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A Combined DWT-DCT approach to perform Video compression base of Frame Redundancy

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Abstract- **Videos is the most useful and most appealing approach to represent some information. Today all the communication approaches are working with such kind of media. The only problem with such kind of media is its large size. Either we have to store the data in database or to transfer video over some communication medium, video size always effect the efficiency. Because of this video compression is required to save the storage space. The most common compression techniques find the redundancies in the movie frame and the correlation between the scenes to get high degree of compression. The proposed approach is also about the up-down sampling based approach. Here we are presenting a combined DWT-DCT approach to perform the video compression with scalability vector. In this proposed approach DWT will perform the adaptive filtering and DCT will use these weighted values as DCT coefficient. The combined approach will return the high degree of compression ratio. It will give the compression approach to reduce the media size and Improve the video compression by improving the frame based similarity and the correlation.**

Keywords: **DWT, DCT, Adaptive, compression, redundancies.**

I. INTRODUCTION

The reduction of a video size by means of a video compression, "Compressed" just means that the information is packed into a smaller space. Video takes up a lot of space. Uncompressed footage from a camcorder takes up about 17MB per second of video. Because it takes up so much space, video must be. Compression decreases the file size, allowing for a reasonable amount of download time or Streaming capability but also decreases the quality of the video. It is a necessary function of Recording Video and TV signals onto a Computer Hard Drive. Because raw Video footage requires lots of space, without Video Compression, Video files would quickly eat up gigabytes of hard drive space, which would result in only short amounts of

Video or TV recorded onto the Computer's Hard Drive. With Video Compression, smaller Video files can be stored on your PCs Hard Drive, resulting in much more space for Video files. Television services in Europe currently broadcast video at a frame rate of 25 Hz. Each frame consists of two interlaced fields, giving a field rate of 50 Hz. The first field of each frame contains only the odd numbered lines of the frame (numbering the top frame line as line 1). The second field contains only the even numbered lines of the frame and is sampled in the video camera 20 ms after the first field. It is important to note that one interlaced frame contains fields from two instants in time. American television is similarly interlaced but with a frame rate of just less than 30 Hz. In non-interlaced video, all the lines of a frame are sampled at the same instant in time. Non-interlaced video is also termed 'progressively scanned' or 'sequentially scanned' video. The chrominance bandwidth may be reduced relative to the luminance without significantly affecting the picture quality. For standard definition video, CCIR recommendation 601 [3] defines how the component (YUV) video signals can be sampled and digitized to form discrete pixels.

A. Methods for compression

There are four methods for compression

1. Discrete Cosine Transform (DCT)
2. Discrete Wavelet Transform (DWT)
3. Vector Quantization (VQ)
4. Fractal Compression (FC)

1. Discrete Cosine Transform (DCT)

Discrete cosine transform is a lossy compression algorithm. That is discards those frequencies which do not affect the image as the human eye perceives it. For the two dimensional DCT the mathematical function is described as follows:

$$t(i,j) = c(i,j) \sum_{n=0}^{N-1} \sum_{m=0}^{N-1} s(m,n) \cos\frac{\pi(2m+1)i}{2N} \cos\frac{\pi(2n+1)j}{2N}$$

For the purpose of decoding, the Inverse Discrete Cosine Transform function is there, which is explained as follows:

$$s(m,n) = \sum_{i=0}^{N-1}\sum_{j=0}^{N-1} c(i,j)t(i,j)\cos\frac{\pi(2m+1)i}{2N}\cos\frac{\pi(2n+1)j}{2N}$$

The Discrete Cosine Transform decoding and encoding equations information is provided generally and to explain the Discrete Cosine Transform functions complexity (J. Reichel, 2005).

2. Discrete Wavelet Transform (DWT)

Like DCT, Discrete Wavelet Transform mathematically transforms an image into frequency components. The low pass filter performs an averaging/blurring operation, and is expressed as:

$$H = \frac{1}{\sqrt{2}}(1,1)$$

And the high-pass filter performs a differencing operation and can be expressed as:

$$G = \frac{1}{\sqrt{2}}(1,-1)$$

on any adjacent pixel pair. Ratio 43:1

3. Vector Quantization (VQ)

Vector quantization is a lossy compression that looks at an array of data, instead of individual values. It can then generalize what it sees, compressing redundant data, while at the same time retaining the desired object or data stream's original intent.

4. Fractal Compressions (FC)

Fractal compression is a form of VQ and is also a lossy compression. Compression is performed by locating self-similar sections of an image, then using a fractal algorithm to generate the sections.

II. Related Works

Xin Jin [1] work an early skip mode decision algorithm is reduce the computational complexity and power consumption in surveillance video compression by detecting the content of the whole video encoding system is significantly reduced 84%,without loss observed in both of subjective and objective video quality.M. Abdoli [2] will discuss about distance increment between camera locations in multi-view video when talking about compression and the existing trade-off related to complexity of codec and efficient compression, as well. Jelte Peter Vink [3] shows how to build a highly relevant metric for video compression artifacts using supervised learning. To obtain the ground truth for training, Author first build a reference metric for local estimation of the artifact level, this is robust to scaling and sensitive to all types of compression artifacts. Nam Ling [4] work the technology and applications of video compression from the past to the present and into possible directions and challenges for the next five years. Authors discuss key compression techniques and trends for future video coding efficiency, perceptual quality, and computational complexity.G.Sureshet.al [5] defined; low complex Scalable ACC-DCT based video compression approach which tends to hard exploit the pertinent temporal redundancy in the video frames to improve compression efficiency with less processing complexity. Presented model consists on 3D to 2D transformation of the video frames that allows exploring the temporal redundancy of the video using 2D transforms and avoiding the computationally demanding motion compensation step. Fernando Pereira [8] work reviews the current status quo in video compression, as well as the main trends, with special emphasis on video compression standards, considering their particular influence on the deployment success of this technology.

III. PROPOSED METHOD

Today in the communication approaches the only problem with video is its large size, So that video compression is required to save storage space. The most common compression techniques find the redundancies in the movie frame and the correlation between the scenes to get high degree of compression. The proposed approach is also about the up-down sampling based approach. Here we are presenting a combined DWT-DCT approach to perform the video compression with scalability vector. First we input the AVI video in sequence, then analyze video format those are AVI or not, if that is satisfy then analyze the compression model in which analyze all frame of video those are accepted or rejected if satisfy then put on extract key frames it do frame in different way in sequence and then implement Ritz transformation in which we apply DWT-DCT based approach to improve frame maching and then identify similar frames then remove similar frames and then reset frame in sequence and last rebuild video in sequence. Proposed Model shows in figure 1

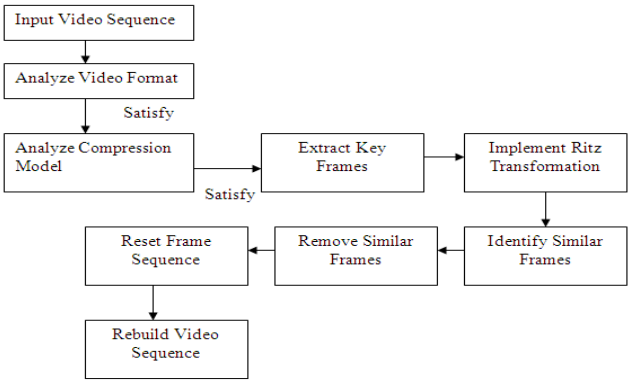

Fig. 1 Proposed Models.

The proposed work is about to compress the video data. The complete proposed work is divided in 3 main phases.

1. Pre-Processing
2. DWT-DCT based compression
3. Analysis

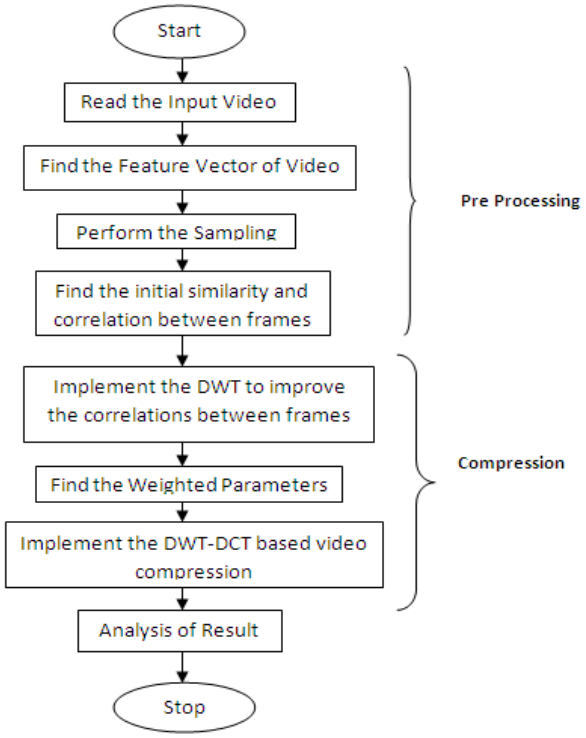

Fig. 2 Proposed-Flow-Chart

A. Proposed Algorithm

Step 1: Read the Input Video
Step 2: Read the Video Features and Compression format, if it is uncompressed Video Process on it.
Step 3: Find the Number of Frames in Video called N
Step 4: For i=1 to [Repeat Steps 5 to 7]
Step 5: Get the ith Frame from Image called FrameImage
Step 6: If i=1
Then
Write FrameImage to seprate Folder
Else

6.1 Implement the Convolution Filter on FrameImge(i) and FrameImage(i-1)
6.2 Perform the Simalrity measure called Riez transformation to extract the internal image features
6.3 Perform the Edge Detection on both images

6.4 Create the structured Mask on both images
6.5 Implement the Similary measure and return the similarty vector between 0 and 1

Step 7: If
SimilaryVector(FrameImage(i),FrameIm
age(i-1))=1
{
Discard the Similar Image
}
Step 8: Create an empty Video file
Video1
Step 9: Now we get all the absolutely different images in a folder imgfolder
Step10: 1For i=1 to Length (imgfolder)
{
Step 11: Read Image img (i) from folder
Step 12: Add the image img (i) in
Video1
}
Step13: Save the video and show the
result
}

IV. EXPERIMENTAL RESULTS

A. RESULTS

This work is implemented by using MATLAB 7.8. The objective of this work is to improve the video compression by improving the frame based similarity and the correlation.

In this work, the AVI file has been set as input video sequence on which compression is performed. The proposed work is beneficial in videos that have lesser movement. A video having maximum number of still frames will give the better compression ratio. This kind of work is beneficial to compress the videos captured by CCTV cameras where the movement is done rarely and the camera set on a particular scene.

To proceed with this work, the compatibility of compression model with AVI sequence is to be checked. If the compression model supports then the work will continue on it. In the next stage, we need to perform the splitting on video sequence that is needed to perform and extract the frames from this video. Once the frames are extracted the next work is convert these frames to image. For this conversion we have used jpg format of image. Because of this on individual image the JPG compression is performed. Now the work is performed on these compressed images.

Next work is finding the similarity between these images in a sequence. To perform the similarity measures an efficient Ritz Transformation approach has been used. According to this transformation the decomposition is used along with internal feature analysis to identify the similarity between frames. The internal features includes the edge based matching between images as well as the some other features extracted based on convolution operators.

Once the similar frames found in a sequence. One frame out of them has been kept and avoids the remaining frames. Finally these all images are collected to form a new video sequence or the result video sequence. Figure 4.1 Shows results of video in sequences. Figure 4.2 bike stunt video used in proposed work. Table 4.1 show Frame Details of all AVI video used in this work and PSNR value of AVI Videos. Figure 4.3 Shows PSNR graph of all AVI Video. Figure 4.4 PSNR values of all AVI Videos Frame. Table 4.2 Shows Existing Compression Techniques and its Compression Ratio [35]. Table 4.3 Shows Proposed technique and Compression Ratio. Figure 4.5 Shows Compression Size of all Videos. Figure 4.6 Compression ratios of existing and proposed work

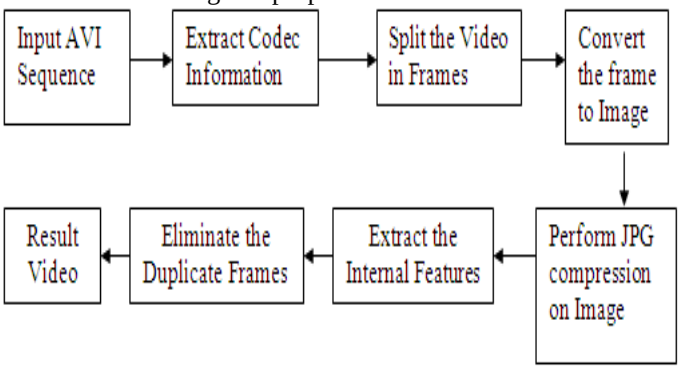

Fig. 3 Result Video Sequences

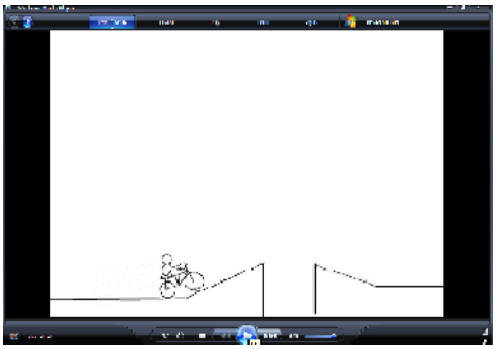

Fig.4 Bike stunt.

TABLE I

Frame Details and PSNR value of AVI Videos

Sr. No.	Name	Total Frames	Similar Frames	Dissimilar Frames	PSNR
1	Sample video	40	1	39	18.88
2	Bike stunt	31	4	27	75.32
3	Cycling	15	4	11	43.02
4	3D	37	8	29	51.24
5	Miss	41	7	34	47.83
6	Flying	15	4	11	47.04

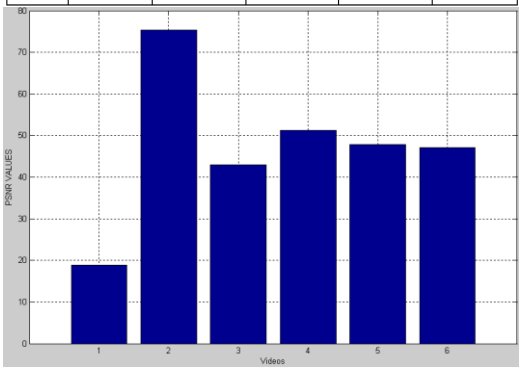

Fig.5 PSNR vs. AVI Video

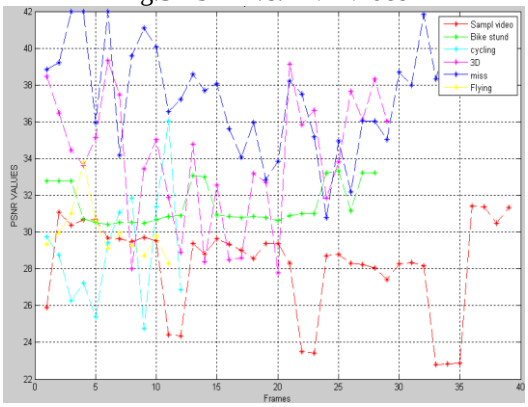

Fig. 6 PSNR vs. Videos Frame

B. Discussion

Table 4.2 shows the existing video compression techniques and its compression ratio. Table 4.3 shows the actual size, compression size and its compression ratio for AVI videos compressed by proposed work. Figure 4.5 shows the compression size of all AVI Videos, the blue line shows the original size of video and red line shows the compressed

size. The minimum compression obtained is 30% and on average it is above 50%, it is concluded that the proposed system is far better in terms of compression ratio obtained from existing approaches. Figure 4.6 shows all compression Ratio with graph.

TABLE II
Existing Compression Techniques and its Compression Ratio [27]

Sr. No.	Compression Technique	Compression Ratio
1	Intel RTV/Indeo	3:1
2	Intel PLV	12:1
3	IBM Photo motion	3:1
4	Motion JPEG	10:1
5	Fractals	10:1
6	Wavelets	20:1
7	H.261/H263	50:1
8	MPEG	30:1

TABLE III
Proposed technique and Compression Ratio

Sr. No.	Video Name	Actual Size	Compression Size	Compression Ratio
1	Sample Video	624	371	40:1
2	Bike stunt	974	82	91:1
3	Cycling	811	358	56:1
4	3D	634	112	82:1
5	Miss	932	337	64:1
6	Flying	1974	511	74:1
			Average	67:1

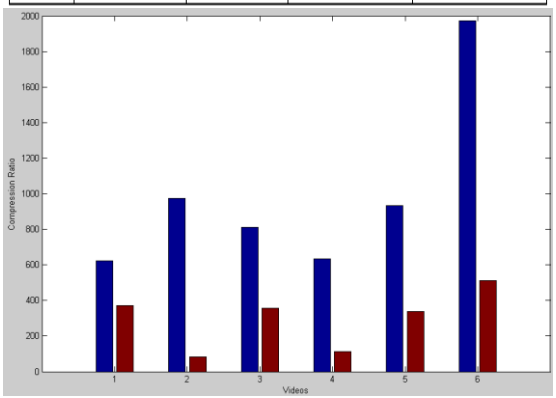

Fig. 7 Compression Size of all Videos

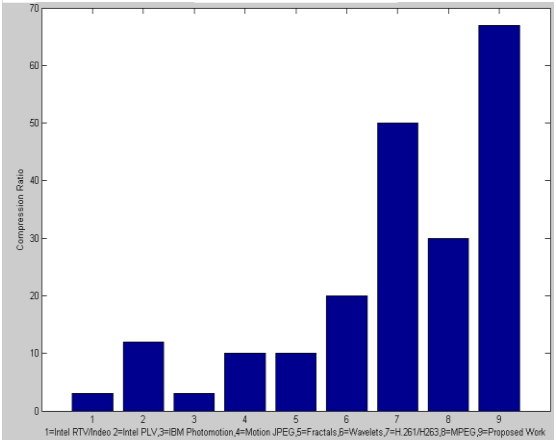

Fig. 8 Compression ratios of Existing and proposed work

- Existing work is on MPEG videos and proposed work is on AVI videos.
- To perform the matching frame they are using Histogram approach that is very older, in proposed work, Ritz Transformation Approach to identify the similarity level between key frames.
-

V. CONCLUSION

A. Conclusion

The work is about to improve the video compression by improving the frame based similarity and the correlation. We are presenting a DWT-DCT based approach to perform the video compression with better compression ratio. In this approach the DWT willperform the Adaptive filtration to improve the similarity and the correlation between frames. The weighted values driven from the filtration is used by DCT as the coefficient to perform the video compression. The video quality is evaluated by Peak Signal to Noise ratio (PSNR) in AVI videos, which give good video quality after frame reduce and combine videos.

B. Future Work

- It will save the disk space while storing the video data in databases
- It gives higher storage capacity to the surveillance system where 24 hours video data is taken
- It gives the efficient communication of video data over different kind of networks.
- It improve the video compression by improving the frame based similarity and the correlation.
- DWT-DCT based approach to perform the video compression with better compression ratio.

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