DISTRIBUTED VIDEO CODING WITH ZERO MOTION SKIP ENCODER USING LDPC CODE

[1]Priyanka Chavan , [2]Chitra M

[1]Student , [2]Assistant Professor

Department of Electronics and Communication, MSRIT, Bangalore, (India)

ABSTRACT

Distributed video coding is another coding worldview for compression, which depends on the Slepian–Wolf and Wyner–Ziv theorems, which utilizes the statistical characteristics of signal source and recommends that we can likewise accomplish efficient at the decoder side by using statistical characteristics of signal. The hybrid DVC has capacity to exploit the temporal redundancy so as to improve the coding efficiency which differentiates the video coding from the still image coding. The temporal prediction between the pictures of video sequences is combined with transform coding techniques (DCT, DWT, and SWT) by distributed video coding for the prediction error. The predicted error signal is transformed and predicted and it eliminates redundancy information from the data. By the use of quantization after the transform step, unimportant parts of the data are removed. In this paper we are using zero motion blocks to reduce the encoder complexity, which increases coding efficiency.

Keywords: DCT (Discrete Cosine Transform), DWT (Discrete Wavelet Transform), SWT (Stationary Wavelet Transform), LDPC (Low Density Parity Check Code), Distributed Video Coding (DVC)

I INTRODUCTION

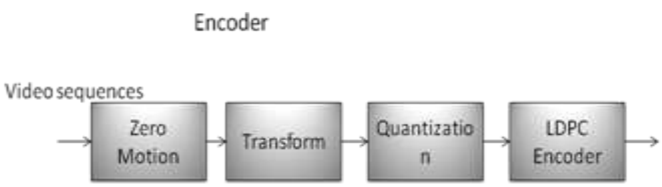
In order to transmit the video through a network or channel we need to follow some coding standards. Some of the traditional video coding standards are JPEG, MPEG and H.264. In MPEG and ITU- H.264 encoder is more complex than decoder but with the betterment in the upcoming technologies, the video application demand for the lower encoder and decoder complexity. For example mobile handset which supports many application like multimedia data transfer, communication etc, the new media-rich "uplink" wireless video transmission applications need a total redesign of these traditional downlink friendly video architectures. It's necessary to redesign the video coding architecture, with the emerging applications. DVC is developed based on theory of distributed source coding. Distributed Video Coding (DVC) adopts a completely different coding paradigm by giving the decoder the task to exploit - partly or wholly - the source statistics to achieve efficient compression. This change of paradigm also moves the encoder-decoder complexity balance. In distributed video coding, exploits spatial and temporal redundancy. The best way to exploit spatial redundancy is transform coding where fewer coefficients are coded due to compression, no. of coefficients to be coded are reduced. In this hybrid DVC temporal redundancy is exploited by both encoder (with high complexity) and decoder (with low complexity). In Paper [1] author proposed a scheme where he uses DCT domain and hash code distributed video coding method. Here Special challenge is rate control since temporal correlation is exploited at decoder only but not at the encoder. In paper [2] author uses syndrome based video coding technique. The estimation of each frame is accurate by using low quality frame as reference frame. Even though these techniques tried out to represent the Slepian–Wolf and Wyner–Ziv theorems in distributed video coding but still there is significant gap between the compression efficiency of distributed video coding and that of conventional video coding.

II OVER VIEW OF THE PRESENT DVC

Existing distributed video coding which makes better use of spatial and temporal correlation, without adequate examination on the effective representation of the correlation. This is one of the reasons that there still exists substantial gap between present DVC and traditional hybrid video coding. In conventional video coding, the blocks which are represented effectively those blocks are zigzag scan, run length and skipped macro block has lead to improved R-D performance. In order to overcome the problem of current DVC, that is, effective representation of temporal and spatial correlation, we are proposing new strategy of DVC which will increase rate distortion performance. The complexity of existing traditional video coding is also one of the problems for multimedia communication.

III DISTRIBUTED VIDEO CODING WITH ZERO MOTION

In the first step, the video sequence is divided into N number of frames. These frames are applied to the zero motion block, in zero motion block difference of two frames are taken and compared with the threshold. . Each frame is compared with the reference frame and difference is compared with the threshold if the difference is less than the threshold then that frame is skipped, which is considered as there is no motion between the frames. That is motion between frames can be skipped. Due to the zero motion block complexity of the system can be reduced. Computational complexity of encoder is reduced. After detection of zero motion blocks are detected transform coding is performed on unskipped frames and then LDPC is applied to unskipped frames. At the decoder inverse operation is performed and retain the skipped frames motion estimation is used. As shown in figure1.



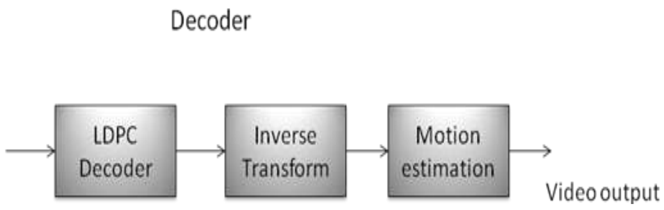


Fig1 : Distributed Video Coding

IV TRANSFORM CODING

4.1 Discrete Cosine Transform

The discrete cosine transform is a transform matrix of size N x N and the values of the matrix are function of cosine terms. It is a frequency based technique and converts each pixel in an image into set of spatial frequencies.

DCT is a modified version of DFT which uses both imaginary and real data for computation and hence computation is complex. Whereas, DCT uses only real data to compute its coefficients which reduces no. of computation. Form 2N point sequence of DFT is reduced to N point sequence of DCT. The DCT values are periodic and symmetric. For an image, image is divided into NxN block and then dct coefficients are calculated for each block and these coefficients are quantized and inverse dct is performed.

The definition of the two-dimensional DCT for an input image P and output image Q is

$$B_{mn} = \alpha_m \alpha_n \sum_{p=0}^{P-1} \sum_{q=0}^{Q-1} A_{pq} \cos\frac{\pi(2p+1)m}{2P} \cos\frac{\pi(2q+1)n}{2P},$$

$$0 \leq m \leq P-1;\ 0 \leq n \leq Q-1 \qquad (1)$$

IDCT

$$A_{pq} = \sum_{n=0}^{Q-1} \alpha_m \alpha_n B_{mn} \cos\frac{\pi(2p+1)M}{2P} \cos\frac{\pi(2q+1)N}{2P},$$

$$0 \leq p \leq P-1;\ 0 \leq q \leq Q-1$$

Where

$$\alpha_m = \begin{cases} \frac{1}{\sqrt{P}}, & m = 0 \\ \sqrt{\frac{2}{P}}, & 1 \le M \le P-1 \end{cases}$$

And

$$\alpha_n = \begin{cases} \frac{1}{\sqrt{Q}}, & n = 0 \\ \sqrt{\frac{2}{Q}}, & 1 \le n \le Q-1 \end{cases}$$

P and Q are the row and column size of A, respectively. The DCT coefficient of a real data is also real. The DCT concentrates on information and makes it useful for image compression.

4.2 Discrete Wavelet Transform

Wavelet transform make use of the special correlation and frequency correlation. Wavelet compression is alike sub band coding where signal is disintegrated by filter banks. After the wavelet transform image is broken down into approx. and detailed subsignals. The approximation subsignal contains maximum pixel values and other three subsignals contain horizontal, diagonal and vertical detail. These three sub band signals can be set to zero if its values are below threshold value and hence increases compression ratio [3].

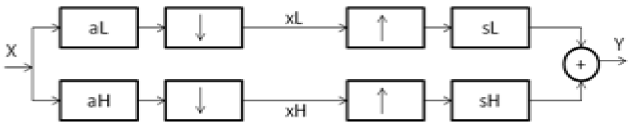


Fig1.Two channel filter bank for DWT

Where

aH- high pass filter; aL-low pass filter for input sequence

sH- HP filter; sL-LP filter for reconstructed signal

xH and xL – transform signal

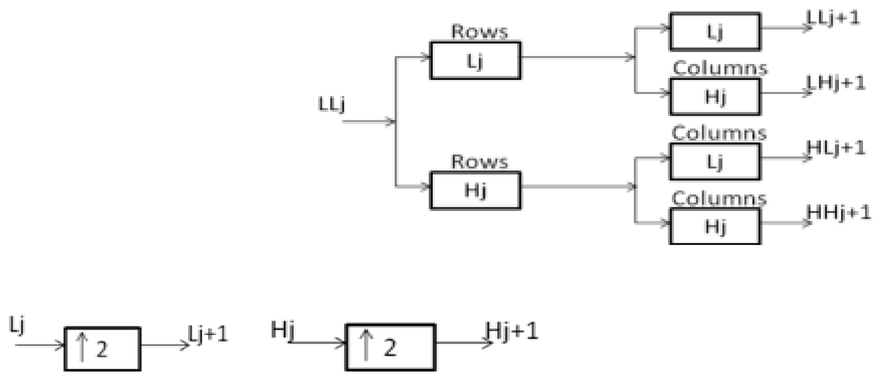
For 2D image we will have four filter banks, one is for approximated coefficients and other three for horizontal, vertical and diagonal detail coefficients.

The DWT for a 2D signal such as image can be obtained from 1D DWT. By multiplying two 1D functions we can obtain low pass and high pass signal for 2D signal. For each row pixel values of a 2D image, 1D wavelet transform is applied to obtain an intermediate values along with coefficients for each row and 1D transform is applied to each column. For 2D image there will be 3 wavelet functions that read pixel values in vertical, horizontal and diagonal direction. To represent this four filter banks are used [4].

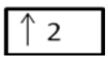
4.3 Stationary Wavelet Transform

The stationary wavelet transform is an extended version of standard DWT. In DWT rendered version of a signal x is not the similar to the DWT of the original signal. To overcome this translation invariance of DWT we go for SWT.

DWT uses up sampler and down sampler for its operation, after down sampling of filter coefficients, the threshold and decomposed coefficients may result in infirm and edge distortion . In SWT at each level of data low and high pass filters are applied to produce two sequences at next stage. The lengths of the two new sequences are same that is, have same number of sample in input and output. Every filter is modified at each stage just by filling out the space with zeros [5].



Where



Upsample

Fig 2.Two dimensional SWT

V LOW DENSITY PARITY CHECK MATRIX

LDPC was proposed by Gallager in his doctorate thesis at M.I.T. in 1960. The better and efficient performance of LDPC, these codes is widely used in today modern communication system. LDPC is capable of accomplishing a significant fraction of channel capacity at low complexity.

LDPC uses sparse check matrix which is generated randomly which has only a few 1's in that is compared with the amount of 0's.

LDPC code can be presented by Tanner graph which comprises of two vertices, 'n' vertices called bit nodes (for codeword bits) and m vertices called check node or variable nodes (for parity check equations). A v_node is connected to a c_node if that bit is present in the accompanying parity check equation so the number of connections in the Tanner graph is as same as the no. of ones in the parity-check matrix [6].

Considering a parity check matrix (H) n, k (8, 4).

$$H = \begin{bmatrix} 0 & 1 & 0 & 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \end{bmatrix}$$

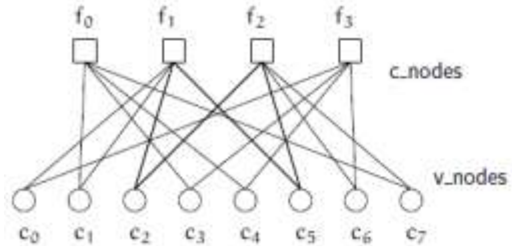


Fig3 .Tanner graph representation to the parity check matrix H.

C_node Fi is connected to v_node Cj if the element Hij of H is 1.

VI EXPERIMENT RESULT

The experiment result when transform coding (DCT, DWT, and SWT) and error control coding (LDPC) Applied for a video.

The compression ration and PSNR is tabulated below

Table1. Comparison result

Transform	PSNR	BER
DCT	7	$10^{-0.35}$
DWT	11	$10^{-0.28}$
SWT	14	$10^{-0.1}$

The results includes some of the images of the frames.

Fig4. Original input frame

Fig5. DCT of a frame

Fig6. DWT of a frame

Fig7. SWT of a frame

VII CONCLUSION

In this paper we did analysis of bit error rate and PSNR for three transform coding techniques that is discrete cosine transform, discrete wavelet transform and stationary wavelet transform with error control coding

(LDPC). From Table1 we can say that SWT gives better bit error rate and better psnr compared to DCT and DWT. And from fig 5, fig 6, fig 7 we can see that SWT gives better quality image or clear image. Hence we can say that SWT is better than DCT and DWT.

VIII ACKNOWLEDGEMENT

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