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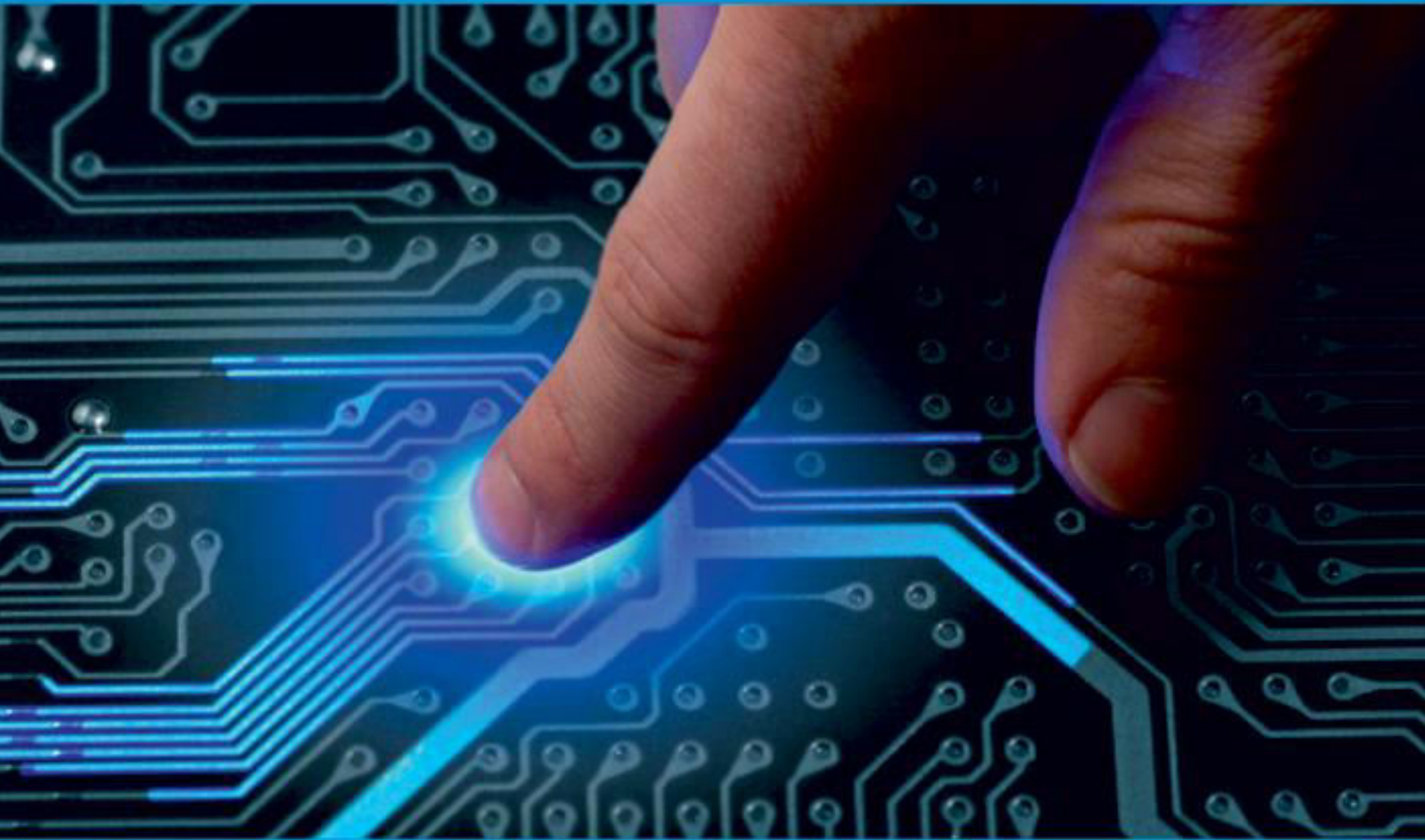

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Video Compression using SPIHT Algorithm.

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ABSTRACT: This current paper offers a unique one-dimensional (1-D) SPIHT and DWT method that increases the quality of video by internally using an adaptive compression proportion for the SPIHT algorithm on the basis of the DWT coefficients that maintains the identical bit-stream size. The classification of DWT coefficients tell about block complexity. The basic blocks are compressed firmly with a low CR (compression ratio), whereas multiplex blocks are compressed with a high CR. The SPIHT algorithm assumes the logarithm of MSE (mean squared error) to be directly associated with the logarithm of processed DWT coefficients. Experimental findings show that the proposed technique significantly increases video quality by an average of 2.23 dB in PSNR when the SPIHT algorithm's target compression ratio is 5/16. DL (Deep learning) technologies have been highly installed in a variation of applications, together with picture fixing, image compression, and computer perception. The most extensively utilized lightweight compression methods for frame memory compression.

KEYWORDS: SPIHT algorithm's, DWT coefficients, DWT-SPIHT method, compression, Deep learning.

I. INTRODUCTION

This relationship between SPIHT algorithm and DWT coefficients characteristics in portable multimedia devices that enable video processing or video recording is what this study is dependent on. The video recording system should include video compression methods to decrease the amount of memory required for video storage. Video compression methods require a high level of computational difficulty and external memory bandwidth. Which results in more power utilization. Additionally, the 1-D structure can bear the raster scan refining order, which reduces the FMC operating delay. Additionally, the 1-D SPIHT and DWT can handle a wide range of coding granularities and CRs, making it easier to apply the suitable CR to one and all compression units based on its characteristics. In terms of compression organization live SPIHT and DWT algorithms with these advantages perform well, but the relationship between coefficients of DWT is weak and the SPIHT approach is ignored. This current research emphasizes the connection between DWT coefficients and SPIHT algorithm characteristics to make up for this shortcoming. There have been presented a number of EC methods for display systems and video compression. While non modify methods like differential pulse code modulation using block truncation coding and valuable length coding are also successful in compressing images, transform-based approaches have the upper hand. The enhanced compression order techniques were the main focus of this work. The EC compresses image or video frames in real time before saving theme in external DRAM when using the FMC recording as well as processing of video. The EC module's should not contain the prime video compression module from the video recording system or the video computer vision module from the video processing, and the addition of FMC through EC should not have any effect on these activities. Additionally, it is important to take into account the exchange of hardware components and compression firms. The FMC is ideally suited to apply loss compression, which provides major power savings with very little quality loss, in order to attain maximum memory bandwidth reduction without losing acceptable video quality. The complexity of the FMC compression algorithm must be much less complex than that of video coding standards like H.264 or HEVC in order to prevent a large rise in hardware cost. To fulfill the requirements mentioned above for the FMC encoder, it is appropriate to flatten 1-D (one-dimensional) 3-level synthesis lifting DWT coefficients using SPIHT (set partitioning in hierarchical trees) coding, which attain high compression order while being computationally simple. Three primary function led to the 1-D SPIHT and DWT combination being chosen for the FMC. Firstly, it begins by generating a bit stream with a predefined CR, which makes it easier to compute addresses for compressed data and uses fewer resourses. The 1-D structure may allow the image element scan processing order, which reduces the FMC operating latency and needs fewer hardware resources than two-dimension (2-D) operations such as JPEG2000. Furthermore, the 1-D SPIHT and DWT can work with a wide variety of coding granularities and CRs, making it simpler to choose the right CR for each compression unit depending on its properties. Existing DWT and SPIHT algorithms give good

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compression efficiency, but the association in the middle of DWT coefficients and the SPIHT algorithm is not taken into account. The current research emphasizes on the connection between SPIHT algorithm and DWT coefficients characteristics in order to compensate for this constraint. The fundamental idea is that although very complicated coding. The key principle is that the DWT coefficients are efficiently integrated in the low-pass band for relatively simple coding blocks, while highly complex coding blocks still hold a significant number of DWT coefficients in the high-pass band. This paper suggests a unique strategy for greatly improving video quality while keeping the final bit-stream size same. JPEG, JPEG-2000, H.263, and MPEG-4 are examples of international standards that fulfill compression efficiency by sacrificing picture and video content quality. When data preservation is more crucial than compression efficiency; lossless compression is the best option. Digital movie store is another application of lossless video compression. In color video sequences, there are three types of redundancy: spatial, spectral, and temporal. Spatial redundancy between nearest pixels in a frame is utilized to predict pixel values in a frame from nearest pixels. Lossless JPEG employs simple linear estimation derived from the linear combination of neighboring pixels. CALIC employs nonlinear gradient approximation. JPEG-LS employs a MED (median edge detector) approximation to detect edges in adjacent pixels. If the frame is in the RGB color space, the threecolor components are redundant. Penrose predicts the current pixel using a linear combination of nearest pixels from the current color component and the reference color component. To change from RGB to YCrCb color space, the JPEG-2000 standard employs RCT (Reversible Color Transform). RCT is a reversible integer-to-integer approximation.

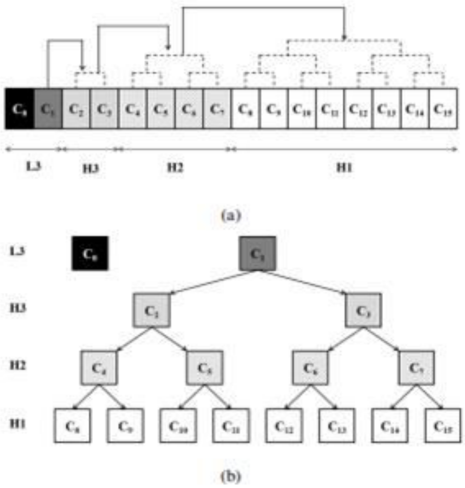

Figure .1The Correlation between 1- D DWT when DWT Decomposition Level is Three (a) The Array Structure (b) The Corresponding Binary Tree Structure.

The most important details in this text are the techniques used to upgrade compression efficiency. Temporal forecast can eliminate temporal redundancy in the middle of frames, and block-based temporal prediction by motion compensation yields large coding improvements in lossy compression. High-speed areas have a weak relationship with the comparable zones in the preceding frame, and temporal prediction does not perform well in this scenario. In static environments with little motion between frames, temporal prediction outperforms spatial prediction. The WT(wavelet transform) has shown to be an effective tool for image and video compression, and energy compaction is an important characteristic of the wavelet transform. The majority of the original image's energy is compressed into the coarsest sub-band after the wavelet transform.

Need of compression - Video is continuation of visuals in video processes enormous amounts of data. Aa a result, large amount of storage space and high bandwidth are required to convey this type of data. The largest medium carrying information and the most significant information carrier in people's lives is picture. It is made up of pixels that are very closely connected to one another. However, because of this correlation; it has several redundancies which take up lot of storage space and reduce transmission bandwidth. File compression reduces the amount of space needed for a file to store a data. Compression technique may free up important space on hard drive or a web server by

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reducing the amount of space required to store data. The compressed video must be much smaller in size than uncompressed version. The movie might then be delivered across a network more quickly and saved in a smaller file. Dat storage requirements are reduced through file compression. Utilizing compressed files might save up significant storage or a web server space. Word documents, for example may be reduced 90 % of their original size. The Original format of video is changed once it has been compressed into new format (based on the codec utilized). To play the video file , the video player must either support that video format or be integrated with the compression codec file. The compressed video must be much smaller size compared to the uncompressed video. The video might then delivered across a network more quickly and saved in a smaller file. The largest medium carrying information and most significant information carrier in peoples Live's is the picture. It is made up of pixels that are very closely connected to one another. However, because of this correlation; it has several redundancies which take up a lot of storage space and reduce transmission bandwidth. Three different forms of data redundancy have been identified.

(1) Spatial Redundancy: Since nearby pixels are linked, it is required to exclude repeated data from one frame to minimize size of the picture.

(2) Temporal Redundancy: The amount of bits required for picture representation must be decreased in order to describe the data.

(3) Spectral Redundancy: It is the correlation between different color planes it what it is. compression must be carried out for little storage and reduced bandwidth while maintaining quality to get around such redundancies. The rebuilt picture has good visual quality and is sufficiently similar to the original.

II. LITERATURE SURVEY

The concept of deep compression approach, which employs certain object identification techniques to distinguish between moving and stationary items from a real frame in an apron surveillance video, was briefly introduced by M. Casares and S. Velipasalar et al. This technique of video compression significantly decreases the amount of storage space needed without erasing the original video data[1].

Information on the SPIHT method with adaptive selection of CR dependent on DWT coefficients was supplied by I. Hong, H. Yoo et al., and S. Park. In this case, frame memory compression (FMC) method is utilize to compress video in order to lower the need for external data bandwidth , which in turn saves electricity[2].

A concise overview and point of view on the topic of design and implementation of SPIHT method for image compression were presented by X. Bao, D. Zhou, P. Liu and others. The SPIHT method enhancement reduces the time and space requirements, making SPIHT a more suitable algorithm for hardware implementation, but it still has a lot of redundantsearch, which significantly slows down encoding performance [3].

Image Compression Using SPIHT Techniques was the topic of material from Y. Jin. Y. Lee, et al. A quick and effective compression method is SPIHT-based picture compression. In this paper, MATLAB programming is used to develop SPIHT Image Compression utilizing WT.The paper's conclusion is that PSNR values provide greater compression when compared to CR and MSE results[4].

S. Kim, D. Lee and H. J. Lee et al. provided a brief overview and perspective on the subject of A Power Recording System. This paper discusses how to reduce power consumptionand to increase battery lifetime. [5] .

G. K. Wallance et al. provided information on the subject of survey of various techniques of video compression. A digital video file may be successfully derived and receive across a network and saved on computer drives by using video compression methods to reduce and remove unnecessary video data [6].

III. PROPOSED SYSTEM

3.1 Methodology

Many image compression methods make use of transform coding in some way. Figure 2.1 depicts a block diagram of a transform coding encoder and decoder. The 1st step is to try a mathematical adjustment to the image pixels in order to banish pixel correlation. The transform coefficients are the results of the transformation. Following this stage, in loss compression, an explicit quantizes or an implicit quantize, such as bit stream trim, may be utilized. The quantize is the source of data loss in image compression. As a result, the quantize is not used in the lossless compression situation. The third stage is coefficient coding, which demand reorganizing the transform coefficients in order to exploit transform

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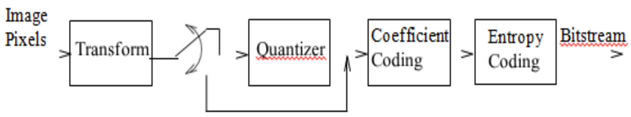
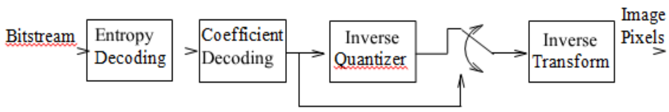
coefficient qualities and receive new symbols to be encoded in the fourth step. The transform coefficients, for example, can be thought of as a collection of quad-trees or zero-trees and/or treated in a bit plane approach. such that the compressed bit stream can be scaled. At the entropy coding step, the symbols from the efficient coding are losslessly compressed. Entropy coding can refer to any approach that can compress a series of symbols, including Huffman coding, arithmetic coding, and Golomb coding.



(a) Encoder



(b) Decoder

Fig.2 Block Diagram of an Encoder and Decoder using Transform Coding.

SPIHT: A set will be divided using the hierarchical trees technique, removed from the subsets, and either added into the LSP or the LIP. The ultimate result of the refining procedure is the nth MSB of the coefficient in the LSP. As n becomes less, sorting with refinement is used once more until n=0. Because, SPIHT algorithm precisely regulated the bit rate and the execution may be stopped at any point. The decoding procedure is used after completion of the encoding phase.

The picture is first divided into four sub-bands. Repeated degradation takes place until the ultimate scale is reached. 1 low-frequency sub-band with 3 high-frequency sub-bands make up the decomposition. Iteratively applying the DWT on the picture yields a decompose picture. This deconstructed picture is encode using the SPIHT algorithm.

CR-Compression Ratio: The ratio of the input image's size to the compressed bit stream size. It accesses how well the compression algorithm performs. CR = Output file size (bytes) / Input file size (Bytes)

1. **Mean Square Error (MSE):** It is the statistic utilized to confirm the image's MSE. The MSE is utilized to calculate squared error value difference between two images.
2. **PSNR-Peak Signal Noise Ratio:** PSNR is utilized to determined the ratio between the signals maxi-mum

Power and the noise corrupted signal which has an impact on accuracy of the signal representation. It's serves as a meter for evaluating image quality. When the PSNR (Peak Signal Noise Ratio) value is high, the quality of restricted image and when it is low the quality of rebuilt image is poor.

There are redundancies amid adjacent pixel values in most photographs; that is, adjacent pixels are highly connected. Therefore, based on a region of pixels, a current pixel can be sooner well forecast. The prediction error has lower entropy than the original pixels since it is derived by subtracting the prediction from the original pixel. The prediction error may thus represented with less data by utilizing fewer bits. In predictive coding, the correlation between nearby pixels is removed residual values are encoded. Predictive coding uses DPCM (Differential Pulse Code Modulation).

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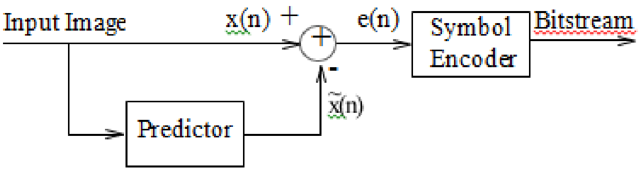

Fig.3 Lossless DPCM Encoder

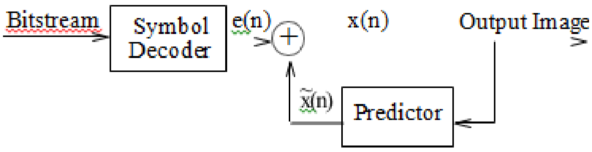

Fig.4 Lossless DPCM Decoder

To represent image pixels with the fewest number of bits possible, image compression is used. As a result, if the transform coefficients accommodate a few non-zero values, they can be expressed with a few bits. As a consequence, the transform must compress the energy into as fewest number of coefficients. The average squared reconstruction error and average squared quantization error are equivalent since the transformations are orthogonal. The best energy compaction in the sense of mean square is produced by the KL (Karhunen-Loeve) transform using the eigenvectors of the auto correlation matrix.

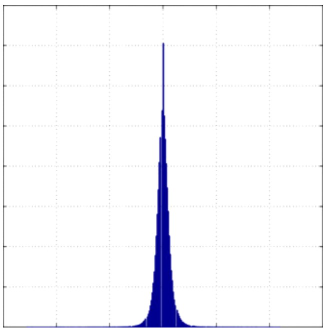

Fig.4 Distribution of the Prediction Error in DPCM

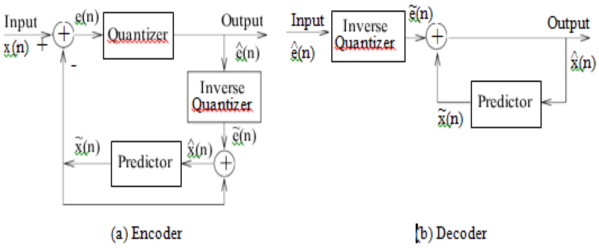

Fig.5 Loss DPCM Encoder and Decoder

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The KL transform, on the other hand, is difficult to apply. For starters, an image's autocorrelation matrix is not immobile. Second,it can be difficult to compute the autocorrelation matrix eigenvectors since the matrix may be unique and some of the eigenvectors cant be defined separately. There is no fast KL transform technique and calculating the eigenvectors takes a lot of time. The KL transform is often utilized as a standard for other transforms since it reflects the lower limit of energy compaction.

3.2 Motion Estimation and Compensation

A video sequence's consecutive frames are remarkably similar. This verbosity between consecutive frames is referred to as temporal repetition. Video compression methods can take use of temporal redundancy by approximating object displacement between subsequent frames (motion estimate). The motion information obtained (a motion vector) can then be used to perform effective inter-frame coding (motion compensation). Alternatively the frame itself, the motion information and the prediction error are provided. The most prevalent approaches for motion estimation in video coding are Block Matching (BM) techniques. Each macroblock is chosen to produce least amount of inaccuracy. By subtracting the motion-compensated frame from the current frame, the prediction error frame is obtained. A comprehensive search that examines every table movement of the macroblock in the search region surrenders the best BM performance. However, the entire search is quite computationally demanding. For instance, 3131 = 961 shifts are needed to evaluate search range of upto 15 pixels in both horizontal and vertical directions. Each shift needs 1616 = 256 pixel difference calculations for a certain macroblock. In the literature, several sub-optimal matching algorithm have been presented. By establishing a basic motion estimate by thorough search using a pair of low-pass subsampled image and then refining it with a small local search utilizing the full resolution image , high hierarchical BM may greatly decrease computation. A 16:1 computational reduction is achieved by Subsampling by 2:1 in both direction, which also decrease the number of macroblock pixels and shifts by 4:1.

Video Sequences		IAM	TIAM	Data Rates ORG	JPEG-LS	ADAP
Akiyo	176×144	18.183	0.195	9.580	4.330	1.547
	352×288	12.744	1.176	9.622	3.999	1.831
Carphone	176×144	18.834	5.436	9.524	4.975	4.283
	352×288	13.845	6.297	9.564	4.546	4.407
Foreman	176×144	22.782	7.143	9.434	5.869	4.784
	352×288	16.515	13.200	9.522	4.988	4.703
Salesman	176×144	23.046	2.595	9.057	5.864	3.408
	360×288	19.545	5.028	9.141	5.455	4.692
Tempete	352×288	34.326	10.233	9.837	6.322	5.709
	720×480	34.473	14.700	9.845	6.580	6.388
Tennis	352×240	43.350	14.979	9.208	7.305	6.253
	720×480	36.378	14.853	9.222	7.129	6.567

Table.1 Data Rates (Bits/pixel) Relative to the Frame Size.

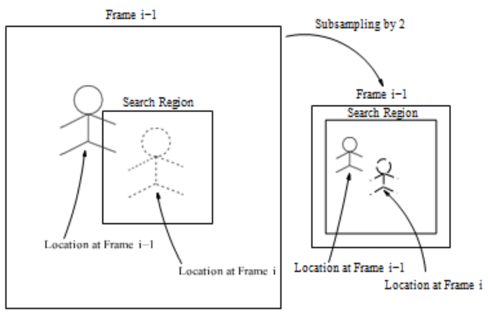

Fig. 6 Motion Estimation in Sub sampled Video Sequence.

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IWT	Adaptations		Video Sequences				
	Subband Level	MB Level	Angela	Firework	Fountain	Marbles	Music Player
0	0	0	5.037	5.371	3.786	5.170	6.500
	0	1	4.898	5.221	1.136	4.987	6.038
	1	0	5.037	5.371	3.786	5.170	6.500
	1	1	4.898	5.221	1.136	4.987	6.039
1	0	0	5.257	5.598	2.070	5.115	6.384
	0	1	5.004	5.390	1.380	4.944	6.292
	1	0	5.023	5.272	4.486	4.954	6.301
	1	1	4.785	5.213	1.380	4.845	6.086

Table.2 Data Rates (Bits/pixel) relative to the Adaptive Selection of Perdition Mode for Video Sequences

IWT	Adaptations		Video Sequences				
	Subband Level	MB Level	News1	News2	New York	Popple	Tempete
0	0	0	4.762	4.362	4.816	6.935	6.730
	0	1	4.468	4.248	4.503	6.597	6.438
	1	0	4.762	4.362	4.816	6.597	6.731
	1	1	4.468	4.248	4.503	6.597	6.438
1	0	0	4.851	4.535	4.750	6.758	6.917
	0	1	4.624	4.490	4.735	6.528	6.579
	1	0	4.805	4.394	4.788	6.488	6.669
	1	1	4.422	4.215	4.652	6.393	6.388

Table.3 Data Rates (Bits/pixel) relative to the Adaptive Selection of Prediction Mode for Video Sequences

Proposed algorithm

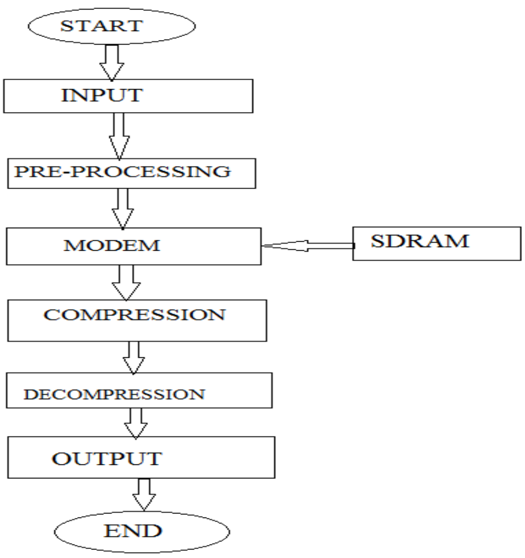

FIGURE 7 : FLOWCHART OF VIDEO COMPRESSION

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A. *Description of the Proposed Algorithm:*

The figure shows the flowchart of a video compression. It consists of modem, RAM. First ,we have to take a video as an input. Noise or unwanted data is removed in pre-processing. In modem modulation and demodulation is performed and produce encoded signal that can betransmitted easily and decoded accurately to reproduce the original digital data. Encoded datais store in memory. Compression is performing to reduce the file size. Decompression is performing to get back original video.

IV. CONCLUSION AND FUTURE WORK

This paper provides the latest lossless compression technique for colour video patterns and a current temporal prediction technique. The latest scheme excceed the state-of-the-art lossless compression methods when operating; the latest backward-adaptive secular prediction and the adaptive selection approach in the middle of spatial and temporal prediction. The present approach is depending on the spatial prediction technique utilized in JPEG-LS and every time has greater shorten fulfilment than JPEG-LS because of the newest forecast methodology. CALIC typically outperforms JPEG-LS in terms of compression performance when the complexity is increased. When novel prediction approaches, like reverse-adaptive secular forecast and adaptive secular mode, are combined with a CALIC-based approach, the latest algorithm outperforms the CALIC approach. Two ways to improve a video encoder's compression performance are to manufacture secular residuals with lower entropy and to more efficiently encode the prediction residuals. For a video sequence, the search range for motion estimate is fixed and every block's search range information should be sent to the decoder. For entropy coding, the proposed novel technique employs simple context modelling and the more advanced context modelling utilized in CALIC and JPEG-LS allows for better compression. A quantization step can be used to build a loss version of the proposed technique and quantization is applied to the predicted residual frames to reduce entropy. To create a bit stream with a certain data rate budget, the quantization step size can be adaptively changed.

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