheme is B=$\frac{2T-P}{2P}bpp,$

In order to increase the data hiding capacity, multiple iterations of the algorithm are chained. A spatial domain reversible watermarking providing high data embedding bit-rate at a very low mathematical complexity . In terms of embedding bit-rates, the proposed scheme largely outperforms most of the reversible watermarking schemes reported in the literature and provides almost the same bit-rate as the difference expansion scheme and its extensions.While Comparing Above Methods This Will Have Low Complexity. computational complexity is having low complexity bit manipulation. Which is applicable for real-time applications. Finally, by distributing the location map and by storing the saved true values close to the corresponding pixel pairs, the RCM scheme provides robustness against cropping..

SL. No	AUTHOR	METHOD USED	HIGHLIGHTS
1	JAIN TAIN[1]	Difference expansion	High embedding capacity more than 1bpp
2	Zhnicheng Ni Yun-Qing Shi [2]	Zero or minimum points of the histogram	PSNR of marked image is 48 db
3	Revesible contrat mapping[4]	Reversible Contrast mapping	Visible watermark
4	Hao-Tian wu Jiwu huang[6]	Prediction errors by efficient histogram modification	High embedding capacity
5	Zhenfei Zhao Hao Luo Zhe Ming Lu[5]	Multilevel histogram modification	High embedding capcity

III. CONCLUSION

On analysing different types of techniques and their approaches towards different segments of image by increasing the capacity of embedding in an image like in Difference expansion which gives 1bit per pixel And increase of contrast of an image and modifying its histogram leads a great approach towards Reversible Image Data Hiding With Contrast Enhancement

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