Journal of Network Communications and Emerging Technologies (JNCET) www.jncet.org
Volume 5, Issue 2, November (2015)

Video Watermarking using Fractal Encoding & RLE Encoding

Navdeep Kaur
Research Scholar, CEC Landran, Mohali, India.

Er. Amandeep Mavi
Assistant Professor, CEC Landran, Mohali, India.

Abstract – Compression of the color images and videos has many applications in most of the mobile technologies. Reducing the time taken for file transfer is important in digital communication fields. Image compression means reducing the graphics file size, without degrading the quality of the image. For digital images, Fractal image Compression (FIC) and run length coding has been considered as an efficient method. FIC is a lossy compression method that explores the self-similar property for natural image. In this paper fractal with quad-tree technique and Run Length Encoding is proposed to compress the image. Implementation result shows that the image is compressed effectively using the proposed work.

Index Terms – Watermarking, classification of watermarking, image compression techniques, Fractal encoding, RLE encoding.

1. INTRODUCTION

Watermarking is one of the most important aspect related with information hiding. It is a process that is been used to embed some kind of information inside a guest content. The guest file can be a multimedia content such as picture, audio or video. It is basically used for the purpose of copyright protection and owner authentication. Digital Watermarking technique gets its name from watermarking, which is very common since past several years. Digital watermarking is a technique that provides solution to the many longstanding problems related with copyright of digital data that can be detected or extracted later to make out some statement about the data. The information that needs to be hidden is embedded by manipulating the contents of the digital data. These digital watermarks remain inviolate under the conditions related with transmission/ transformation, allowing one to protect the ownership rights in digital form. Digital watermarking has become an active and important area of research, and development and commercialization of watermarking techniques is being deemed essential to help address some of the challenges faced by the rapid proliferation of digital content. Digital watermarking came to be in great demand when sharing information on the Internet became a usual practice.

2. RELATED WORK

Hartung and Girod have concentrated on watermarking of compressed video for fingerprinting applications. They employ a straightforward spread-spectrum approach and embed an additive watermark into the video. The watermark is generated using a PN signal with the same dimensions as the video signal that is modulated with the information bits to be conveyed. Each information bit is redundantly embedded into many pixels. For each compressed video frame, the corresponding watermark signal frame is DCT transformed on an 8by8 block basis, and the resulting DCT coefficients are added to the DCT coefficients of the video as encoded in the video bit stream. Due to variable length coding, the watermarked coefficient may or may not need more bits for encoding than the un-watermarked one. If more bits are required, and the bit rate of the video sequence may not be increased, the coefficient is not used for embedding. Due to the inherent redundancy in the watermark, the watermark information can still be conveyed as long as enough coefficients can be embedded.

Jordan et al., have proposed a method for the watermarking of compressed video that embeds information in the motion vectors of motion-compensated prediction schemes. Motion vectors pointing to flat areas are slightly modified in a pseudorandom way. Because the blocks pointed to by the original and the modified vectors are very similar (there is not much detail), this does not introduce any visible artifacts. The embedded information can be retrieved directly from the motion vectors, as long as the video is in compressed format. After decompression, the watermark can still be retrieved by first recompressing the video.

Hsu and Wu, present a watermarking method for compressed video which is an extension of their method for images and which modifies middle-frequency DCT coefficients in relation to spatially (for I-frames) or temporally (for P- and B-blocks) neighboring blocks. The coefficients are forced to assume a smaller or larger value than the corresponding neighboring coefficients, depending on the watermark sample to be embedded into the specific coefficient. The watermark signal is a visual pattern, like a logo, consisting of binary pixels. Prior to embedding, the watermark signal is spatially scrambled such that it can be recovered from a cropped version of the video.

Swanson et al., propose a multiscale watermarking method working on uncompressed video which has some interesting properties. In a first step, the video sequence to be watermarked is segmented into scenes. Each scene is handled as an entity. A temporal wavelet transform is then applied to each video scene, yielding temporal low-pass and high-pass frames. The watermark to be embedded is not an arbitrary message, but rather a unique code identifying the IPR owner and taken from a predefined codebook. Also, the watermark is designed with a signal-dependent key and thus avoids deadlock problems. The watermark is embedded into each of the temporal components of the temporal wavelet transform, and the watermarked coefficients are then inversely transformed to get the watermarked video.

Busch *et al*.,apply a still-image watermarking method working on DCT blocks to video sequences. The watermarks are embedded into the luminance component of uncompressed video and retrieved after decompression. In order to improve the invisibility of the watermarks, especially at edges, blocks are selected for watermarking depending on the block activity. For critical sequences, the authors propose to introduce additional temporal redundancy by embedding the watermark into several consecutive frames and averaging in the retrieval.

3. PROBLEM FORMULATION

There are many algorithms which have used to embed watermark but they lack in few stages. Video watermarking approaches can be divided into two main categories which depend on the method of hiding watermark bits in the host video. These are: By just manipulating the pixel intensity values of the video frame. Second alter is spatial pixel values of the host video according to a predetermined transform. But attacks like cropping, scaling, rotations and geometrical make these techniques unsuccessful. The commonly used techniques are Discrete Fourier Transform (DFT), the Discrete Cosine Transform (DCT), and the Discrete Wavelet Transform (DWT), PCA and SVD. But they are not efficient in finding the interest points where to embed the watermark. Even they all are not so stable. Thus to overcome these issue a new technique is introduced in implementation of watermarking.

4. PROPOSED WORK

In general, there are two types of techniques for embedding a predefined watermark into an Video frame. One is fractal encoding and the other is run length encoding. In this paper, in order to subjectively verify the ownership of Video frame with the aid of extracting a watermark. One of the main challenges of the watermarking is to achieve a trade-off between robustness and perceptivity. In general, increasing the strength of the embedded watermark can achieve robustness, but it would lead to an increase in the visible distortion as well, and vice versa. Since the orthogonal fractal decoding is mean-invariant iteration, the range block mean is a good robust place to hide a watermark. After fractal decoding, the embedded watermark diffuses throughout the reconstructed Video frame .In order to gain high robustness as well as low sensitivity in Video frame watermarking. . Initially the color image will be partitioned into non-overlapping blocks. Fractal will be employed to every block of the image. The resultant image is segmented by quad-tree technique as fractals. The image also compressed using Run Length encoding.

5. CLASSIFICATION OF WATERMARKING

Classifications of Watermarking

1) Visible Watermarks

Visible watermarks are those watermarks which can be easily perceived by the viewer, and clearly identify the owner. The visible watermarks are viewable to the normal eye such as bills, company logos and television channel logos etc. This type of watermarks can be easily viewed without the requirement of any mathematical calculation but at the same time these embedded watermarks can be destroyed easily. [3]

2) Invisible Watermarks

Invisible watermarks are those watermarks that cannot be perceived by human eyes. This type of watermark is not visible in the watermarked image without degradation of image or data. Invisible watermark may be any logo or any signature**.** Most research currently focuses on invisible watermarks, which are imperceptible under normal viewing conditions. [3]

5.1. General Watermarking System

The digital watermarking system essentially consists of a watermark embedder and a watermark detector. The watermark embedder inserts a watermark onto the cover signal and the watermark detector detects the presence of watermark signal. An entity called watermark key is used during the process of embedding and detecting watermarks. The watermark key has a one-to-one correspondence with watermark signal (i.e., a unique watermark key exists for every watermark signal).The watermark key is private and known to only authorized parties and it ensures that only authorized parties can detect the watermark. Further, the communication channel can be noisy and hostile (i.e., prone to security attacks) and hence the digital watermarking techniques should be resilient to both noise and security attacks.

6. TECNIQUES OF DIGITAL WATERMARKING

1) Spatial Domain Method

Spatial-domain method is been used for embedding the watermarks into a particular text, image by directly changing the pixel values of original host images. Some common spatial-domain algorithms include Least Significant Bit (LSB) Modification, Patchwork, Texture Block Coding, etc. The most serious drawback of spatial-domain technologies is that it tends to provides limited robustness. It is complex for spatial-domain watermarks to subsist under attacks such as lossy compression and low-pass filtering. Also the amount of information that can be embedded in spatial domain is also very limited. [5]

2) Frequency-Domain Technologies

In comparison to spatial-domain watermark, watermarks in frequency domain are more robust and much more compatible to popular image compression standards. Thus frequency-domain watermarking technique is more widely used and obtains more attention in comparision to spatial domain method. To embed a watermark, a frequency transformation needs to be applied to the host data. Then, modifications are made to the transform coefficients. Possible frequency image transformations include the Discrete Fourier Transform (DFT), Discrete Cosine Transform (DCT) and others. In recent years they are becoming generally desolated. [5]

7. IMAGE COMPRESSION TECHNIQUES

The image compression techniques are broadly classified into two categories depending whether or not an exact repro of the original image could be reconstructed using the compressed image. These are:

1. Lossless technique
2. Lossy technique

1) Lossless compression

It is a compression technique that does not lose any data in the compression process. Lossless compression "packs data" into a smaller file size by using a kind of internal shorthand to signify redundant data. If an original file is 1.5MB (megabytes), lossless compression can reduce it to about half of that size, depending on the type of file that is being compressed. This makes lossless compression convenient for transferring files across the Internet, as smaller files transfer faster. Lossless compression is also handy for storing files as they take up less room. That's because when these files are decompressed, all bytes must be present to ensure their integrity. If bytes are missing from a program, it won't run. If bytes are missing from a data file, it will be incomplete and falsified. Lossless compression has advantages as well as disadvantages. The advantage is that the compressed file will decompress to an exact duplicate of the original file, mirroring its quality. The disadvantage is that the compression ratio is not all that high, precisely because no data is lost. Following techniques are included in lossless compression:

1. Run length encoding
2. Huffman encoding
3. LZW coding
4. Area coding

2) Lossy Compression

It is a compression technique that does not decompress data back to 100% of the original. Lossy methods provide high degrees of compression and result in very small compressed files, but there is a certain amount of loss when they are restored. Audio, video and some imaging applications can tolerate loss, and in many cases, it may not be noticeable to the human ear or eye. In other cases, it may be noticeable, but not that critical to the application. The more tolerance for loss, the smaller the file can be compressed, and the faster the file can be transmitted over a network. Examples of lossy file formats are MP3, AAC, MPEG and JPEG. Lossy compression is never used for business data and text, which demand a perfect "lossless" restoration. [8]

Lossy schemes tend to provide much higher compression ratios than lossless schemes. Lossy schemes are widely used since the quality of the reconstructed images is adequate for most applications. By this scheme, the decompressed image is not identical to the original image, but reasonably close to it. [10] Lossy compression techniques includes following schemes:

1. Transformation coding
2. Vector quantization
3. Fractal coding
4. Block Truncation Coding
5. Sub band coding

8. FRACTAL ENCODING

Fractal encoding technique of lossy compression. It try to construct an approximation of the original image i.e. correct sufficient to be an acceptable. Its main task to examine similarities between larger and smaller portions of image. It depends not only on the self-similarity but also manage the quality of reliable images. From using this, fractal algorithms convert parts of the images into mathematical data called "fractal codes" which are used to recreate the encoded image. One time an image has been converted into fractal code its relationship to a specific resolution has been lost; it becomes resolution independent. It provide better performance in that it produces an approximation that is closer to the original at higher compression ratios. Why fractal encoding?

For self-similarity in the images

A typical image does not consist self-similarity but it consist different kind of similarity. By using this, firstly take starting image and then divide it into non-overlapping sub-blocks. Further each parent blocks divided into 4 blocks. Compare these blocks and determine which larger block has the smallest difference according to some computation between larger block and smaller block. Smaller the Block size, more accurate will be the encoding of the image. This is done for each block. During decompression, opposite processing is done to recover the original image.

Resolution Independence

It is very important feature of fractal image compression. It occurs after the image being converted into fractal code i.e. its relation is free from the specific resolution.

Fractal interpolation

The resolution independence can be used to increase the display resolution of an image .This process is also called fractal interpolation. In this, through fractal compression, image is encoded into fractal codes and afterwards decompressed at higher resolution.

9. RUN LENGTH ENCODING

Run-length encoding (RLE) is a very simple form of data compression in which runs of data (that is, sequences in which the same data value occurs in many consecutive data elements) are stored as a single data value and count, rather than as the original run. This is most useful on data that contains many such runs: for example, simple graphic images such as icons, line drawings, and animations. It is not useful with files that don't have many runs as it could greatly increase the file size. Run-length encoding performs lossless data compression and is well suited to palette-based bitmapped images such as computer icons. RLE can compress any type of data regardless of its information content, but the content of data to be compressed affects the compression ratio. Consider a character run of 15 'P' characters which normally would require 15 bytes to store: PPPPPPPPPPPPPPP is stored as 15P .With RLE, this would only require two bytes to store, the count (15) is stored as the first byte and the symbol (P) as the second byte.

10. SIMULATION RESULTS

Methodology

Video watermarking is the process of embedding data into the video. In the proposed work the image is embedded in the video. The methodology of the proposed work is described below:-

1) For video watermarking, initially a video is selected for further processing as image is to be embed in the video.

2) After selecting the video, next step is to select the frame of the video that is selected for the process of video watermarking.

3) Next step is to perform the RLE encoding on the selected frame of the video, the video that us selected earlier.

4) For watermarking, an image is selected from the data set of images that is to be embedded in the video frames that are selected from the video.

5) After the selection of the watermarked image from the given set of image, preprocessing of the selected watermarked image is done

6) Next step is to embed the selected watermarked imaged into the selected frames of the video, to perform video watermarking.

7) In this step the video is converted into its original form and finally the encryption of the video is done.

RESULTS

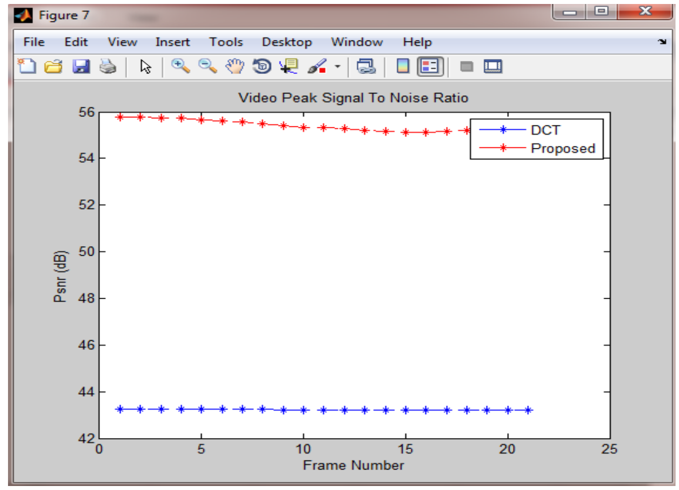

Fig 1: Video PSNR vs Frame Number

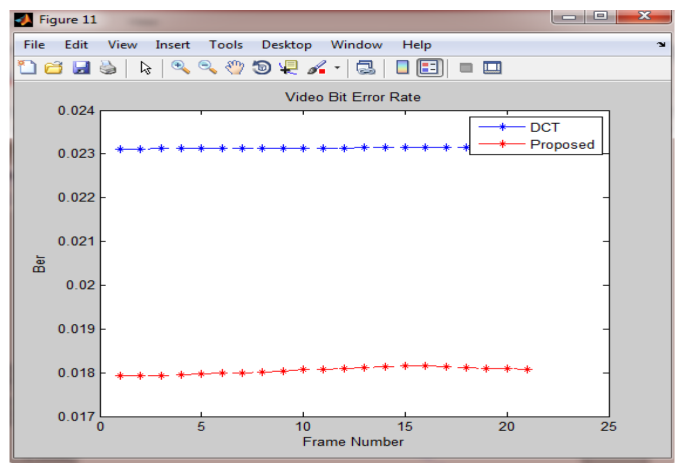

Fig 2: Video BER vs Frame Number

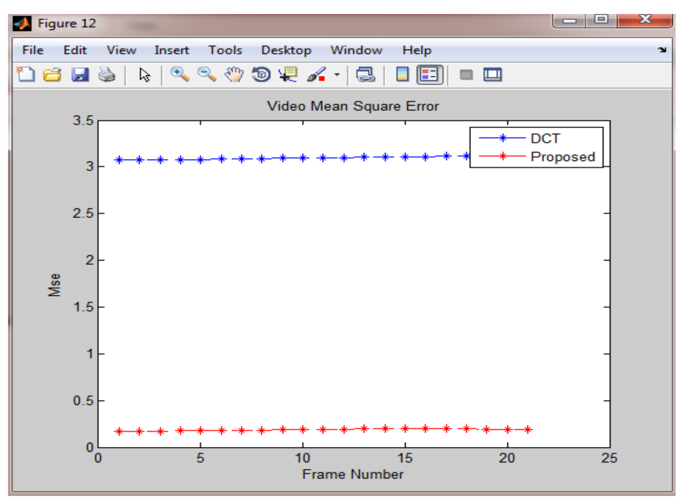

Fig 3: Video MSE vs Frame Number

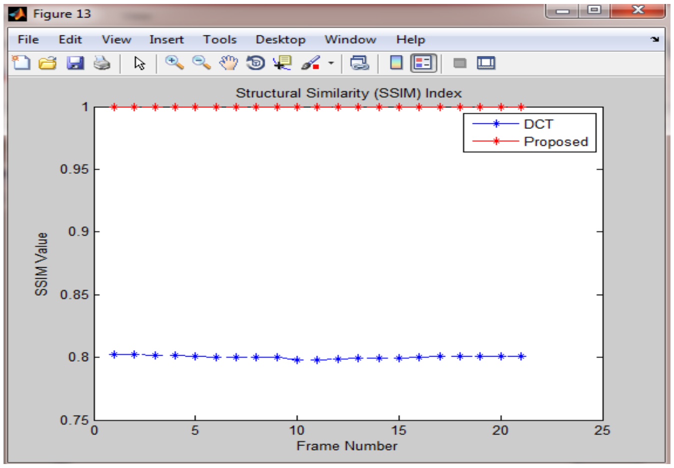

Fig 4: SSIM vs Frame Number

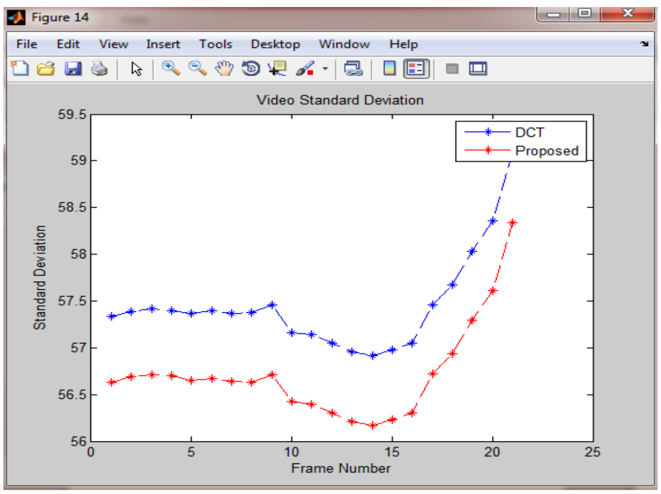

Fig 5: Video Standard Deviation vs Frame Number

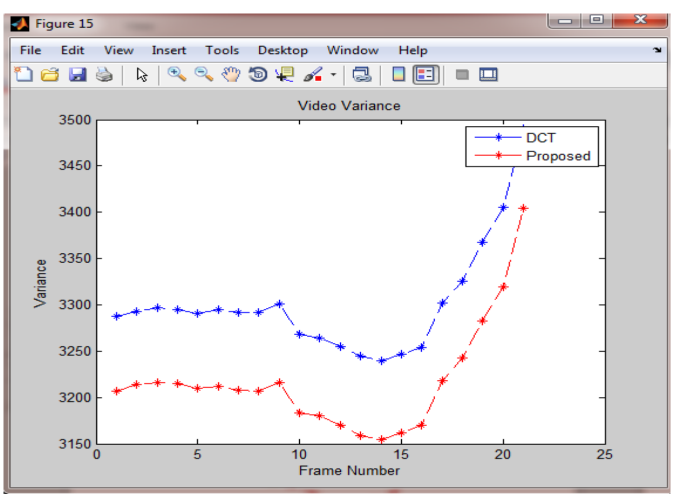

Fig 6: Video Variance vs Frame Number

11. CONCLUSION

We have reached the conclusion that robustness, geometric attack, imperceptibility, PSNR (Peak Signal to Noise ratio) are the most important requirements for a watermarking system. The performance analysis shown in this paper for watermarking techniques considering different parameters using fractal and RLE encoding. By observing this paper one can say that fractal and RLE encoding techniques have superior performance as compared to other techniques.

REFFRENCES

[1] Barnsley M. F., "Fractal Image Compression", Notices of the AMS, pp. 657-662, June 1996.

[2] Y Fisher, "Fractal Image Compression", SIGGRAPH-1992 Course Notes.

[3] Rafel C. Gonzalez, Richard E. Woods, "Digital Image Processing", Second Edition, Pearson Education Asia, 2005

[4] Fisher, Y.: Fractal Image Compression: Theory and Applications. Springer, New York, 1995

[5] K. M. S. Soyjaudah, I. Jahmeerbacus, " Fractal Image Compression using Quadtree Partitioning", International Journal of Electrical Engineering Education 38/4, October-2001.

[6] Wagdy Mahmoud, D. J. Jackson, "Improved Quadtree Decomposition/Recomposition Algorithm for Fractal Image compression", IEEE Proceedings Southeastern, pp. 258-263, 1999.

[7] Sofia Douda, Abdelhakim EI Imrani, Abdallah Bagri, "A New Approach for Improvement of Fractal Image Encoding", International Journal on Computer Science and Engineering, vol. 2, no. 4, pp. 1387-1394, 2010.

[8] Hai Wang, "Fast Image Fractal Compression with Graph-Based Image Segmentation Algorithm", International Journal of Graphics, vol. 1, no. 1, November-2010.

[9] C. M. Kung, W. S. Yang, C. C. Ku, C. Y. Wang, "Fast Fractal Image Compression Base on Block Property", IEEE Proceedings of International Conference on Advanced Computer Theory and Engineering, 2008.

[10] Chou-Chen Wang, Chaur-Heh Hsieh, "An Efficient Fractal Image-Coding Method Using Interblock Correlation Search", IEEE Transactions on Circuits and Systems for Video Technology, vol. 11, no. 1, January-2001

[11] S. Kaur and V.S.Verma," Design and Implementation of LZW Data Compression Algorithm", International Journal of Information Sciences and Techniques (IJIST) Vol.2, No.4, July 2012

[12] Cabeen K. and Gent P., "Image Compression and the Discrete Cosine Transform," *Mathematical Journal*, vol. 4, no. 1, pp. 81-88, 2010.

[13] Gonzalez, R. and Eugene, R. Digital image processing, 466, . 2008.

[14] Kaouri, A. H. . *Fractal coding of still images*. Queen's university of Belfast, UK. 2002.

[15] Hu, L., Chen, Q. and qing, Z. An image compression method based on fractal theory. The 8th international conference on computer supported cooperative work in design proceedings, 546 – 550. 2003.