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A Comparative Study of Different Video Compression Technique

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Abstract: currently there are number of video standard and techniques are available in the current scenario. According to the size and quality the different techniques are used in different way as per the requirement. In this paper I explain about, how to different video standard and formats are work and how they are different with each other. The High Definition (HD) Video required huge amount of storage space to store in the digital form. It is required to convert the HD Video in that format which requires less amount of space without changing the quality of the video.

Keywords: MPEG, DWT, DCT, H264/AVC, Intra Prediction, Inter Prediction, Quantization.

I. INTRODUCTION

As in the rapid change in the multimedia the digital video formats are day to day improved to make the more quality and clear video. There are many formats and standards are used to convert the video into the reliable form to store in the available space or to transfer over the communication network such as television, video calling or convert in to digital TV, HDTV. In this paper I discuss about the different formats and standards available in the current multimedia and comparing them to find the more efficient form of the video to use and store in the space. Compare available compression technique and at the end to show the graphical view of the result. First here we first discuss different standards and technique used to compress the video.

II. LITERATURE SURVEY OF STANDARDS AND TECHNIQUE

Video form is created by combining number of moving images per seconds and generates the sequence. To get the appropriate video form, it is required to get the appropriate frame rate per second and appropriate bit rate per frame. It is also required the image resolution to get the best result of the video form. All the moving images are arranged in the proper digital format and then they will be play in a sequence that is called video[1].

Different Video Formats

Available Video formats[1]

1. MP4

MP4 is also known as MPEG-4 part14 and is a digital format of multimedia, which is commonly used to store video and audio[8].

2. AVI

Full form of AVI is Audio Video Interleave which is introduced by Microsoft in Nov 1992. AVI contain both Audio and Video data and also supports multiple streaming[9].

3. 3GP

3GP is the Third Generation Partnership Project (3GPP) and used on mobile phones. 3GP format is used to store video and audio media type specially for mobile[10].

4. WMV

Windows Media Video (WMV) is a multimedia format which developed by Microsoft. WMV actually first designed for Internet Streaming application[11].

5. MKV

The Matroska format is current most growing format in the Multimedia, which is an open standard free container format, The MKV file contain the unlimited number format in one file[12].

6. MPG

The MPG is the most popular format for the compact disk video type and is a file extensions for MPEG-1 or MPEG-2 audio and video compression[13].

7. VOB

VOB (Video Object) is a format used in the DVD-Video media. DVD file format contain the information about the digital video, digital audio, subtitles, DVD menus and navigation contents multiplexed together into a stream form[14].

8. MOV

The MOV is the special format used with quick time player and exported to the iTunes multimedia application used by the iPhone. The format contains one or more tracks, each of which stores Video, Audio, Special Effect and also Text file (like Subtitles)[15].

9. FLV (Flash Video)

The FLV format is the extension of the flash file which is uploaded on the internet using the Adobe Flash Player. The FLV format is also exported to the SWF format for playing the media file in the Flash Player[16].

Different Standards and Technique

1. DCT

First the JPEG image (or a single frame from a video) is converted into the 8x8 blocks (e.g. the image of 640x480 resolution is converted in to 8x8 blocks then total blocks are 4800). Each block in processed separately. Each block of 64 pixels goes through a transformation called Discrete Cosine Transform (DCT). The 8x8 block is converted in to the new block that contain the DC component which contain the significant value according to the original 8x8 block and other AC components and 0 which depends on the DC component for changing the value. Similarly generate the all other block and combine to make the image after the Discrete Cosine Transformation. After the calculation of DCT components, they are normalized according to a quantization table with different scales[7]. The quantization method is discussed later in this paper.

2. DWT

DWT (Discrete Wavelet Transform) is an another transmission method for compressing signals. DWT is used to process and improve signals. DWT is also used to remove noise from the image. In DWT, mathematical functions are used to transform one function representation into another. This transform performed on multi resolution image

analysis. It is a sum of wavelets functions to represent the DWT. The 2D wavelet analysis uses the 'mother wavelets' for decomposition[5].

3. Intra Prediction

In H.264 intra prediction is improved by Bi-directional Intra Prediction (BIP) modes, using the weighting matrix, the prediction blocks are combined from two prediction[4].

4. Inter Prediction

For more improvement in the H.264 technique, the inter prediction is efficient in this increasing the resolution of the vector from 1/4-pixel to 1/8 -pixel to obtain higher efficiency of the motion prediction is suggested[4].

5. Quantization

As discussed in 2.2.1 the image (or a frame) is converted in 8x8 block and the DCT is applied on it. Now it required to apply quantization. Quantization is the method to minimize to quantum values using the quantization table so that the 8x8 block in reduced to required compression. DCT Data Quantization is used for JPEG and DWT Data Quantization is used for JPEG 2000[17].

6. MPEG-1

The first public standard for the Moving Picture Experts Group (MPEG) committee was the MPEG-1[2]. Which is approved in 1991 and released in 1993. MPEG-1 is the best for CD-ROM and digital audio broadcasting. With the help of MPEG-1 the VCR quality is 640x480 resolution with 25 frames per seconds and 24 bits used by per pixels and use about 368.64 Mbps data transfer over broadcasting in uncompressed form and 1.5 Mbps in compressed form[18].

7. MPEG-2

The MPEG-2 is similar to MPEG-1. The MPEG-2 was approved in November 1994, extended compression technique of MPEG-1 to coat big picture and higher quality at the rate of higher bandwidth usage. MPEG-2 is designed for digital television broadcasting applications[2]. In MPEG-2, the image is converted in to 10x10 block instead of 8x8 block for DCT to get better quality[18].

8. MPEG-4

The MPEG-4 was accepted in October 1998 and it is standard for low bit-rate networks and for use in portable application like videophones. The MPEG-4 compression methods are mainly used for Graphics Work (like Flash or 3dMax application work) also used for texture mapping of 2D and 3D meshes, temporal and quality scalability, images and video[2].

9. H.264

H.264 is an advanced and efficient compression method for Industry. The process of converting video into a compressed format with high quality and less amount of data for stored or transmitted. Video Compression is required for converting huge amount of video data used by Television Broadcasting, DVD-file, Videoconferencing and internet video streaming. And it also required to get back the compressed video in to the original form. The H.264 contain the maximum video resolution 4096x2304 and it is standard for current multimedia[3][6].

III. COMPARISON OF DIFFERENT VIDEO FORMATS

As discussed in section 2.1, there are number of video formats are available and as discussed in section 2.2 there are number of compression technique. But we select some of them to test the current scenario of the video quality according to the technique used. Here we take the most high definition video from the internet and convert the video in different format, as

shown in the table, the table contain the format of the video, size in KB (and MB), Time taken to convert from one format to another, the resolution achieved by a particular format.



Fig (1) : Video Clip from Dhoom 3 –Official Trailer

Format	Size(in KB)	Size(in MB)	Time	Resolution
Original	53497	52.24	0	1280x720
MP4	74073	72.34	4.15	1280x720
AVI	74371	72.63	4.23	1280x720
3GP	6881	6.72	1.29	512x288
WMV	100268	97.92	0.56	1280x720
MKV	74077	72.34	4.21	1280x720
MPG	28474	27.81	0.29	384x288
VOB	99228	96.90	0.40	720x576
MOV	74104	72.37	4.25	1280x720
FLV	12815	12.51	1.05	640x480

Table (1) : Analysis of different video formats.

The actual size of the original video file is 53497 KB and the time duration is 2 minutes and 45 seconds. The original video then converted in to different video format and the analysis is recorded in the table. Using this analysis the following two graphs are created, which shows the efficiency of the video format.

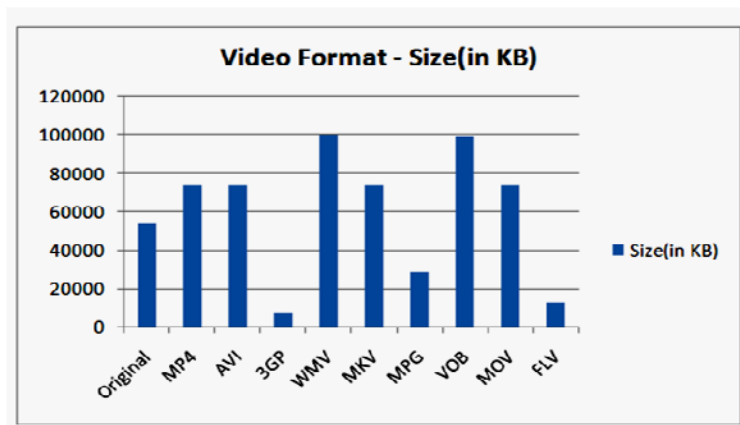


Figure (2) : Video Format v/s Size (in KB)

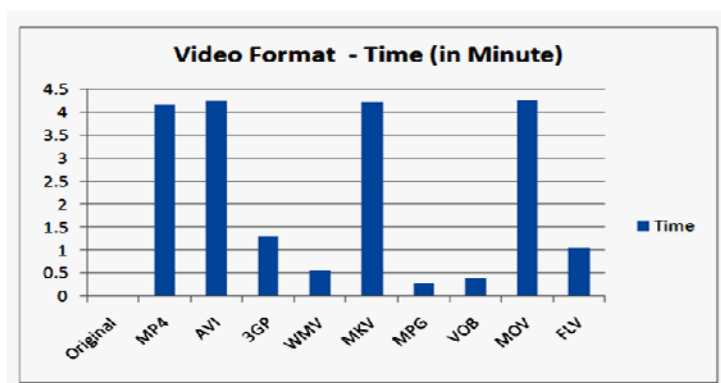


Figure (3) : Video Format v/s Time (in Minute)

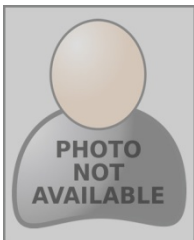
IV. CONCLUSION

In this paper we discussed about a comparative study of different video formats and techniques used to compress video. There number of video formats are available in the current scenario, but here I am just using some them and trying to explain how different video formats are different from each other and how they are store in the space by requiring them. There may be a different methods and technique are available or in the developed in the future to judge more efficient compression technique.

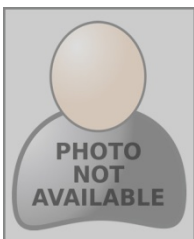
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