SECURE AND IMPROVED REVERSIBLE WATERMARKING (RW) BASED ON LOCAL PREDICTION

P. JAISON,
UG Student
Francis Xavier Engineering College,
Tirunelveli, Tamil Nadu, India
jaisonjpr@gmail.com

P.JENCY JENO,
PG Student
Francis Xavier Engineering College,
Tirunelveli, Tamil Nadu, India
jencyjeno@gmail.com

Dr.M.Angelina Thanga Ajisha,
Associate Professor
Francis Xavier Engineering College,Tirunelveli, TamilNadu,India.
ajeeshain2010@gmail.com

Abstract- The main objective of this project is Reversible watermarking using local prediction. There are contains two steps embedding and extraction. In embedding divided the images into blocks. Apply the prediction. In prediction used the local prediction. Choose the key image. In extraction procedure the user to remove the logo from the watermarked image and restore the unmarked image. The proposed system provides good quality for the images. It enhances the flexibility and practicability of the system.

I. INTRODUCTION

WHILE classical watermarking introduces permanent distortions, reversible watermarking not only extracts the embedded data, but also recovers the original host signal/image without any distortion. So far, three major approaches have already been developed for image reversible watermarking. They are reversible watermarking based on lossless compression, on histogram shifting and on difference expansion. The lossless compression based approach substitutes a part of the host with the compressed code of the substituted part and the watermark. In order to avoid artifacts, the substitution should be applied on the least significant bits area where the compression ratio is poor. This limits the efficiency of the lossless compression reversible watermarking approach. A more efficient solution is the histogram shifting approach. A histogram bin is selected and the space for data embedding is created into an adjacent bin (either the bin located at the left or at the right). The original approach considered the embedding into the maximum of the histogram in order to maximize the embedding bit-rate. Several other strategies have also been investigated. For embedding less than the size of the two largest histogram bins, a very efficient histogram shifting was proposed. The embedding is performed into the smallest two bins, one from the left and the other for the right that provide the needed capacity. Since only the tails of the histogram must be shifted, the distortion is minimized. As the required embedding capacity increases, more embedding stages are performed. While in a single embedding stage the histogram shifting approach introduces distortion of at most one gray level per pixel, this is no longer true for multiple embedding levels. In such cases, the most efficient approach is difference expansion (DE). An important advance in this direction is the replacement of the location map by a histogram shifting procedure allowing the identification of the embedded pixels based on the corresponding difference. A straightforward idea to reduce the embedding distortion consists of expanding lower differences. The most widely used approach is the replacement of the simple pixel difference with the prediction error.

The improvement of the prediction is important for both histogram shifting and difference expansion based reversible watermarking schemes. Lower estimation errors than the ones of MED and GAP are provided by the simple average of the four horizontal and vertical neighbors. Each watermarked pixel takes part in the prediction of two other pixels, namely of the right horizontal and of the lower vertical neighbors. The image pixels are split in two equal sets, diagonally connected, as the black and white squares of a chessboard. The watermark is embedded in two stages. The pixels of a set are marked by using for prediction the pixels of the other set. The prediction of the first set is done with original pixels, while the one for the second set uses already modified pixels. On the entire image, the overall performance of the two stages scheme slightly outperforms the direct raster scan watermarking. The reversible watermarking of is very efficient. It clearly outperforms the classical DE schemes based on MED or GAP. The overall very good performances of the simple average on the rhombus context are due to the fact that prediction is performed on an entire neighborhood surrounding the pixel and not only on part of it. The prediction can also be improved by using adaptive predictors. For each image, the coefficients of the predictor are computed in order to minimize the prediction error. A popular solution is the least squares (LS) prediction, namely the solution minimizes the sum. of squares of the prediction error. The LS solution computed for the context of MED usually slightly outperforms the results obtained for MED. The use of LS is somehow natural since the mean square error (PSNR) is used to evaluate the results. This paper investigates the use of local LS prediction in DE reversible watermarking. The basic idea is to compute, for each pixel, a distinct LS predictor on a block centered on the pixel. The most interesting aspect of our approach is the fact that the same predictor is recovered at detection, avoiding the need of embedding a large amount of additional information. The proposed local prediction is general and can be applied regardless of the predictor order or the prediction context. For the particular case of pixel estimation as the average of its four horizontal and vertical neighbors, the proposed adaptive reversible watermarking clearly outperforms the scheme based on local prediction on the context of MED, GAP or SGAP significantly outperform the classical reversible watermarking counterparts. The outline of the paper is as follows. The difference expansion reversible watermarking is briefly reminded in Section II, The local prediction based reversible watermarking is discussed in Section III. Experimental results and comparisons with the classical schemes and notably, with the scheme

2. REVERSIBLE WATERMARKING

Here we discuss about the some of the basic things which are related to the reversible watermarking. Some of them are given below in the following sections.

Watermarking Schemes

In General, the watermarking process includes various steps. A watermark is an identifying image or pattern in paper that appears as various shades of lightness/darkness when viewed by transmitted light (or when viewed by reflected light, atop a dark background), caused by thickness or density variations in the paper. Watermarks have been used on postage stamps, currency, and other government documents to discourage counterfeiting. There are two main ways of producing watermarks in paper; the dandy roll process, and the more complex cylinder mould process. Watermarks vary greatly in their visibility; while some are obvious on casual inspection, others require some study to pick out. Various aids have been developed, such as watermark fluid that wets the paper without damaging it. Watermarks are often used as security features of banknotes, passports, postage stamps, and other documents to prevent counterfeiting (see security paper). A watermark is very useful in the examination of paper because it can be used for dating, identifying sizes, mill trademarks and locations, and determining the quality of a sheet of paper. Encoding an identifying code into digitized music, video, picture, or other file is known as a digital watermark. In existing system, the reversible watermarking schemes are mainly based on MED and GAP. The context embedding is used for embedding purpose but it reduces the overall embedding rate. The adaptive predictors are used to find the prediction errors. The Genetic Algorithm is being used to solve the threshold optimization problems in reversible watermarking. To overcome the above drawbacks in this project we proposed a method called "Local Prediction based Reversible Watermarking". The local prediction based reversible watermarking was analyzed for the case of four prediction contexts, namely the rhombus context and the ones of MED, GAP and SGAP predictors.

3. RELATED WORK

Xin Li et.al (2001) proposed a method on Edge-Directed prediction for lossless compression of natural images. This system is based on the least-square (LS)- adaptive prediction schemes for lossless compression of natural images. The analysis shows that the superiority of the LS-based adaptation is due to its edge-directed property, which enables the predictor to adapt reasonably well from smooth regions to edge areas. The LS-based adaptation improves the prediction mainly around the edge areas. A novel approach is proposed to reduce its computational complexity with negligible performance sacrifice. The lossless image coder built is to achieve better performance than the state-of-the-art coder CALIC with moderately increased computational complexity.

In the novel approach instead of using pixels in LS optimization, the predictor coefficients are updated only when the magnitude of prediction error is beyond a pre- selected threshold .Edge directed prediction refers to the role of the pixels around an edge in LS optimization process. The drawback of edge directed prediction is computational complexity. A novel approach for reducing computational complexity can be achieved to maintain its performance. It is used in tasks such as error concealment. The main disadvantage of this system is LS optimization can be done only for a fraction of pixels in the image. Ricardo L.de Queiroz (2004)proposed method on Processing JPEG-Compressed images and Documents[14] In this concept the Joint Photographic Experts Group (JPEG) has become an international standard for image compression. This techniques allows the processing of an image in the "JPEG-compressed" domain. The goal is to reduce memory requirements while increasing speed by avoiding decompression and space domain operations. An effort is made to implement the minimum number of JPEG basic operations. Techniques are presented for scaling, previewing, rotating, mirroring, cropping, recompressing, and segmenting JPEG-compressed data. JPEG compression is performed by a series of operations, they are transform, quantization, zigzag scanning, differential pulse code modulation(DPCM)and entropy coding. Previewing and resizing of the JPEG also happens .The original blocks is scaled into an integer number of new blocks. Here pixels of an image is organised as encoding cost map(ECM).By storing and deriving the ECM the individual blocks are easily addressed. Segmentation is done in regions containing halftone, text, pictures etc.

This method reduces memory requirement, increasing the speed by avoiding decompression and space domain operations, reduced cost and simple to control image brightness. JagadishH. pujaret.al(2010) have proposed a new lossless method of image compression and decompression using Huffman Coding techniques. This proposed system uses the lossless technique for compression of Images during transmission & storage of the raw images. This compression technique is faster, memory efficient and simple suits the requirements of the user. The Lossless method of image compression and decompression is used by a simple coding technique called Huffman coding. This technique is simple in implementation and utilizes less memory .The images to be compressed are gray scale with pixel values 0 to 255,This technique collects unique symbols from source image and calculate its probability value for each symbol and sorts the symbol from lowest to highest priority. Gregory K. Wallace(1991)have proposed a method on the JPEG still picture compression Standard. This method supports a wide variety of applications for continuous-tone images. To meet the differing needs of many applications, the JPEG standard includes two basic compression methods, each with various modes of operation. A DCT based method is specified for "lossy'' compression, and a predictive method for "lossless'' compression. JPEG features a simple lossy technique known as the Baseline method, a subset of the other DCT based modes of operation. The Baseline method has been by far the most widely implemented JPEG method is sufficient in its own right for a large number of applications. This system provides an overview of the JPEG standard, and focuses in detail on the Baseline method. But the application costs is very high. If there are two applications, they cannot exchange uncompressed images because they use incompatible color, spaces, aspectratio, dimensionetc. ArjunNichalet.al(2012)have proposed a high capacity Data hiding method for JPEG2000.

Imperceptibility and Hiding Capacity are very important aspects for efficient secret communication. It is necessary to increase hiding capacity for JPEG2000 baseline system because available redundancy is very limited. In this system Redundancy Evaluation method is used for increasing hiding capacity. This method determines embedding depth adaptively for increasing hiding capacity.ie. without changing much image quality maximum secret data is embedded. Large quantity of data is embedded into bit planes, but at the cost of slightly changes in Peak Signal to Noise Ratio (PSNR). This method easily implemented in JPEG2000 compression encoder and produced stego stream decoded normally at decoder. This method results in secure and increased hiding capacity. Redundancy evaluation method increases Embedding capacity (EC) at the cost of slight change in Peak Signal to Noise Ratio (PSNR).

4. METHODOLOGY

4.1 System Architecture

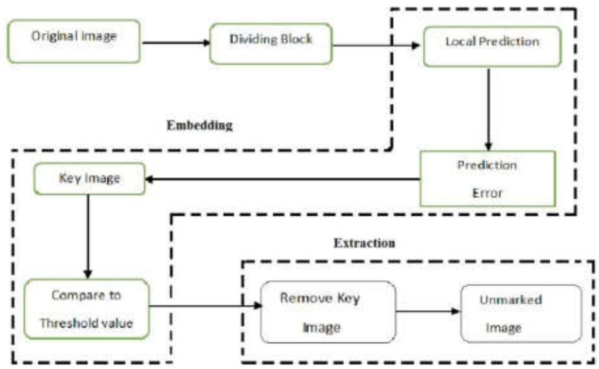

Figure: 1 Block Diagram

4.2 Modules

1. Segmentation
2. Apply Local prediction for Segmentation
3. Embedding
4. Extraction

Segmentation:

To choose the image for embedding process. The images are JPEG, GIF, PNG and any other format. Choose any one image and given to the block dividing. First give the block size and apply the block dividing. The image is divided into small blocks and the function applies in each block. In this the block dividing is used to divide the in blocks for example 3x3,5x5 etc. Each block apply all operations.

Apply Local prediction for Segmentation:

After block dividing apply the local prediction. Get the input image from database. The input images are divided into blocks.The detection proceeds pixel by pixel and row by row, starting with the last marked pixel. According to pixel position, the appropriate predictor is selected. If the pixel is a border pixel, the fixed predictor is used. Otherwise, the least square predictor is computed for the data block centered on the current pixel. If the pixel has been embedded, the message bit is extracted and the original pixel is recovered. If the pixel has been shifted, it is simply shifted in the opposite direction and so on.

Block Dividing

First give the block size and apply the block dividing. The image is divided into small blocks and the function applies in each block. In this thesis block dividing is used to divide the in blocks for example 3x3,5x5 etc. Each block apply all operations.

Embedding

Embedding is used to combine original and key image and send that image. It is also same as the original image. In embedding this project proposed local prediction and find the prediction error.

Algorithm for Embedding

This embedding algorithm is used to combine the key image and original image. This project the embedding is used for the compression

1. The input image is divided into blocks. The blocks are predicted and find the prediction error.
2. The prediction error is greater than the threshold value then vector quantization is used for compression.
3. The prediction value less than or equal to the threshold value then embedding the watermark bit 0 and 1.
4. If the embedding bit equal to 0 then Side Matching Vector Quantization is used for compression.
5. The embedding bit is equal to 1 then image in painting is used for compression.

Algorithm for Extraction

This Extraction algorithm is used to separate the original image and this project extract the watermark bit.

1. The embed image is given to the input of extraction. The input image is divided into blocks.
2. Take the indicator bit 0 and 1.
3. The indicator bit is equal to 0 then read the index value and apply the inverse process of VQ compression and also extract the watermark bit.
4. The indicator bit is equal to 1. Read the index values for the key images.
5. If the index values are equal then apply the inverse process of SMVQ compression and extract the watermark bit 0.
6. Otherwise apply the inverse process of image in painting and extract the watermark bit 1.

Local Prediction

- After block dividing apply the local prediction.
- Get the input image from database.
- The input images are divided into blocks.
- The detection proceeds pixel by pixel and row by row, starting with the last marked pixel.
- According to pixel position, the appropriate predictor is selected.
- If the pixel is a border pixel, the fixed predictor is used.
- Otherwise, the least square predictor is computed for the data block centered on the current pixel.
- If the pixel has been embedded, the message bit is extracted and the original pixel is recovered.
- If the pixel has been shifted, it is simply shifted in the opposite direction and so on.

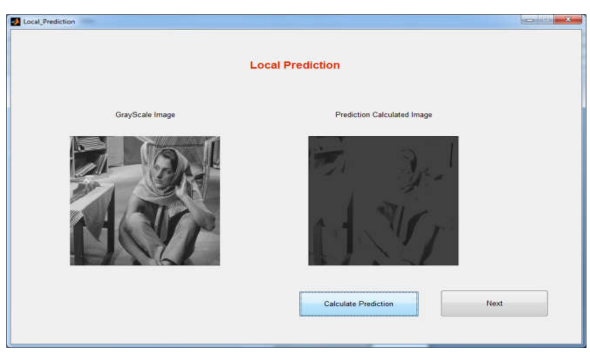

Figure:2 Local Prediction

Prediction Error

After prediction find out the prediction error. The prediction cannot be correctly predicted. So the prediction errors occur and remove the redundant images. A prediction error term contains the average and the least number of 1's which is identify the prediction errors.

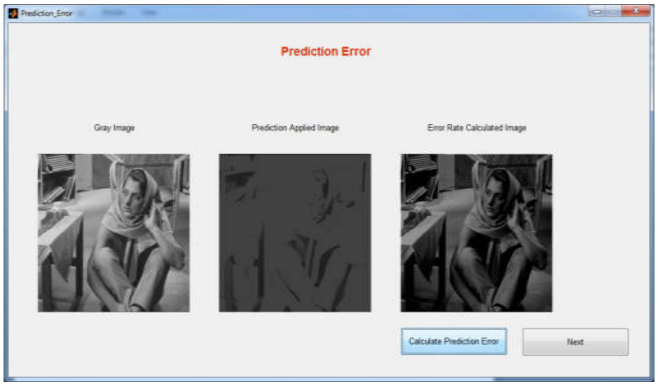

Figure:3 Prediction Error

Extraction

Extraction is used to separate the original and key image. In this project get the embedding image input for the extraction and removes the key image and get the unmarked image.

5. EXPERIMENTAL RESULTS

The proposed system to be implemented as MATLAB. And the following shows the results

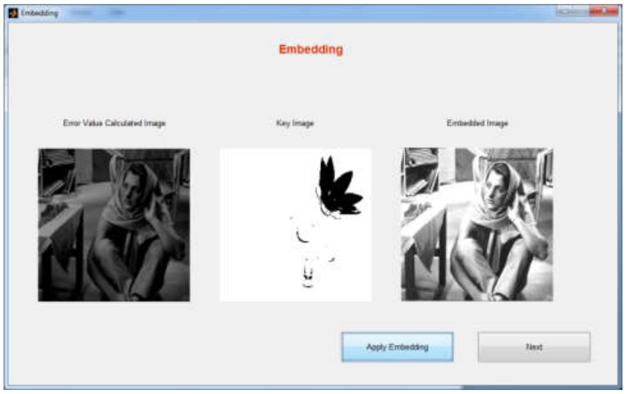

Figure:4 Embedding

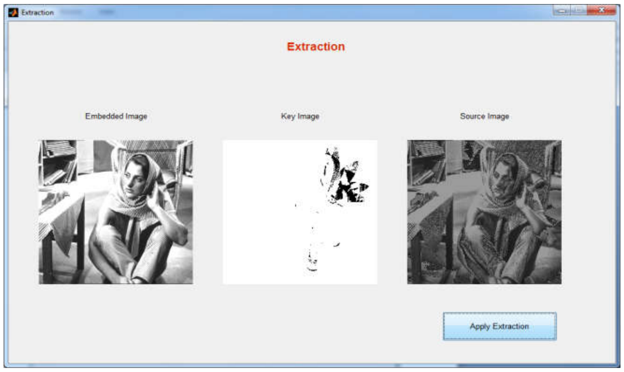

Figure:5 Extraction

6. CONCLUSION

This work proposed the reversible data hiding using the local prediction. The above chapters are explained methods in detail. The existing method has the drawbacks. This project is used to overcome this limitation and this system is very secure. The results shows the performance of the proposed system.

7. Reference

[1] K.Hari Babu, M.Tech;T.Naga Jyothi, M.tech;K.Sowjanya "High Capacity and Low Distortion Reversible Image Watermarking using Integer Wavelet Transform" International Journal Of Engineering And Computer Science ISSN:2319-7242 Volume 2 Issue 11 November, 2013 Page No. 3192-3196.

[2] Pramod R Sonawane, K.B.Chaudhari "Reversible Image Watermarking Using Adaptive Prediction Error Expansion " International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 2, Issue 2, March 2013 627.

[3] Shijun xiang "Non-Integer Expansion Embedding for Prediction-Based Reversible Watermarking"

[4] Shaowei Weng, Yao Zhao, Jeng-Shyang Pan2 and Rongrong Ni "A Novel Reversible Watermarking Based On An Integer Transform" 1-4244-1437-7/07/$20.00 ©2007 IEEE.

[5] Yongjian Hu, Heung-Kyu Lee, and Jianwei Li "DE-Based Reversible Data Hiding With Improved Overflow Location Map" Ieee Transactions On Circuits And Systems For Video Technology, Vol. 19, No. 2, February 2009.

[6]. Ya-Fen Chang and Wei-Liang Tai "Histogram-based Reversible Data Hiding Based on Pixel Differences with Prediction and Sorting" Ksii Transactions On Internet And Information Systems Vol. 6, NO. 12, Dec 2012 3100 Copyright ⓒ 2012 KSII.

[7] Nutan Palshikar, Prof. Sanjay Jadhav "Lossless Data Hiding using Histogram Modification and Hash Encryption Scheme" International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 1, January 2014) 485.

[8] Biao Chen · Weiming Zhang · Kede Ma· Nenghai Yu "Recursive code construction for reversible data hiding in DCT domain "Multimed Tools Appl DOI 10.1007/s11042-013-1493-x.

[9] B.Himabindu "Image Interpolation Algorithm for Edge Detection Using Directional Filters and Data Fusion " International Journal Of Computational Engineering Research (ijceronline.com) Vol. 2 Issue. 5 Issn 2250-3005(online) September| 2012 Page 1699.

[10] Shaode Yu, Rui Zhang, Shibin Wu, Jiani Hu,Yaoqin Xie "An edge-directed interpolation method for fetal spine MR images" BioMedical Engineering OnLine 2013, 12:102.

[11] Gregory K. Wallace "The JPEG Still Picture Compression Standard" Submitted in December 1991 for publication in IEEE Transactions on Consumer Electronics.

[12] Prabhakar.Telagarapu, V.Jagan Naveen, A.Lakshmi..Prasanthi, G.VijayaSanthi "Image Compression Using DCT and Wavelet Transformations" International Journal of Signal Processing, Image Processing and Pattern Recognition Vol. 4, No. 3, September, 2011

[13] Jagadish H. Pujar, Lohit M. Kadlaskar "A New Lossless Method Of Image Compression And Decompression Using Huffman Coding Techniques" Journal Of Theoretical And Applied Information Technology

[14] Ricardo L. de Queiroz, "Processing JPEG-Compressed Images and Documents" IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 7, NO. 12, DECEMBER 1998 1661

[15] Brian C. Smith "Compressed Domain Processing of JPEG-encoded images" National Science Foundation under grants DCR-85-07256 and MIP-90-14940.

[16] Roman Starosolski " Simple Fast and Adaptive Lossless Image Compression Algorithm" December 20, 2006

[17] Dr.E.KANNAN G. Murugan "Lossless Image Compression Algorithm For Transmitting Over Low Bandwidth Line" Volume 2, Issue 2, February 2012 International Journal of Advanced Research in Computer Science and Software Engineering

[18] Mehmet UtkuCelik, Gaurav Sharma, A. Murat Tekalp "Gray-level-embedded lossless image compression" Received 25 June 2002; received in revised form 12 December 2002; accepted 28 January 2003

[19] Matthew J. Zukosk "A novel approach to medical image compression" Int. J. Bioinformatics Research and Applications, Vol. 2, No. 1, 2006 89

[20] Xin Li,, and Michael T. Orchard, "Edge-Directed Prediction for Lossless Compression of Natural Images" IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 10, NO. 6, JUNE 2001 813