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Region Based Texture Approximation Technique for Efficient Video Compression

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Abstract: To improve the performance of video compression produced by the previous solution, we propose a region based texture approximation technique. There are situations where the tiny part of the image would vary and transmitting the entire image will not necessary. To overcome such problem, the method splits the video into frames and for each successive frame the method splits the frame into number of regions. Between regions of two successive frames the method computes the feature similarity. Based on the feature similarity the method sends the selective region to the other end, where the method retains the feature of the previous frames for the un received region. This improves the performance of the video compression than the previous method.

Key words: Digital Authentication · E-Learning · Video Compression · Feature Approximation

INTRODUCTION

The modern information technology uses various forms of data from numerical and textual to multi media. Most of the business process is performed through the internet and to maintain the secrecy of sensitive information, the organization use multimedia information. Further the educational institutions have shifted to provide E-learning. E-learning is the process learning the subject through internet. By providing E-learning, the learner can educate from their own location and they need not go to the institution. There will be number of tutorials available and to provide E-learning, the entire seminar video has to be transferred to the user [1].

To provide the video to the user who request the video, it must be transferred to the user side. The video is large in size and it occupies more bandwidth. The network has intermediate nodes and has only limited bandwidth. In order to provide efficient service the video has to be transmitted within short time. The video is a collection of frames and there will be number of frames in a single second video. So transmitting the video in the original form requires more bandwidth and increases the latency also [2].

When you consider the video conferencing, the video must be transmitted in short time and if there is a delay then the video will become meaningless. In order to achieve the data transmission efficiency, the video must be transmitted in short time. To achieve this, the video sequence has to be compressed, so that the bandwidth consumption will be reduces. To perform video compression, there are number of methods discussed earlier. But the methods suffer to achieve the compression ratio and suffer to produce video compression in short time.

The most methods transmit the entire video frame and that also increase the bandwidth occupation. If you consider two adjacent frames of any video, there will be a limited feature variation. So transmitting the entire video frame of same snapshot will not produce any efficiency in video transmission. In some other methods, the method transmits the variation values of two successive frames, which also introduces the overhead. To overcome such deficiency, the image can be split into number of small regions. By computing the feature similarity between the regional images, the region which differs can be sent to the remote side. This can help the video compression to be performed in efficient manner and can reduce the bandwidth utilization.

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Related Works: There are number of video compression techniques discussed earlier and this section discusses about the methods.

Video Compression Algorithm Based on All Phase Biorthogonal Transform and MPEG-2 [1], works based on the all phase biorthogonal transform (APBT) theory, which has three kinds of forms in accordance with different transform matrices, referred to as the all phase Walsh biorthogonal transform (APWBT), the all phase discrete cosine biorthogonal transform (APDCBT) and the all phase inverse discrete cosine biorthogonal transform (APIDCBT). Compared with the conventional DCT, APBT reduces the inter-pixel redundancy and the computational complexity using the uniform quantization for the intra frames transform-coding. Experimental results show that the peak signal to noise ratio (PSNR) of the proposed algorithm performs close to the DCT for the tested frames and there is no difference in visual quality [3].

Low-complexity depth map compression in HEVC-based 3D video coding [4], discuss a low-complexity algorithm is proposed to reduce the complexity of depth map compression in the high-efficiency video coding (HEVC)-based 3D video coding (3D-HEVC). Since the depth map and the corresponding texture video represent the same scene in a 3D video, there is a high correlation among the coding information from depth map and texture video. An experimental analysis is performed to study depth map and texture video correlation in the coding information such as the motion vector and prediction mode. Based on the correlation, we propose three efficient low-complexity approaches, including early termination mode decision, adaptive search range motion estimation (ME) and fast disparity estimation (DE).

Standardized extensions of high efficiency video coding [5], describes extensions to the High Efficiency Video Coding (HEVC) standard that are active areas of current development in the relevant international standardization committees. While the first version of HEVC is sufficient to cover a wide range of applications, needs for enhancing the standard in several ways have been identified, including work on range extensions for color format and bit depth enhancement, embedded-bitstream scalability and 3D video.

3D high efficiency video coding for multi-view video and depth data [6, 7], describes an extension of the high efficiency video coding (HEVC) standard for coding of multi-view video and depth data. In addition to the known concept of disparity-compensated prediction, inter-view motion parameter and inter-view residual prediction for coding of the dependent video views are developed and integrated. Furthermore, for depth coding, new intra coding modes, a modified motion compensation and motion vector coding as well as the concept of motion parameter inheritance are part of the HEVC extension. A novel encoder control uses view synthesis optimization, which guarantees that high quality intermediate views can be generated based on the decoded data. The bitstream format supports the extraction of partial bitstreams, so that conventional 2D video, stereo video and the full multi-view video plus depth format can be decoded from a single bitstream.

Efficient intra prediction algorithm for smooth regions in depth coding [8-10], aiming to efficiently encode smooth regions in depth maps. By taking the textureless characteristics of depth maps into account, only one single prediction direction instead of multiple prediction directions is sufficient in intra prediction of depth maps. Consequently, coding of the prediction direction can be skipped which results in lower computational complexity and higher coding efficiency for synthesized views [11].

Depth and depth–color coding using shape-adaptive wavelets [12-15], present a novel depth and depth–color codec aimed at free-viewpoint 3D-TV. The proposed codec uses a shape-adaptive wavelet transform and an explicit encoding of the locations of major depth edges. Unlike the standard wavelet transform, the shape-adaptive transform generates small wavelet coefficients along depth edges, which greatly reduces the bits required to represent the data. The wavelet transform is implemented by shape-adaptive lifting, which enables fast computations and perfect reconstruction. We derive a simple extension of typical boundary extrapolation methods for lifting schemes to obtain as many vanishing moments near boundaries as away from them. We also develop a novel rate-constrained edge detection algorithm, which integrates the idea of significance bitplanes into the Canny edge detector.

All the above discussed methods produces poor compression rate and produces higher time complexity.

Regional Texture Approximation Technique: The regional feature approximation technique splits the image into small scale frames. For each tiny image generated the method extracts the features and compares the features to find out the variation. The process has been split into number of stages and each will be discussed clearly.

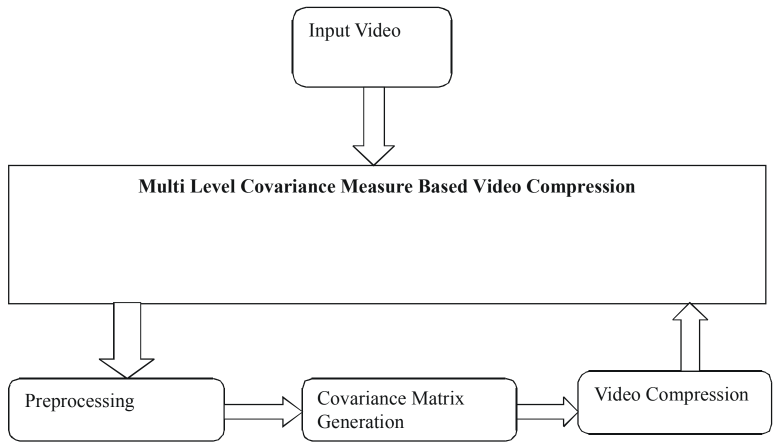


Fig. 1: Architecture of Region based approach

The Figure 1, shows the architecture of the proposed region based approach and shows the functional components.

Preprocessing: At this stage, the input video is taken into processing and splits the entire video into number of sub sampling image. The generated image is applied with histogram equalization, which improves the quality image and removes the noise from the image. The generated image will be used to perform feature extraction in the next stage.

Preprocessing Algorithm:
Input: Video V
Output: Frame set Fs
Start
Read Input Video V.
Split Video into frames.

$$Fs = \int Split\,(V)$$

For each frame Fi from Fs
Fs(i) = Histogram-Equalization(Fi).
End
Stop.

The above discussed preprocessing algorithm splits the video into number of frames and for each frame generated, the histogram equalization is applied to enhance the image quality.

Region Based Texture Approximation: For any two successive frames of the video, the method splits the frame into number of small scale regions. For each region the method computes features similarity between the other in the next frame. Based on the similarity value the method selects required regions to be transmitted.

Region Based Texture Approximation Algorithm:
Input: Frame Set Fs
Output: Region Set Rs
Start
For each Frame Fi from Fs
Read Previous Frame Pf.
Split Frames into sectional images.

$$SI_p = \int_{i=1}^{size(Pf)} Crop(Pf, size)$$

$$SI_c = \int_{i=1}^{size(Cf)} Crop(Cf, size)$$

For each sectional image Si from SI compute similarity measure.

$$Rsim = \int_{i=1}^{size(SI)} \frac{\Sigma Dist(SI(i)SIC(i)}{size}$$

If Rsim>Th then
Add region to region set.
End
End
Stop.

The region based approximation technique splits the image into number of sectional images and for each region the sectional similarity is computed. Based on computed similarity value the region will be selected. The similarity value decides whether the region has to be sent as it is or not.

Video Compression: To compress the input video given, the method first performs preprocessing and then between each successive frames the method performs the region based feature approximation. Based on the feature similarity value computed the method selects required region of the image to be transmitted. On the other end the method reconstruct the frame with the received and with the regions of previous frame.

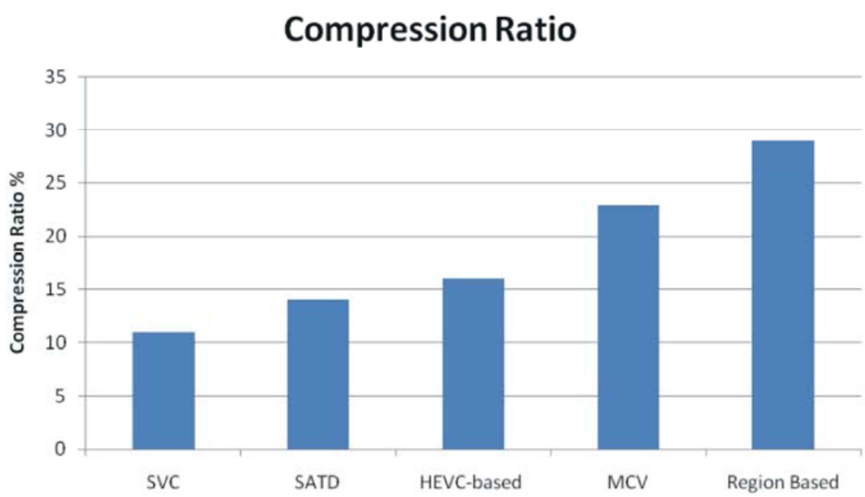
RESULTS AND DISCUSSION

The proposed region based feature approximation techniquefor video compression has been implemented using matlab and the performance of the methods has been evaluated using different videos. The methods have produced efficient result in compression ration and reduce the distortion ratio than other methods.

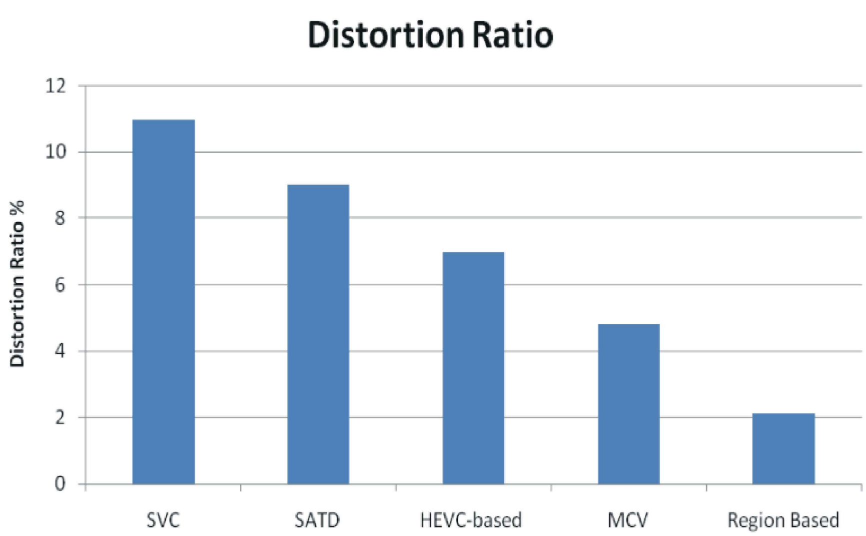
The Graph 1, shows the comparison of video compression ratio being achieved by different methods and it shows clearly that the proposed methods has produced more video compression ratio than other methods.

The Graph 2, shows the comparison of distortion ratio being produced by different methods and it shows clearly that the proposed method has produced less distortion ratio and the methods reduces the distortion ratio rapidly.

The Table 1, shows the comparison of different video compression measures produced and it shows that the proposed method has produced efficient results.



Graph 1: Comparison of video compression ratio



Graph 2: Comparison of distortion ratio

Table 1: Comparison of various video compression measures

Method	Compression Ratio %	Distortion Ratio %	Time Complexity in seconds
SVC	11	11	87
SATD	14	9	81
HEVC-based	16	7	76
MCV	23	4.8	56
Region Based	29	2.1	45

CONCLUSION

In this paper, an efficient region based feature approximation technique has been discussed to improve the performance of video compression. The method first splits the input video into number of frames and for each frame generated histogram equalization has been applied. Then the method splits the image into number of small scale images and for each sectional image the method computes the feature similarity measure. The region based feature approximation returns a small set of region which can be transmitted to the other end. If the number of regions selected from the approximation technique is higher than particular threshold then the entire image has to be sent. The proposed method has produced higher rate of video compression and reduces the time complexity.

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