An improvement analysis on video compression using file segmentation

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Abstract. From the past two decades the extreme evolution of the Internet has lead a massive rise in video technology and significantly video consumption over the Internet which inhabits the bulk of data traffic in general. Clearly, video consumes that so much data size on the World Wide Web, to reduce the burden on the Internet and deduction of bandwidth consume by video so that the user can easily access the video data.For this, many video codecs are developed such as HEVC/H.265 and V9. Although after seeing codec like this one gets a dilemma of which would be improved technology in the manner of rate distortion and the coding standard.This paper gives a solution about the difficulty for getting low delay in video compression and video application e.g. ad-hoc video conferencing/streaming or observation by surveillance. Also this paper describes the benchmark of HEVC and V9 technique of video compression on subjective oral estimations of High Definition video content, playback on web browsers. Moreover, this gives the experimental ideology of dividing the video file into several segments for compression and putting back together to improve the efficiency of video compression on the web as well as on the offline mode.

1. Introduction

A video takes a huge amount of data when storing on disk, an uncompressed video takes up somewhat 15 MB of size considering the fact that it is been recorded with a good quality camcorder therefore it takes so much space which leads to the way of video compression, compression means to converting the information into a smaller space. Compressions mainly are two kinds.
Lossy Compression speak of the compressed file will have the much less data than the data in original file, sometimes in some cases the file output is of very less quality file because in process of compression the information is lost that's why the name lossy compression the advantage of using lossy compression technique is in some scenario lossy can produce a much more smaller compressed file comparing to other method. Lossy method repeatedly used for compressing images, videos and sounds. Files using lossy compression are of lesser size and thus cost less amount of data to store and to transfer to the Internet, an essential for streaming video facilities such as streaming audio services like Spotify and video broadcasting service Netflix.

Lossless Compression as the name suggests that a compression where no part or piece of the information is lost in the process of compressing, in most cases the compression part actually ends up the same amount of size the original video does it may sound pointless because the foremost goal is to reduce the size. However if the file size is not considered as a problem this compression will give output as perfect quality picture for e.g transferring a file from one computer to another using video editor via hard disk might use lossless compression to preserve quality while that person is working. Most used lossless compression opted by zip compression.
A digital frame or video consist of 3 dimensional array of numeric values one array for each of 3 component tristimulus (the term used for combination of red, blue and green) color demonstration for the spatial zone denoted in the pictures. Video codec technique uses a color illustration method having 3 elements named as "Y", "Cb", and "Cr" Element Y is called Luma means brightness. The 2 Chroma elements Cb and Cr shows the degree of the colour vary from grey toward first blue then red, Because the human visual part is much more sensitive to luminous simply luma i.e. brightness than it comes called Chroma, often a test group arrangement is used which shows that the Chroma element arrays all have only 1/4 as numerous samples as the corresponding element luma element array. This is known as 4:2:0 sampling method. The breadth of each one element is naturally meant with eight bit of precision /sample for user class film.

2. File Segmentation Scattering

In today's computer generation the CPU power has been getting so much powerful day by day as we can see the Moore's law of doubling the transistors in every two years, still we have no idea what future holds for us human's as far as we know we are not utilizing the full cpu's potential in the domain of video compression. In this paper, I am proposing an idea of File Segmentation which can be combined with both of the major video codec's that is experimental analysis on improving the video compression efficiency in data compression which means by increasing the performance and decreasing the data storage on disk. The ideology behind the file segmentation is to divide the desired video file into 2 or 4 or 8 parts (depends upon the CPU's capability) and then applying the compression codec algorithm on the files parts so that all the CPU cores can be utilized in a proper way by applying the same piece of code of video compression each part is in the process of compressing the data after the completion all parts are combined again into one as complete formatted output ready to serve. Now that raises the questions that how again all the parts be merged properly in a way it used to seem original the solution is that all the parts when getting segmented the segmenting algorithm will provide them a header with the index number and metadata about that part which is checked by machine when dividing the part or connecting the part as whole. The idea says that each processor core should be dedicated to part of file so that a processor can utilize its power to give the better efficiency to user with the data handling and efficient and effective compression of videos. To squeeze the real performance of system for the video compression of the file in the best way using File segmentation is our proposed solution for the given problem.

3. Proposed Work

The heading means in what factors are compressed when video compression process begins

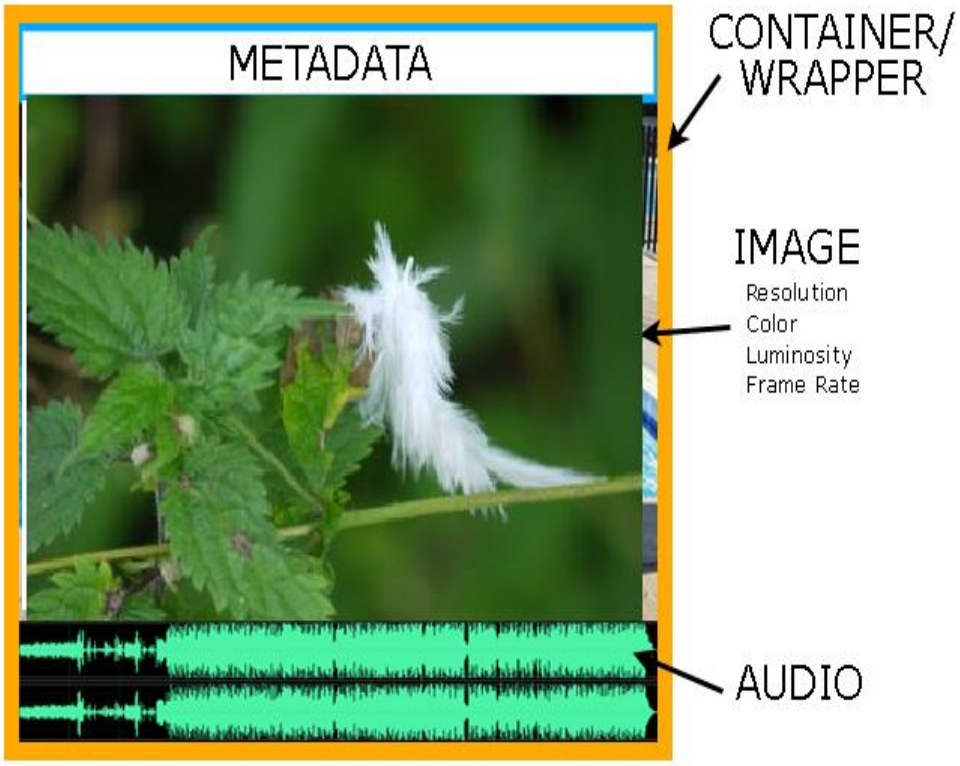

Figure 1. Video Compression Factors

3.1. Metadata

Metadata is simply refers to data or information about data.3 evident types of metadata exist: structural metadata, descriptive metadata, and administrative metadata. Descriptive metadata depicts a helpful asset for purposes, for example, revelation and personality. It could comprise of variables including recognize, dynamic, maker, and key expressions. Structural metadata will be metadata about boxes of metadata and recommends how compound articles are assembled, as an occurrence, how pages are requested to shape parts. Administrative metadata gives measurements to help control an asset, which incorporates while and how it progress toward becoming made, record kind and diverse specialized information, and who can get admission to it.

3.2. Image

Image is a factor of video component which refers to the 2 dimensional entity forming a pixelated shade on a particular area although image as a video compression focuses on compressing the data size by minimizing the resolution of each frame so that as a group or video the less data size happens. Color changing to dull of every picture might not bring clarity to video. Luminosity goes by the amount of brightness focuses on frame by frame causes expansion in data. Frame rate or changing of frame can be saved by removing the same frames repeatedly.

3.3. Audio

Audio file is important part of video which is embedded to it to compress an audio the bitrate of it can be reduced by separating the audio from it and then put a conversion to lower level which again goes to the process of adding the file to the compressed video file.

3.4. Container or Wrapper

It is a file system which tells the operating system what kind of file is this and that's how it should handle. Containers are important because an OS checks before opening any file that what application is needed to run the application by checking the extension and wrapper file and checks is the data arranged in it the way it should be if yes run the file if not the file can't be open by the application occurs.

4. Video Compression Standard/Formats

Video compression is term called for the method for reducing the size of data and to encode the digital video. In this paper we are focusing on showing the MPEG and VP9 standards so here goes the discussion-

4.1. MPEG

"**M***oving* **P***icture* **E***xperts* **G***roup*" is a working group of the International Standard Organization. MPEG naturally yields better quality video than competing formats like indeo and videos for windows and QuickTime. In past MPEG files on PC's wanted hardware decoders (codecs) for processing mpeg formats. Nowadays PC can use codec software's including Windows Media Player and Real networks and QuickTime.
MPEG algo's compresses the video to form small bits which can be transmitted easily and simply decompresses it. Mpeg achieves high rate compression by storing the differences from one frame to another frame rather than every frame. MPEG uses a lossy compression though sometimes the data gets lost but the data is imperceptible to the visual senses of human eye.
There are some major standards in MPEG let's see-
Moving Picture Expert Group-1(inception):
MPEG adopted JPEG and H.261 composed to form to be called a 'Suite'. The exact term for used for this suite was MPEG-1. This is bounded upto 1.5 MBPS, 4:2:0 and stereophonic aural only that period it was used to be NTSC and PAL and VHS.
Moving Picture Expert Group –Part 2
In the year of 1999, technology was authorize to have an upgrade of the suite.MPEG-2 part one includes two major classification which is Transport Stream and Program Stream. Second part is titled H.262 it had interlacing backing for interlacing and 4:2:2 method. The vast insurgency for audio is the invention of 5.1 channels and file format like mp3 was reviewed to merged this design.
Back then most of the TeleVision adopted this to broadcast data and yet the most commonly used codec format nowadays for film broadcast furthermore Digital Video Disk adopted this technology was capable to embrace surround sound as an outcome.
MPEG part 2 also included AAC (Advance Audio Coding) audio format and HDV format adopted by professional camera.
MPEG-4
By 2004 the internet has risen up massively MPEG was prepared by way of the 3rd suite called MPEG-4(don't get confused MPEG-3 was not used) MPEG part-2 is moreover named as H.263. It invented a new notion called "Profiles" for that HDCAM SR uses the particular portion.
Part 3 is still audio. Part 3 show s the AAC there are 30 part in MPEG 4 one for each technology part 10 and 14 are most concerned.
H.264 or MPEG part 10/AVC
The new MPEG designates the AVC((Advance Video coding) that is H.264 Rather than showing fresh suite they preferred to make it a part.

H.264 is the utmost broadly used video coding nowadays on this planet even surpassing MPEG-2 well obviously for usage for the internet it is used by NETFLIX and YouTube and other websites. This codec also runs in Blu-ray after mpeg-2 this is the largest codec adopted by as well this could deal also 4K video.

HEVC or H.265

In the year 2013, the innovative beast came in the market is MPEG-H. Part 2 (for the video, of course) is moreover termed as H.265 or popularly called by engineers as HEVC (High Efficiency Video Coding).Here are its key benefits:

•Color bit depth 12bit
• Data amounts surpasses several GB/s
• Supports up to 8K UltraHDTV (8192 * 4320 max resolution)
• 300 fps is supported (fyi earlier version can be up to 59 fps)
•File size is now subjectively half the size of it with better quality.

Table 1: Timeline of various compression standards

Year	**MPEG**	**Part**	**Layer/ Profile/Type**	**Usage**	**VCEG**	**Variants**
1984	**Not Formed**	**Practically Not Useful**			**H.120**	
1988	**Not Formed**	**Video Conferencing**			**H.261**	
1993	**MPEG-1**	**VHS and Television Recording**				
		Part 1	**Systems**			
		Part 2	**Video**	**VCD**	**H.261**	
		Part 3	**Audio**			
			Layer 1			
			Layer II			
			Layer III	**MP3**		
1999	**MPEG-2**	**Broadcast, Distribution, DVD**				
		Part 1	**Systems**			
			Program Stream			

			Transport Stream			
		Part 2	**Video**		**H.262**	**HDV,XDCAM**
		Part 3	**Audio**			
			Layer 1			
			Layer II			
			Layer III	**MP3**		
2004	**MPEG-4**	**Broadcast, Internet, Blu-ray**				
		Part 1	**Systems**			
		Part 2	**Video**		**H.263**	**HDCAM SR**
		Part 3	**Audio**			
		Part 10	**Advance Video coding**	**MPEG-4 AVC**	**H.264**	**AVCHD,XAVC**
		Part 14	**MP4 Container**	**MP4**	**H.265**	
2013	**MPEG-H**	**Part 2**	**Video**	**HEVC**		

4.2. VP9

VP9 is developed by Google, it's an open source royalty free video codec technology that is part of WebM open source project funded/powered by with previous version VP8. The VP9 and HEVC (H.265) codec are similar because they supports parallel processing, VP9 capable of decreasing the bit-rate to the half of the original data without disturbing the quality of video and enables quality streaming for low end machines like mobile phones. The VP9 is capable to convert or codec video files and can broadcast or streams at 4K resolution.

A video codec basic theory is to compress raw video with the algorithm to make it suitable for spreading over the web. An UHD video contains a large amount of information, so it's difficult to transfer such amount over the internet. VP9 provides a better way to codec the huge size video files without losing the quality much with VP9 it's easy to stream a 720p video over a channel that was previously handling the streaming up to 480p.

VP9 uses 64*64 a block which is scattered into smaller block for compression. It has 4 transform size chart which is 32*32, 16*16, 8*8, and 4*4. The VP9 codec codes each and every frame into 3 sections such as uncompressed header, compressed frame data and compressed header.

VP9 codec is broadly supported by many video streaming services YouTube and Netflix video services it is officially announced as that YouTube is going to use VP9 as their standard format. It is supported by most popular tech-tycoon firms like Panasonic, L.G, Sony, ARM, Broadcom, NVidia, Samsung, Mozilla, Qualcomm, Toshiba and many more. The major rival in the market for VP9 is HEVC H.265) but the HEVC is not an open source codec thus VP9 has advantage over here though VP9 is provided by many vendors.

Gary J. Sullivan and Thomas Wiegand [1] wrote the paper and In this paper the author starts the research telling the basic concepts of video compression and give a brief idea about terminology used in domain of video compression and codec design form a scenario of basic video compression then explains how the features is going to be integrated into the video and include the one of the most popular video codec standard MPEG (H.264/AVC) and along the way they found about the technique named VCL stands for Video coding layer which is used to represent the video content and provides a header information to the package that is for network transport. Also they have claimed that the VCL design integrated with H.264 standard provide somewhat 50% savings of bit rate quality comparatively to performance of earlier standards.

Martin ˇReˇ r´ abek, Pavel KorshunovTouradjEbrahimi and Philippe Hanhart [2], are the authors and published in their paper which basically follows the lead of getting the best out of both newly most popular concepts of HEVC (High Efficiency Video Codec) and VP9 (technology developed by Google) the author comprises the information and benchmark performances of both the technique rate-distortion and state of the art coding potentials. As both codec compared to Advance Video Coding anchor consuming 8 different HD contents and as a conclusion HEVC gives better performance of 59.5% bit rate savings comparatively to VP9 which gives 57.3% to the matter of AVC.

In article [3] published by IEEE transactions on image processing in 2015 propose a method by visual compression artifact fall by adaptive fusing multiple hypothesis based on their responses. Their investigational outcomes shows their offered technique can actually increase the quality of the sequences with as subjective and objective can be plugged into many video sequences. The method is also used as pre-processing instrument in transcoding presentation which in terms can support in bit-saving in streaming.

Hao Wu, Xiaoyan Sun, Jingyu Yang, Wenjun Zeng, Fellow, and Feng Wu [4], proposed a hybrid method using lossless compression to reduce the size of the bunch of JPEG images without the loss of information they done clustering on JPEG image found that it can be time consuming if big data came so they provide an assistant information on images such as time stamp and GPS data in the metadata to isolate the large collection to smaller data.in this way they increase performance for their method and further they reduce the intricacy in their algo by using some proposed HEVC fast algorithms.

5. Result Analysis

Table 2: Analysis of compression performance using PSNR

S. No.	File Name	Original File Size(in MB)	Compressed File Size	Time Taken	PSNR ratio
1.	My video Part 1	18.6	14.6	35 Seconds	High
2.	My video Part 2	18.9	15.4	40 Seconds	High
3.	Wonder Woman	20.2	18.1	50	High

	Trailer			Seconds	

6. Output

Figure 2. Original Video Snap

Figure 3. Converted HEVC 720p Compression Snap

7. Conclusion

In this paper, proposes a two phases of information firstly this paper provides the information on what video is what video compression is meant and provide what are the video factors and then comes to important part of this first phase of the document the introduction or the comparison of the two major sensational video compression techniques High Efficiency Video Codec and VP9 currently running in Computer world we can conclude that HEVC is much more faster than VP9 but HEVC is only available in open source under GPL2 licenses source code can be available on www.multicore.com website under x265 section and its video compression efficiency is 59% which includes the conversion of Ultra-High-Definition Videos which is up to 8K, comparatively to its competitor VP9 which is open source and purely royalty free codec is invented by Google Corporation is also a good option for choosing for your video compression technique but its little less than HEVC codec which provide approximately 57% of efficiency the technique is they divide the image in a matrix by 4*4,8*8, or 16*16 can increase the performance. The second phase is the solution which is experimental idea of

dividing one file into chunks and implementing the algorithm on each part providing the parallel computing solution to video compression is somewhat increase 10-15% of efficiency in both the major techniques in time. Although both have the source code available on the internet we can test it any time with the changes in the code for file segmentation algorithm that we have to develop this is the improvement analysis which can be play a major role in video compression technique if we follow. For the analysis we have divided a file into two and converted into hevc 720p compression file which causes actual decrease in file size by 20-30%. We have taken 3 files and put this method shows efficiency than the method used in normal, hopefully we can propose some new tweaks and propose this method internationally.

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