Improved Set Partition Hierarchical Tree Algorithm for Video Zipping in Real time Applications

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***Abstract*—*This paper describes an improved video compression for Real time surveillance applications using Improved Set Partition Hierarchical Tree Algorithm. In the proposed system Improved Set Partition Hierarchical Tree algorithm is used to zip the video to track the moving object. This proposed motion detection algorithm comprises of motion detection of successive frames with background frame subtraction for efficient compression. The motion detection of sequential frames is used to detect continuous moving objects between two successive frames and remove it to form the zipped video. After the compression of the video, background subtraction of frame is used to detect moving objects in the current frame of the video. The proposed method is implemented and tested using some sample videos. The proposed system can be used in real time applications like Motion pixel Estimation, Video Surveillance, Weapon Storage Area and Atomic Research Area Surveillance, etc.*

Keywords —Background Deduction; Real time video compression; Video Compression; Video Zipping;

I. Literature Review

There are unforeseen requirements for automated surveillance systems in commercial applications, Law enforcement and military applications. Installing video cameras is inexpensive, but finding accessible human resources to observe the output is costly. Although surveillance cameras are customary in banks, parking lots, and stores video data currently is used only as a forensic tool, thus losing its primary advantage as a dynamic, real-time medium. What is needed is round the clock monitoring of surveillance video to alert security officers to a theft in progress, or to an apprehensive individual loitering in the parking lot, while there is still time to prevent the offense. Apart from security applications, video surveillance can be proposed to measure traffic flow, monitor pedestrian congestion in public spaces, detect accidents on highways, compile consumer demographics in shopping malls, etc. The main aim of this research is to implement and verifies the SPIHT algorithm on video files, to compress the videos and to show how beneficial this will be while handling large video files. The key of this research work lies in the initialization and updating of the background image. The effectiveness of both will distract the accuracy of test results. Therefore, this research work uses an effective method to initialize the background, and update the background in real time. Sometimes problem may occur while applying the encoding, decoding, DWT, Background subtraction methods to the large size videos even though the video, that is the process may take much time for producing the output for the selected large sized video. To avoid this time consumption a method called compression is being carried out in this project. Compression is a method which is used to reduce the total size of the video which has been selected. The two main use of compression technique are namely,Reduced memory and Use of Efficient bandwidth.

Sometimes problem may occur while applying the compression, DWT, Background subtraction methods to the large size videos even though the videos are being compressed, that is the process may take much time for producing the output for the selected large sized video. While splitting the video into frames if the video size is large, more number of frames will be produced. While considering all separate frames for encoding and decoding process it will consume large amount of time. If the bandwidth is very low, great attention must be paid to cut down the bit rate of compressed video bit stream. The Frame Subtraction is generally tough to obtain a complete outline of moving object, liable to appear the empty phenomenon; as a result moving object detection is not accurate. Optical Flow method leads to: large quantity of calculation, sensitivity to noise, poor anti-noise performance, and makes it not suitable for real-time demanding occasions.

II. Literature Review

The objective of the Video Surveillance and Monitoring (VSAM) developed by the Defense Advanced Research Projects Agency (DARPA) was to progress automated video understanding technology in future urban and battlefield surveillance applications. Technological advancement of this project enabled a single human operator to observe activities over a wide area using a distributed network of active video sensors. Thesevideo sensor platforms are mainly independent, notifying the operator only of salient information as it occurs, and engaging the operator minimally to alter platform operations.

A.Existing Works regarding Background Separation

Due to its pervasiveness in various contexts, background subtraction has been elaborated by numerous researchers, and abundant amount of literature has been published [3 - 5]. The usual method to find moving object detection is through background subtractions which require maintaining an up-to-date model of the background to detect moving objects by finding the deviation from such model [1]. Compared to other approaches, such as optical flow, object detection approach is computationally feasible for real-time applications. The key problem is its sensitivity to dynamic scene changes, and the succeeding need for the background model adaptation via background preservation. Such problem is known to be substantial and challenging. Some of the well-known issues in background maintenance, which will be specifically addressed in the sequel, include: lighting Changes, Background movement, Cast shadows, Bootstrapping, etc.

In the proposed method moving object detection is based on the background model generated automatically by a self-organizing method with no prior knowledge about the involved patterns [2]. The idea consists in adopting biologically inspired methods for moving object detection, where visual attention mechanisms are used to support detecting objects that keep the user attention in accordance with predefined features like gray level, shape and motion features.

III. METHODOLOGY

In this research work the video which need to be compressed is browsed/selected, then before encoding the video will be compressed in size. The size of the original video and the compressed video is displayed. Then the compression ratio CR is found by using the formula:

CR = Fo / Fc, where Fo is the original File Size and Fc is the compressed File Size. After compressing the video, it looks as like the original video but the size of the video is reduced.

Motion detection using Threshold method includes three parts as below;

a) Motion detection using consecutive frames

b) Background frame subtraction

c) Linear background frame update

In terms of functionality, motion detection between consecutive frames can be used for later linear background frame update. If there is change between two consecutive frames at the same location, the pixel at this location in the background should be updated; if not, the pixel at this location in the background is left unchanged. The background frame subtraction plays the key role in our motion detection algorithm, which directly separates moving objects from background. To meet the real-time demand, a linear background frame update is adopted.

Diff =current frame (for ground) - previous frame (back ground) for updating the new video. Threshold point should be fixed in the video. That threshold point should be fixed without changing throughout the process. Let ‘In’ and ‘In-1’ denote the current frame and the frame before current frame, respectively. ‘Th’ is defined as a threshold for motion detection and ‘Diff(i, j)’ as a motion identifier for pixel (i, j), which can be calculated as:

$$Diff(i,j) = \begin{cases} 1 & |I_n(i,j) - I_{n-1}(i,j)| > Th \\ 0 & \text{else} \end{cases}$$

Final output can be viewed at this stage. The background fully viewed in black color and the foreground image can be viewed in white color. The threshold point of this moving image would not get changed throughout the process. The final output can be viewed in several frames which are equal to the number of frames which is specified in the encoding and decoding stages. This can be changed manually. But if the number of frames which are selected is high the time which is taken for the whole process will be also very high.

Finally output has been produced to the selected video by applying the ISPHIT Compression algorithm.

A. Frame Separation

It is done by Encoding and Decoding and then Video coding

An encoder compares the block being coded with evacuated blocks in the reference frame (preceding or future frame). The evaluation can use mean squared error (MSE) or some other measure of differences between images. The encoder picks the displaced block in the smallest mean squared error (MSE) difference. At no point has the encoder acknowledged an object in the image. The encoding process is called Motion Estimation. This finds the motion vector (or vectors) for each block. The decoding process is known as Motion Compensation. Motion Compensation accomplishes greater compression than Frame Differencing.

Frames of the source video information are catched and are compressed by a video encoder. The compressed "stream" is transmitted across a network or telecommunications link and decoded (decompressed) by a video decoder and then can be displayed.

B. Compression

Compression is a conversion of data to formats that requires less bits and performed to store and transmit the data more efficiently and it can be reversed back to its original data afterwards. The data size in compressed form (C) relative to the original size (O) is known as the compression ratio (R=C/O). If the inverse process, decompression, produces an accurate copy of the original data then it is lossless compression. Lossy compression used to image data does not allow duplication of an accurate imitation of the original image, but has a high compression ratio. Thus lossy compression permits only a rough calculation of the original to be generated. For image compression, the reliability of the approximation decreases when the compression ratio increases. Compression is similar to folding a letter before putting it in a small envelope to transport it more easily and cheaply. Compressed data is not easily readable and must first be decompressed to restore. Referred from papers ([6] – [14]).

1) *Naturally Lossy Compression*

Objects in the visual system are delineated by edges. Anything like a codec algorithm that obliterates or creates an edge in an image is noticed.

2) *Unnatural Lossy Compression*

Widely used video compression algorithms are lossy. Even they provide high compression rate, most of them will have problems with the edges in the image. Vector quantization, wavelet based image and video compression and block

Discrete Cosine Transform naturally do not represent the intuitive notion of an edge or line.

3)*Image compression by ISPHIT Algorithm*

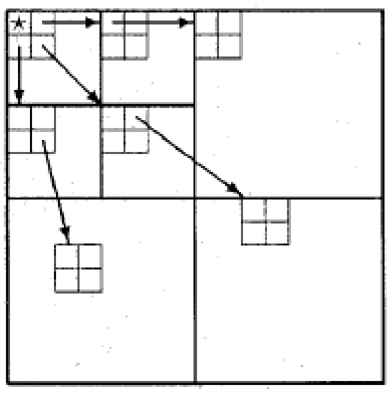
ISPIHT algorithm is based on 3 concepts with a modification

a) Ordered bit plane progressive transmission.

b) Set partitioning sorting algorithm.

c) Spatial orientation trees.

[a] Spatial Orientation Trees – (1)



Tree root is 2 by 2

[b] Spatial Orientation Trees – (2)

The sets of coordinates used to present the new coding method here are：

a) O (i, j)：set of coordinates of all offspring of node (i, j) ;

b) D (i, j) : set of coordinates of all descendants of the node (i, j) ;

c) H: set of coordinates of all spatial orientation tree roots ;

d) L (i, j) = D (i, j) – O (i, j) ;

[c] Coding Algorithm

In a practical implementation of SPIHT the significance information is stored in three ordered list：

a) LIS：list of insignificant sets

b) LIP：list of insignificant pixels

c) LSP：list of significant pixels

In the encoding and decoding, some slight change is made to improve its quality.

Entire frame work of the proposed work is shown in Fig 1, Fig 2 and Fig 3.

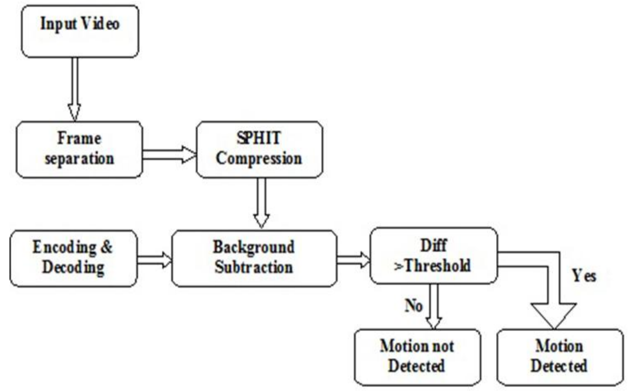


Fig. 1 Over all Framework of Proposed Work

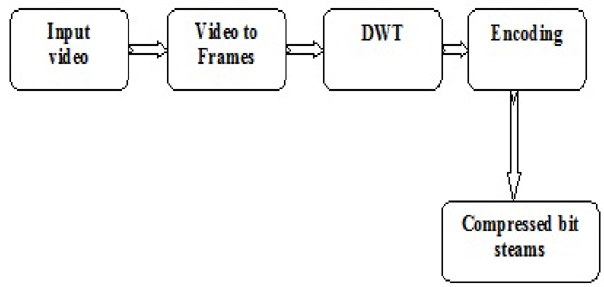


Fig. 2 Framework for Encoding

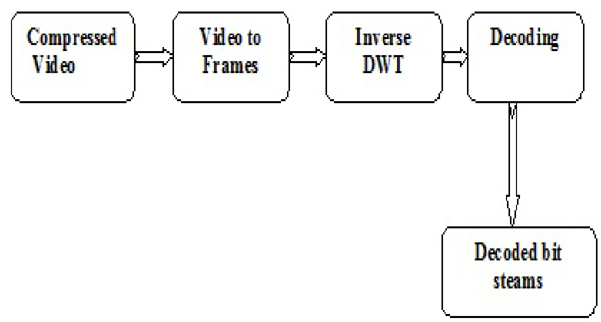


Fig. 3 Framework for Decoding

IV. IMPLEMENTATION AND DISCUSSION

This research work is implemented using Matlab. First input video is selected for compression (Fig 4). Then, the selected video is divided into several frames and that frames are stored in the target folder (Figure 5). After frame separation encoding process has to be carried out. In this process the entire frame is divided into four equal parts by using Discrete Wavelet Transformation method, each frame is named as LL, LH, HL, LL. Video can be viewed in all frames but the clear video can be viewed only in the LL part (Figure 6). Then the encoding process is completed (Figure 7). Next to that Decoding process is carried out by applying IDWT-Inverse Discrete Wavelet Transformation (Figure 8).

Fig. 4 Input Video selected

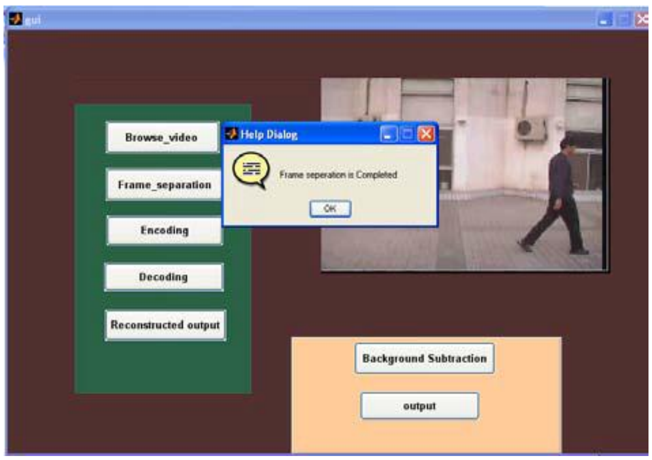


Fig. 5 Input Video selected

Fig. 6 Encoding is in Progress

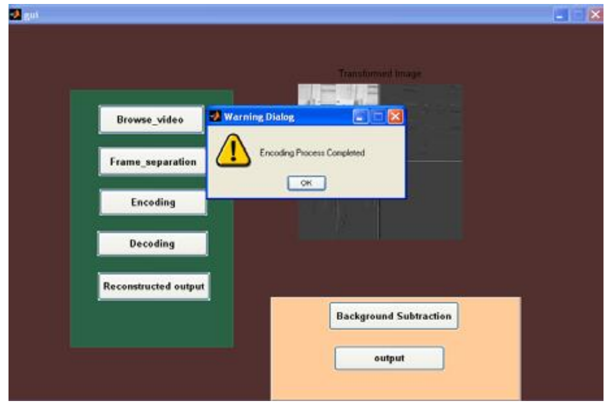


Fig. 7 Encoding is completed

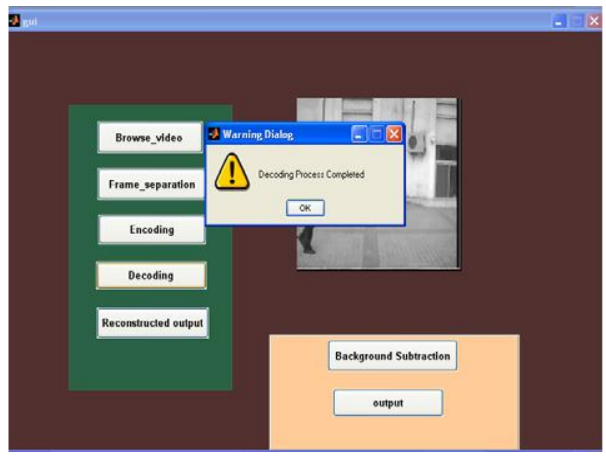


Fig.8After Decoding is Done

After the decoding process, the reconstructed video can be viewed. In that process same video is viewed but after compressing it. The decompression rate is considerably high and the size of the video file is considerably small. For the video taken for tests, the average compression rate is more than 50% and the compression speed is also high.

The result of experiment of the algorithm on one of such video taken is discussed here. The input video is a scene of a walking man. This video has a dimension of 720 × 576 of 7 second duration. The proposed algorithm converts this input video into 51 frames. It gives the output with 28 frames of duration 3 second with dimension of 468 × 378 with compressed size of 658 KB. The mean noise ratio was employed to evaluate the quality of reconstructed images objectively, although it is not always reliable as a gauge of subjective visual quality.

V. Conclusion

In the light of the results from the experiments, some conclusions may be given about the success of the current research, according to the goals that were established for the project. These objectives were the compression of video with improve quality, is satisfactorily achieved with good compression ratio. The ISPHIT video zipping algorithm is fast and effective. This proposed algorithm is automatic and no parameter adjustment and no prior knowledge of the acquisition conditions is required. This is thru'the use of preadjusted defaults values. Inverse filtering gives good results but generally requires prior knowledge on the environment. But in this proposed work, preprocessing and filtering needs no parameters adjustment. The proposed work can be used in applications like Video Surveillance Applications, Motion pixel Estimation Applications, Weapon Storage Area and Atomic Research Area etc.

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