

Hybrid Video Compression using 2D-DCT and Area Encoding Techniques

U.Thavamani¹, Dr.K.Mahesh²

¹Research Scholar, ²Professor

Department of Computer Science and Engineering, Alagappa University,
Karaikudi-600 003, Tamilnadu, India.

¹sputhavamani@gmail.com , ²mahesh.alagappa@gmail.com

Abstract— To store the digital video, even CD/DVD is not sufficient of handling data and therefore, video compression plays an essential role. Video compression removes the redundant information from digital video without reduce the quality to an unacceptable level. In this proposed work, compressing video is efficiently done by using 2D-DCT which is a version of DCT with Median filter and Area encoding gives the high CR than existing algorithms. In this method, first video is divided into frames and remove noises using of Median Filter, then that frames are split in to 8x8 pixel blocks. Then 2D-DCT is employed on these blocks and after that, quantization, zigzag pattern and Area encoding is done on transformed data. Quality of video is good after compressed the video and also algorithm is fast with less complexity. Experimental results of the proposed work ensure that effectiveness and gives highest compression ratio without data loss and quality of video.

Keywords— Video Compression, 2D-DCT, Quantization, ZigZag, Area coding, Compression Ratio, Median Filter.

I. INTRODUCTION

In multimedia applications, it is difficult to deal with transmission of the video due to large. In order to reduce the capacity of data and to reduce the bandwidth, compression technique is used which is employed to original data before its transmission. Video is divided in to frames and difference in the frames are stored, transmitted instead of sending frame one by one which is the idea behind video compression. Compression is classified in to two which are Lossy (original Data!= decompressed Data) and Lossless (original Data = decompressed Data). In lossless compression, data is compressed without loss of data (examples are, Run length Coding, Huffman Coding, LZW (Lempel Ziv- Welch) Coding) and in Lossy compression, data is compressed with loss of data (examples are Vector Quantization, Fractal Coding, Block Truncation Coding, etc.) [1]. Lossy compressors generally obtain much higher compression ratios than do lossless compressors. Among several techniques, DCT is a common method for video compression in which mapping the value from time to frequency domain. In general, DCT is used for being processing of 1D signal but for image and video, use 2D-DCT method. 2D DCT is similar to DCT but main difference is that takes 1D DCT individually to rows and columns [2]. In DCT process, image is split into small blocks and then on each block, DCT is applied. Quantization technique is used to compress each block and in this stage,

less frequency is eliminated. Original image can be restored through decompression by applying Inverse DCT [3]. Transposition buffer is needed in between one DCT which is row wise transformation and another DCT which is column wise transformation.

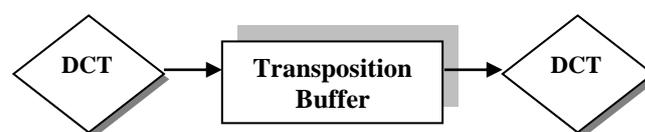


Fig.1 Basic DCT Transformation

Lossless compression is essential in applications such as text file compression. Lossy compression is acceptable in many imaging applications. In video transmission, a slight loss in the transmitted video is not noticed by the human eye. The purpose of Median filtering is remove the noises which is called as nonlinear method. This noise reduction is done at pre-processing step to get best results for the next level processing and also help to preserve edges while this noise reduction from an image. It is very useful to eliminate “Salt and Pepper Noise”. Median Filter going through the image pixel by pixel and substitute one value with median of neighboring pixel. Neighbors pattern is known as “Windows” which slides, pixel by pixel, over the total image. For odd entries of windows, it is just the middle value after all the entries in the window are sorted numerically [4]. For an even number of entries, there is more than one possible median. Area coding is an enhanced form of run length coding, reflecting the two dimensional character of images. This is a significant advance over the other lossless methods. For coding an image it does not make too much sense to interpret it as a sequential stream, as it is in fact an array of sequences, building up a two dimensional object. The algorithms for area coding try to find rectangular regions with the same characteristics. These regions are coded in a descriptive form as an element with two points and a certain structure. This type of coding can be highly effective[5]. Decompression process is similar to compression process but inverse. Compression constraints are Quality, Complexity, Delay, and CR. Quality means compressed video doesn’t lose its quality beyond acceptance level. A complexity indicates that is not too complex when run this algorithm. Delay means compression algorithm takes optimum time to execute and CR stands for Compression Ratio which is the ratio of original file

size to compressed file size. If CR level is increase, then quality also good. Else, quality of video is lost.

II. RELATED WORK

Harjeetpal singh *et al.* [6] use combination of DWT, DCT and Huffman Encoding Techniques for compressing image. In this method, image is partitioned into 16x16 blocks and transformed these blocks by using 2D-DWT. Higher frequencies are eliminated and Lower frequency LL is passed to next phase and decomposed by using second level 2D-DWT. Detailed coefficients are eliminated and applied 2D-DCT to LL. Then Huffman codes are used to obtain compressed image. To reconstruct the image, inverse procedure of encoding is applied. This method is used in many applications such as telemedicine, wireless Capsule endoscopies. Performance is evaluated by PSNR and get higher compression ratio when comparing to standalone DWT and DCT.

Vivek Arya *et al.* [7] have proposed DCT2 method with Huffman coding for compressing medical image. In this method, the image is split into 32 blocks of 8x8 size and DCT2 is employed on each block. The next step is to calculate mean for every block and this mean matrix is transposed. This transposed matrix is convert into vector form and then, arranging coefficients in order to select. Thereafter Zig-Zag coding and Huffman coding is applied to get compressed image. This method ensures that quality of the encoded, decoded image is improved as well as higher CR, PSNR values.

Er. Abhishek Kaushik *et al.* [8] have proposed image compression based DCT technique. In this proposed methodology, image is divided into 8x8 blocks then extracting non-zero coefficients on each and every block. While reconstructing an image, subtract non-zero coefficients from 64 to obtain zero coefficients. Performance of this method is evaluated by calculating parameter MSE. Experimental results of given image get MSE = 0 which is showing that favorable reconstruction is obtained at selection of highest coefficients. Further, it is concluded that successive frames in video transmission showing higher temporal correlation.

A new combination of LZW and BCH is proposed by A. Alarabeyyat *et al.* [9] for lossless image compression. LZW technique is used to reduce the value which is replicated and BCH code is used to detecting or correcting the error. In proposed method, BCH code is repeated till inflation is detected to improving CR. Data set of 20 images are tested by using this proposed method and results are evaluated with the help CR, Bits per pixel. Compression ratio of the proposed method is 1.636383 that means it is better than RLE, Huffman and LZW techniques.

Dalvir Kaur *et al.* [10] have proposed a new method naming Huffman Based LZW Lossless Image Compression using Retinex algorithm. In this method, three steps are involved. Compress image using Huffman coding, Then again compress Huffman coding words using LZW and Retinex algorithm is applied to enhance the contrast and improve the

quality on compressed image. MSE, PSNR, CR is measured to evaluate the performance of this novel proposed method.

III. PROPOSED METHOD

The proposed method is based on the 2D-Discrete Cosine Transform and the video is the input of the proposed system. In this system, input video is divided into frames and remove the noises from this frames by using Median filter. To achieve High CR ratio, apply Median Filter to them before encoding process and these noise free frames are partitioned in to 8x8 pixel blocks. Each block is transformed using 2D DCT which means perform two DCT on 8x8 blocks and transformed blocks are quantized through quantization table. Then, perform zigzag scanning to get 64 coefficients by convert 8x8 matrix. Thereafter, Area encoding technique is employed to the resultant video. Original data and compressed data are equal and thus, no loss of information. Decompression process of video is similar to video decompression but applying procedure reversely.

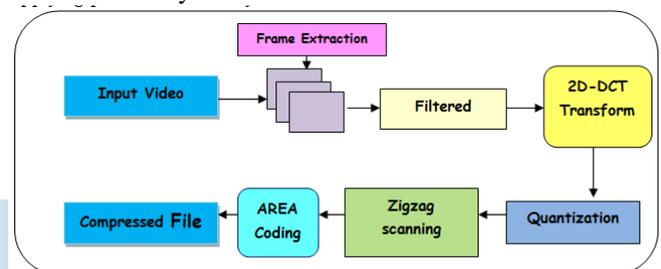


Fig.2 Block Diagram of Proposed method

A. Proposed Algorithm

Algorithm 1: Algorithm for Video Compression.

- Step 1: Input- Video Clip
- Step 2: Divide the input video into frames.
- Step 3: Remove noise from this frame by using Median filter.
- Step 4: Now, this filtered frame is divided into 8x8 pixel blocks.
- Step 5: Applying 2D-DCT on these frames.
- Step 6: Transformed frames are quantized using quantization table.
- Step 7: Scan the block values in zigzag manner to exploit zero coefficients.
- Step 8: Apply Area coding lossless compression algorithm to compress video.
- Step 9: Output: Compressed Video

Algorithm 2: Algorithm for Video Decompression

- Step 1: Input: Compressed video
- Step 2: To decompress the video, apply area decoding technique.
- Step 3: Apply Inverse Zig-Zag.
- Step 4: Every block is de-quantized.
- Step 5: Then apply inverse of 2D-DCT on each block.
- Step 6: Output: Original Video.

IV. RESULTS AND DISCUSSION

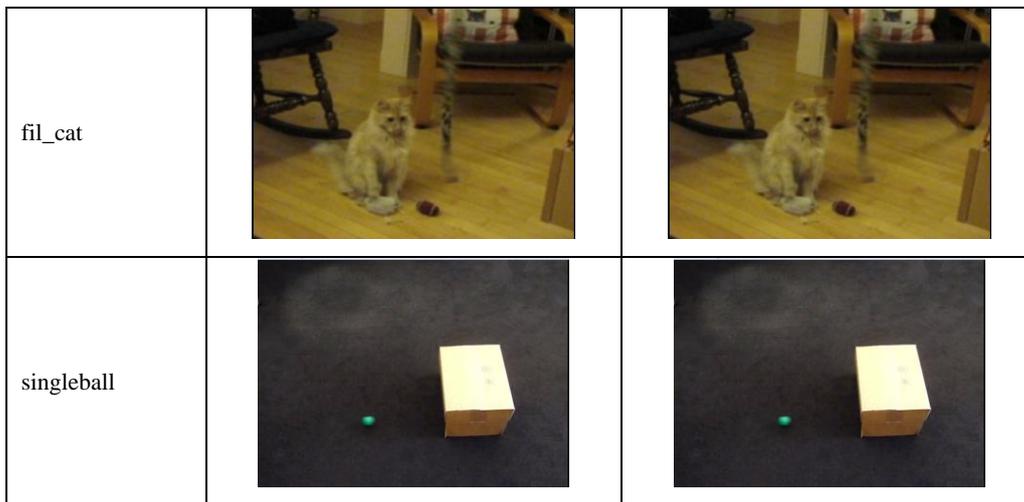
A. Experimental Results

We have conducted a series of experiments to evaluate the performance of the proposed depth compression techniques.

We have tested with the various test sequences with different resolutions in the color video. In this work, the AVI file has been set as input video sequence on which compression is performed. Table 1 Shows results of video in sequences.

TABLE I
EXPERIMENTAL RESULTS OF THE PROPOSED METHOD IN VARIOUS SAMPLE VIDEOS

Video Name	Original Video	Compressed Video
barcodes		
vipbarcode		
vipunmarkedroad		
viplanedeparture		
vipmen		



B. Performance analysis

Table 2 shows the proposed video compression techniques and its compression ratio. It shows the video resolution, frame/sec properties and its compression ratio for AVI videos

compressed by proposed method. The minimum compression obtained is 3.56 and on average it is above 7, it is concluded that the proposed system is far better in terms of compression ratio obtained.

TABLE III
PERFORMANCE OF THE PROPOSED METHOD IN VARIOUS SAMPLE VIDEOS

Video Name	Resolution	Frame /Sec	Compression Ratio
barcodes	640×480	30	15.60
vipbarcode	320×240	30	10.23
vipunmarkedroad	320×240	1	12.56
viplanedeparture	360×240	30	4.58
vipmen	160×120	30	9.65

V. CONCLUSIONS

In this paper, the proposed work mainly focused on improving the compression quality of the video files. 2D-DCT and Area encoding has been effectively used in the proposed work for providing significant compression efficiency. It is concluded that the higher data redundancy helps to achieve more compression. The original and compressed video is equal in quality by using the proposed method, as it efficiently enhances the video contrast. In the Future work of the proposed system, Video can be compressed for storing and transmitting can be done by the other higher level transforms such as Wavelets, Neural networks etc, to improve the compression ratio.

REFERENCES

- [1] Ilam Parithi.T et. al., "A Review on Different Lossless Image Compression Techniques", International Journal of Modern Sciences and Engineering Technology, Vol.2, Issue 4, pp: 86-94, 2015.
- [2] Saloni Singh and Utkarsh Shukla, "Simulink based proposed model for image compression and comparison with other image compression technique", International Journal of Advanced Technology in Engineering and Science, Vol. 3, special Issue 2, 2015.
- [3] S.B. Midhun Kumar and A.Jayakumar, "Video Compression System for Online Usage Using DCT", International Journal of Trend in Research and Development, Vol. 2(4), 2015.
- [4] https://www.cs.auckland.ac.nz/courses/compsci373s1c/PatricesLectures/Image%20Filtering_2up.pdf
- [5] Sonal, Dinesh Kumar, "A Study Of Various Image Compression Techniques".
- [6] Harjeetpal singh and Sakhi Sharma, "Hybrid Image Compression Using DWT, DCT & Huffman Encoding Techniques", International Journal of Emerging Technology and Advanced Engineering, Vol. 2, issue 10, 2012.
- [7] Vivek Arya et. al., "Medical Image Compression Using Two Dimensional Discrete Cosine Transform", International Journal of Electrical and Electronics Research, Vol. 3, Issue 1, pp: 156-164, 2015.
- [8] Er. Abhishek Kaushik et al Int. Journal of Engineering Research and Applications, Vol. 4, Issue 4(Version 1), April 2014, pp.357-364
- [9] A. Alarabeyyat et al., "Lossless Image Compression Technique Using Combination Methods", Journal of Software Engineering and Applications, Vol. 5, pp.752-763, 2012.
- [10] Dalvir Kaur and Kamaljit Kaur, "Huffman Based LZW Lossless Image Compression Using Retinex Algorithm", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 2, Issue 8, 2013.