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Research paper

Wavelet based Video Compression Using Various Encoding Techniques: A Relative Study

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Abstract

In this paper, we are functioning to execute various coding based methods with empirical wavelet transform (EWT) for video compression. These methods are Video coding using wavelet and H.264, Video coding using wavelet and SPIHT, Video coding using wavelet and combination of H.264 and SPIHT, Video coding using wavelet and combination of Huffman and SPIHT, Video coding using wavelet and LZW and our proposed method Video coding wavelet and BWT, MTF and Huffman. For our implementing purpose, we are using MATLAB 2014. By using this evaluation we can check the performance of different techniques. Here we quantify PSNR and compression ratio of these various methods. Using these results, we can compare the performance of these various methods. The proposed method output shows that it got better results than previous methods.

Keywords: *Empirical wavelet transform (EWT), Huffman coding, SPIHT, H.264, LZW, BWT, MTF, PSNR*

1. Introduction

At this moment, through restricted bandwidth we can transmit huge amount of video but it is executed by the use of video compression techniques. In large number of mobile communication applications and multimedia related web applications has engaged new compression and decompression techniques. Video compression is very much useful for many approaches like Television broadcasting, videoconferencing etc. The main motive of video compression techniques is to remove redundancy of data in order to keep or transmit data in a systematic form.

Last few years, the wavelets have favorable results in the domain of video processing, and have been used to find many problems such as video compression and restoration. In our research paper, we compare various techniques related to wavelet and encoding techniques for video compression, results shows that we got sufficient PSNR and compression ratio. We also proposed a method of video compression using Wavelet and combinations of BWT, MTF, Huffman coding.
The performance of this proposed method is calculated by using various measurements. The results show that proposed method is better than the previous methods and quality of the reconstructed video is also good.

2. Video Compression Using Wavelet and Various Encoding Techniques

Here we compress the video by using Empirical wavelet transform and different encoding techniques. The techniques used here are EWT and H.264, EWT and SPIHT, EWT and combination of H.264 and SPIHT, EWT and Huffman, EWT and LZW coding etc.

2.1. Video Compression Using EWT and H.264 (VCEH)

Here we compress the video with the help of Empirical wavelet transform and H.264 coding. H.264 is otherwise known as MPEG-4 AVC and it is block-oriented motion-compensation-related video compression standard. In this idea, we select AVC for getting better quality compressed video. The EWT is mainly used for decomposing the frames and it is most useful than wavelets in certain purposes. First we convert the video in to frames with the help of mat lab. Then we decompose these frames by using EWT and compress the frames by using advanced video coding. Results show that we got better PSNR and compression ratio. In decompression we use IEWT and advanced video decoder for reconstructing the original video. Fig 1 shows the schematic diagram of this method.

2.2. Video Compression Using Wavelet and SPIHT Encoding (VCES)

Here we compress the video by using EWT and SPIHT coding technique. Instead of advanced video coding here we use modified version of SPIHT. First we convert the video in to frames by using mat lab. The EWT is mainly used for decomposing the frames and it is most useful than wavelets in certain purposes. Then we decompose these frames by using EWT and compress the frames by using modified SPIHT.

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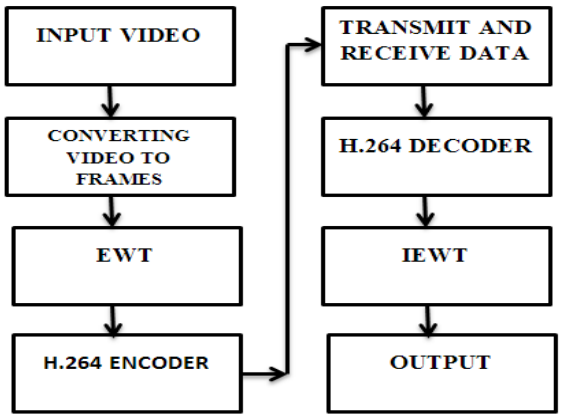


Fig 1: Video compression using EWT and H.264

SPIHT is a wavelet based compression algorithm, it is used to utilize the inherent similarities beyond the sub-bands. Results show that we got better PSNR and compression ratio. In decompression we use IEWT and advanced SPIHT decoder for reconstructing the original video. Fig 2 shows schematic diagram of this method and it is shown below.

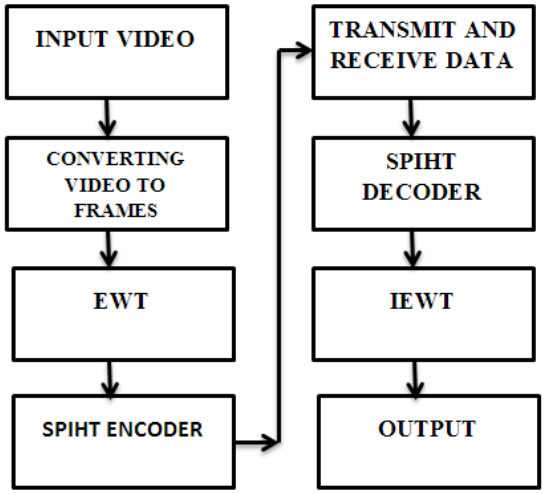


Fig 2: Video coding using wavelet and SPIHT

2.3. Video Coding Using Wavelet and Combination of H.264 and SPIHT (VCEHS)

Here we compress the video by using EWT and combination of H.264 and SPIHT coding technique. H.264 is otherwise known as MPEG-4 AVC and it is block-oriented motion-compensation-related video compression standard. In this idea, we select AVC for getting better quality compressed video. In this approach the input video is first converted in to frames with the help of mat lab. By using empirical wavelet transform decompose the frames related to frequency and it splits in to low frequency and high frequency frames. Here low frequency frames are encoded by using H.264 and high frequency frames are encoded by using advanced SPIHT. Then we reversely do this procedure for getting reconstructed video. Next we calculate the performance of this method for getting reconstructed video. In this method, we got sufficient performance. Fig 3 shows the block diagram for video coding using wavelet and combination of H.264 and SPIHT.

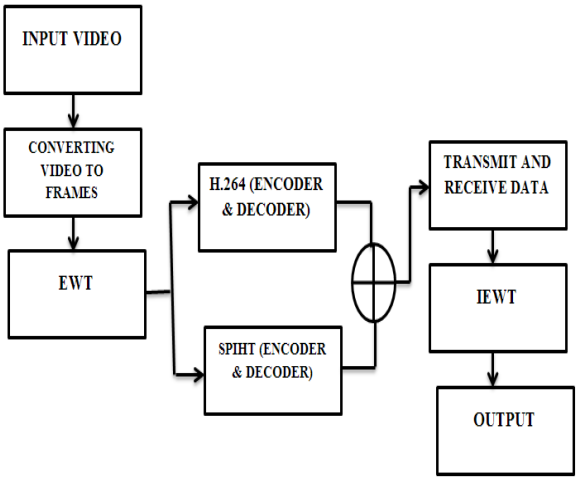


Fig 3: Video coding using wavelet and combination of H.264 and SPIHT

2.4. Video Coding Using Wavelet and Combination of Huffman and SPIHT (VCEHUS)

Here we compress the video by using EWT and combination of Huffman and modified SPIHT coding technique. In our approach, first we convert the input videos in to frames by using mat lab. Then we separate these frames according to their frequency.

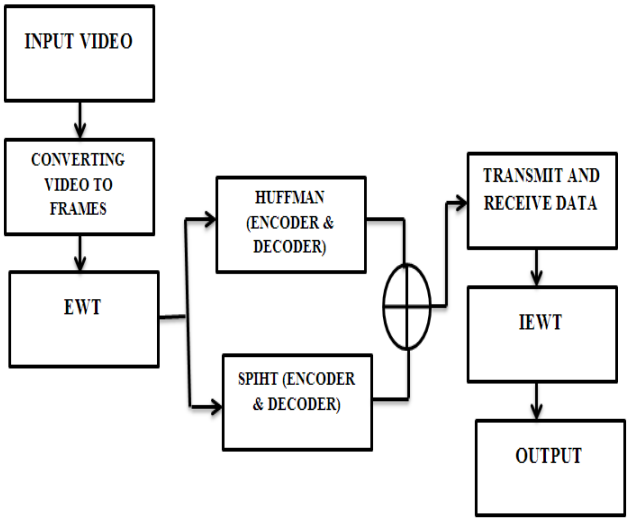


Fig 4: Video coding using wavelet and combination of Huffman and SPIHT.

Basically we divide the frames in to low frequency and high frequency. Then we decompose these frames by using empirical wavelet transform. Here we use two compression standards. We use this standards based on the frequency allotment of the frames. Here Huffman codec is used for encoding low frequency frames.

Huffman coding has the capacity to compress all sorts of data; it is also an entropy-based algorithm. The SPIHT is used for encoding high frequency frames. Results show that we got better PSNR and compression ratio. For reconstruction we use inverse empirical transform and decoder. Fig 4 shows the block diagram of Video coding using wavelet and combination of Huffman and SPIHT.

2.5. Video Coding Using Wavelet and LZW Coding (VCEL)

Here we compress the video by using EWT and LZW coding technique. LZW (Lempel-Ziv–Welch) is a totally dictionary related coding. LZW encoding is mainly separated into static and

dynamic. In static, dictionary is stable during the encoding and decoding processes but in dynamic dictionary coding, we can update the dictionary. LZW compressions restore single codes instead of character strings. In this approach, first we convert the input video in to frames. Then we decompose the frames by using empirical wavelet transform. Then we compress the frame by using LZW. Then we store or transmit this signal. For reconstructing the original video we reverse this process. The performance of this method is calculated by various calculations. Fig 5 shows the block diagram of video coding using wavelet and LZW coding.

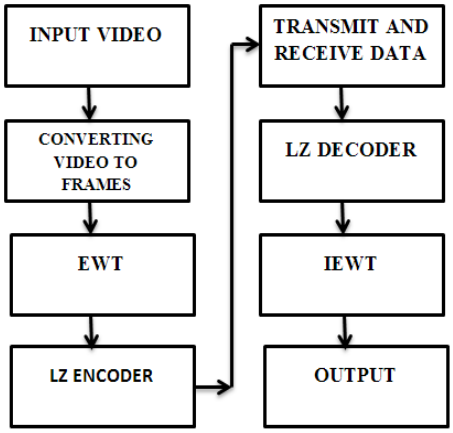


Fig 5: Video coding using wavelet and LZW coding

3. Proposed Method

3.1. Video Coding Wavelet and Combinations of BWT, MTF and Huffman coding (VCEBMHU)

In this approach, first we convert the input video in to frames. Then we decompose the frames by using empirical wavelet transform. The Burrows-Wheeler transform, also called 'block-sorting' does not operate the input sequentially, but instead it operates a block of text as an isolate unit. BWT is a general name that is assigned to presses the sequential transformations that are BWT, MTF 'move-to-front transform'. Here BWT is used for compressing the frames. Move-to-Front encoding is a scheme that uses a list of viable symbols and modifies it at every cycle. The EWT is mainly used for decomposing the frames. First we convert the video in to frames with the help of mat lab. Then we encode the decomposed frames by using BWT, MTF and Huffman coding. Then we calculate PSNR and compression ratio for better performance, results shows that proposed method is better than previous methods. For reconstructing the original video we reverse this process. Fig 6 shows the block diagram of video coding wavelet and combinations of BWT, MTF and Huffman coding.

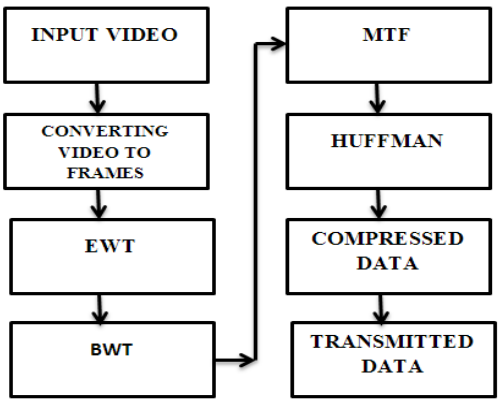
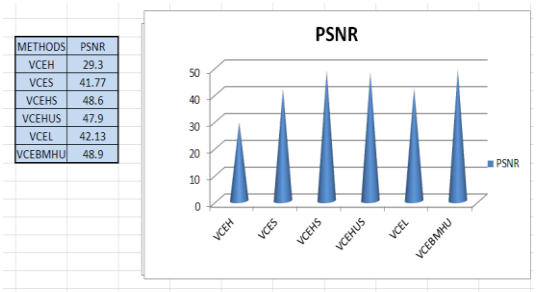


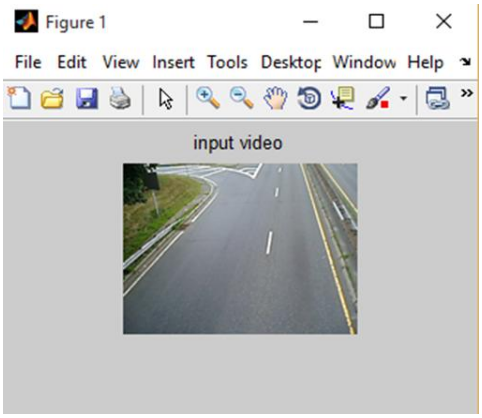
Fig 6: Video coding wavelet and combinations of BWT, MTF and Huffman coding

4. Performance Comparison and Simulation Results

Here we calculate Compression Ratio, Peak Signal to Noise Ratio (PSNR) and Structural Similarity (SSIM) is used for the confirmation of this idea. The performance comparison of certain videos are given below in the following table

METHODS	PSNR
VCEH	29.3
VCES	41.77
VCEHS	48.6
VCEHUS	47.9
VCEL	42.13
VCEBMHU	48.9





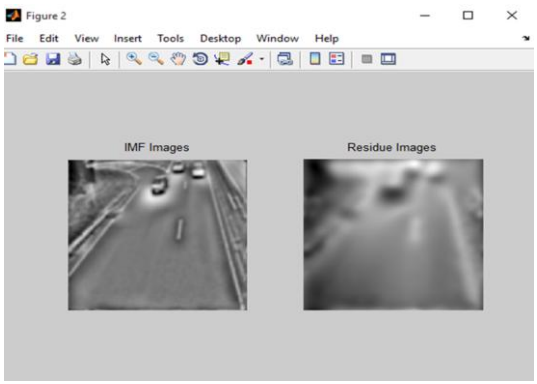
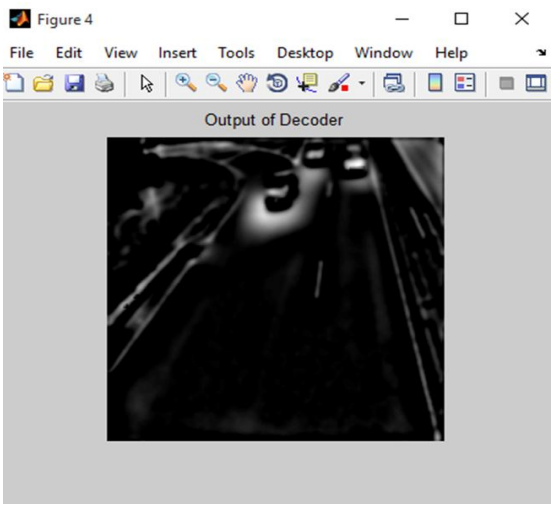


Fig 7: Performance comparison, input video, IMF and Residue images



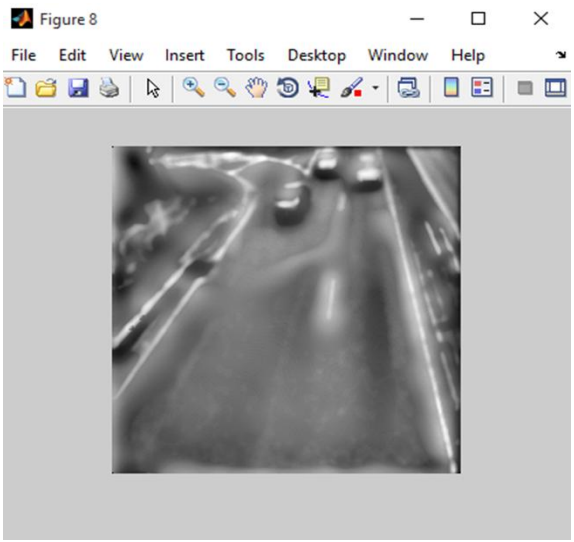


Fig 8: Decoded video of VCEL and VCEBMHU

5. Conclusion and Future Works

In our approach we implement various methods of video compression. These methods are Video coding using wavelet and H.264, Video coding using wavelet and SPIHT, Video coding using wavelet and combination of H.264 and SPIHT, Video coding using wavelet and combination of Huffman and SPIHT, Video coding using wavelet and LZW and our proposed method Video coding wavelet and BWT, MTF and Huffman. In all methods we use empirical wavelet transform but the encoder part is different. By comparing all these methods, the last method Video coding wavelet and combinations of BWT, MTF and Huffman coding (VCEBMHU) got better results than other methods.

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