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Video Compression Algorithm Using Motion Compensation Technique

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Abstract— **Video compression plays an important role in many digital video processing applications such as for digital video transmission, also thousands of website like Youtube ,** NetFlix **that requires large storage space. Video compression technologies are about reducing and removing redundant video data so that a digital video file can be effectively sent over a network or can be stored on computer disks with the reduction of data size. In this project we proposed video compression using motion compensation technique that reduces video data based on motion estimation from one frame to another. Motion compensation is an algorithmic technique employed for the encoding of video data for video compression. Motion compensation describes a frame in terms of the transformation of a reference frame with respect to the current frame. The reference frame may be previous in time or even from the future. The proposed method reduces the candidate of the prediction modes based on the Sum of Absolute Hadamard-Transformed Difference (SATD) between the original block and the intra predicted block. Motion of each block is obtained based on the SATD value. The current frames are further reduced by using the combination of motion and most probable displacement. The proposed method reduces the number of motion in frames to either one or two. When images can be accurately synthesised from previously stored images, the compression efficiency can be improved. Temporal redundancy is exploited so that not every frame of the video needs to be coded independently as a new image.**

***Index Terms*— Fixed size block motion estimation, Block-based motion estimation, Peak-Signal-to-Noise-Ratio (PSNR), block matching algorithm .**

I. INTRODUCTION

Now a days there are videos in high definition or high quality qualities, So it requires a large transmission bandwidth and amount of storage space. To reduce the redundant data in video, there are various strategies to employ that compress the information without negatively affecting the quality of the frames. There are some methods which lossless and lossy, but in lossless in which there is no data is lost, but most are lossy, meaning that information is thrown away that can't be retrieved. So far our discussion on compression has been on still images. In the lossy techniques try to exploit the spatial correlation that exists in a still image. When we want to compress video or sequence images we have an added dimension to exploit, namely, the temporal dimension. Generally, there is little or very little change in the spatial arrangement of objects between two or more consecutive frames in a video. Therefore, it is advantageous to send over the network or store the differences between consecutive frames rather than sending or storing each frame. The difference frame is called the residual or differential frame and may contain far less details than the actual frame itself. Due to this reduction in the details in the differential frames, compression is achieved. To illustrate the above idea, let us consider compressing two consecutive frames of a video sequence . When objects move between successive frames, simple differencing will introduce large residual values especially when the motion is large. Due to relative motion of objects, simple differencing is not efficient from the point of view of achievable compression. It is more advantageous to determine or estimate the relative motions of objects between successive frames and compensate for the motion and then do the differencing to achieve a much higher compression. This type of prediction is known as motion compensated prediction. Because we perform motion *estimation* and compensation at the encoder, we need to inform the decoder about this motion compensation. This is done by sending motion vectors as side information, which conveys the object motion in the horizontal and vertical directions. The decoder then uses the motion vectors to align the blocks and reconstruct the image [1,10].

Video compression techniques are used to reduce redundancy in video data without affecting visual quality. It mostly used in video conference and real time application. In reality, motion compensation based coding are used in video compression techniques. Such encoders make use of inter-frame correlation to provide well-organized compression. For video compression we are using motion compensation method. In this Motion compensation technique, created In the 1960s, to exploit inter-frame redundancy contained in the temporal dimension of video sequence, is implemented in three stages. The first stage estimates object motion (motion estimation-ME) between the previously reconstructed frame and the current frame. The second stage creates the current frame prediction (motion compensation - MC), using the motion estimates and the previously reconstructed frame. The final stage differentially encodes the prediction and the actual current frame as the prediction error. Block transforms used in video encoders are unitary, which means that the transform operation has an inverse operation that uniquely reconstructs the original input. The DCT successively operates on 8 x 8 image blocks. Then, the quantization stage creates a lossy representation of the DCT Coefficients. The quantizer should be well matched to the characteristics of the input in order to meet or exceed the rate-distortion performance requirements.

Motion compensation technique engaged for video compression in the encoding of video data. Motion compensation describes the transformation of a reference frame to the current frame. The reference frame may be previous or even taken the later frames. When current frames can be accurately synthesized from previously transmitted or stored frames, the compression efficiency can be improved.

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II. OBJECTIVES

- Firstly we have to use algorithm for conversion of video into number of frames.
- To calculate difference in frames with the help of these delay to find block matching in current frame from previous frame to develop a algorithm.
- To develop algorithm for Motion Compensation for calculating the difference in between frames with help of block matching.
- In motion estimation there is a requirement to make a algorithm for searching a motion vector in frame, For compression of video for this develop algorithm in motion compensation to reduce video size.
- To develop the transform coding in which DCT and quantization algorithm for image compression.
- For compression of video frames is made Run length coding is done for Data compression.
- Technique to be implemented reconstruction of compressed frames are done by developing the algorithm in Motion compensation Decoder.

III. MOTIVATION

Video compression is the field in Electronics engineering and computer science that works with representation of video data, for transmission and storage, for digital video. Video coding is often related with only for all type of natural video, and also applied to synthetic video, i.e. graphics. Many demonstrations take benefit of primitive features of the Human Visual System to accomplish an efficient demonstration. Using video compression, the biggest challenge is to retard the size of the video data. Due to this reason "video compression" and "video coding" are often used interchangeably by those who don't know the difference. The finding for efficient video compression techniques dominated much of the research activity for video coding ought to 1980s, the first major milestone was H.261, from which JPEG gave the idea of using the DCT; since then other development have been made to algorithms such as motion compensation. Since ultimately 2000 the concentration has been more on Meta data and video search, resulting in MPEG-21 and MPEG-7.

IV. IMPLEMENTATION

A. Motion Compensation Encoder Block

In this block we could make algorithm for video compression using motio compensation technique for the better quality of compressed video size. There was making Sum of absolute transformed differences (SATD) method for better result than SAD method. In Encoder Block there are some different technique are using so we see briefly that technique for higher PSNR and compression ratio.

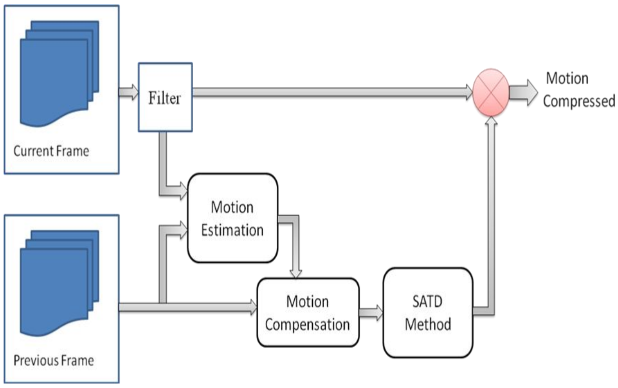

Fig.a.Block diagram of motion compensation method with SATD

Frome the above block diagram It is thus imperative to apply a process of estimating motion vectors (displacement vectors) from one frame to the previous. This is referred to as motion estimation. Translational motion estimation is a very simple model. It cannot accommodate motions other than translation, such as rotation or camera zooming. Occlusion and disocclusion of objects, together with lighting changes and various noise artifacts existing in the frames, complicate the situation even further. Therefore, in order to attain good-quality frames in the receiver, coding of the residual (prediction error) is necessary. Differential signals between the intensity value in the current frame and those of their counterparts in the previous frame, which are translated by the estimated motion vectors, are encoded. Adding the transmitted residual frame to the predicted frame, the decoder may reconstruct the latter frame with satisfactory quality. This reconstruction process is referred to as To reduce the complexity of intra mode decision, we propose an efficient and fast 4x4 intra prediction mode selection scheme. The proposed method reduces the candidate of the prediction modes based on the Sum of Absolute Hadamard-Transformed Difference (SATD) between the original block and the intra predicted block**.** Rank of each mode is obtained based on the SATD value. The candidate modes are further reduced by using the combination of rank and most probable mode. The proposed method reduces the number of candidate mode to
either one or two. Filtering is a nonlinear operation often used in processing to reduce noise. A median filter is more effective than convolution when the goal is to simultaneously reduce noise and preserve edges. The block pads the edge of the input image, which sometimes causes the pixels within [M/2 N/2] of the edges to appear distorted. The median value is less sensitive than the mean to extreme values. As a result, the Median Filter block can remove salt-and-pepper noise from an image without significantly reducing the sharpness of the image.

1) Intra-frame Prediction

In contrast to some previous standards (namely H.263+ and MPEG-4 Visual), where intra prediction has been conducted in the transform domain, intra prediction in H.264/AVC is always conducted in spatial domain, by referring to neighboring samples of previously coded blocks which are to the left and/or above the block to be predicted. This may incur error propagation in environments with transmission errors that propagate due to motion compensation into inter-coded macroblocks [12]. Therefore,

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aconstrained intra coding mode can be signaled that allows prediction only from intracoded neighboring macroblocks. For the luminance (luma) samples, intra prediction may be formed for each 4x4 block or for a 16x16 macroblock. There are a total of 9 optional prediction modes for each 4x4 luma block; 4 optional modes for a 16x16 luma block. The latest H.264 standard also defines 8x8 block and also has 9 prediction modes which are the same as those modes used in 4x4 block. Similarly for chroma 8x8 block, another 4 prediction direction is used.

2) Inter Prediction

Inter prediction and coding is based on using motion estimation and compensation to take advantage of the temporal redundancies that exist between successive frames,hence, providing very efficient coding of video sequences. When a selected reference frame(s) for motion estimation is a previously encoded frame(s), the frame to be encoded is referred to as a P-picture. When both a previously encoded frame and a future frame are chosen as reference frames, then the frame to be encoded is referred to as a B-picture. Motion estimation in H.264 supports most of the key features adopted in earlier video standards, but its efficiency is improved through added flexibility and functionality. In addition to supporting P-pictures (with single and multiple reference frames) and B-pictures, H.264 supports a new inter-stream transitional picture called an SP-picture. The inclusion of SP-pictures in a bit stream enables efficient switching between bit streams with similar content encoded at different bit rates, as well as random access and fast playback modes.

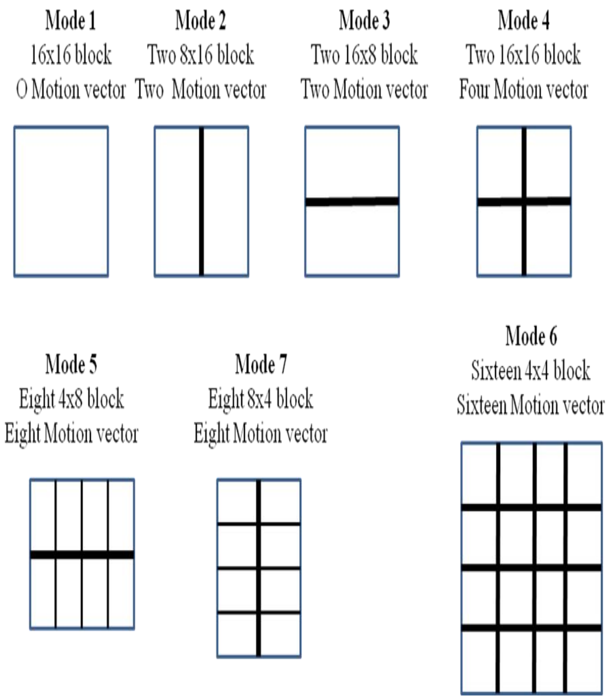

Fig b. Different modes of dividing a macroblock for motion estimation

3) Prediction Error

In this explores the nature of interframe errors caused by various effects of the displacement vector algorithm. In the previous section, it was seen that a reasonably comprehensive set of data is supplied for decoding, comprising motion vectors and new feature labels. Whilst the algorithm is fairly efficient in describing overall trends in interframe motion, small errors do occur where features overlap. The result is that each frame contains areas of unwanted motion artefacts. Using the concepts of spatial filtering introduced in chapter 4, a method of error detection and correction is presented, with the overall objective of improving spatial image quality. It will be suggested that, whilst the spatial quality is still far from that observed in the original images, it is less noticeable as a temporal effect when the images are animated as part of a video sequence.

The signal-to-noise ratio of an image has already been used as a measure of reconstructed image quality, with respect to the base sequence. However, where this was once used for single images only, it is now calculated for all the component frames in a video sequence, revealing changes in signal-to-noise ratio caused by different types of motion. Sequential signal-to-noise ratio plots are also used to show the effect of error correction, with comparisons made with both the H.263 algorithm and conventional block-based motion compensation.

V. RESULT

A. Compression Ratio & PSNR

Table shows the performance of the SATD technique over the SAD method. It lists data for "real time video" sequence from webcam encoded with previous frame from current frame. We were selected so that the total number of macroblocks skipped (macroblocks predicted as skipped as well as the macroblocks skipped after encoding) are approximately the same as the number of macroblocks skipped during the original encoding process. SATD method provided the better result then SAD method and which satisfy the above criterion with a good rate-distortion performance. There was calculated using the actual coding time of the sequence. The table demonstrates that the algorithms can significantly reduce computational complexity with a drop in PSNR (0.89dB) for real time video. This is final output from decoder of each above frame.

Table.5.1. PSNR in dB between SATD and SAD for real time video

Frames	SATD	SAD
1	36.58	35.69
2	36.52	36.63
3	36.50	35.51
4	36.50	35.51
5	36.50	35.50
6	36.51	35.61

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7	36.53	35.63
8	36.74	35.58
9	36.47	35
10	36.47	35.58
11	36.58	35.70
12	36.57	35.65

Table.5.2. Compression ratio between SATD and SAD for real time video

Frames	SATD	SAD
1	11.37	9.472
2	10.77	8.978
3	10.61	8.845
4	10.62	8.845
5	10.61	8.842
6	10.83	9.024
7	10.53	8.773
8	10.53	8.773
9	10.54	8.787
10	10.57	8.807
11	11.38	9.474
12	11.38	9.747

VI. CONCLUSION

Base on result of SATD method for real time video plays a significant role in achieving outstanding performance in compression efficiency and video quality. We can say that with the help of SATD method lot of redundant information carrying frames in temporal domain can be compensate which itself achieves suitable amount of compression. Which further reduces the size and video compression algorithm reduction of size on memory is increased which will be able to store more number of videos within that size in memory. But using the SATD achieve higher quality in compressed video without reducing the compression rate and PSNR or even achieve higher compression rates without significant degradation in the quality of video then SAD method. Thus, results conclude that the use of SATD is used in Motion compensation method implement for video compression.

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