MPEG: It's Need, Evolution and Processing Methods

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Abstract— This paper deals with various aspects and evolution of MPEG standards, its applications and various processing methods. All simulations of suggested processing techniques were done using MATLAB R2009a software.

Keywords—Moving Picture expert Group(MPEG), Asynchronous Transfer Mode (ATM), Video Tape Recorder (VTR)

I. INTRODUCTION

With the advent of digital technology and increased commercial interest in video communication the need for international image and video compression arose. As the size of uncompressed video is too large to store or transmit. Thus to meet such requirements the Moving Picture Expert Group was formed to develop the coding standards in 1988.At the initial stage they came with the MPEG-1 in the year 1992. This standard could support the data rates upto 1.5 Mbit/s [1]. This was the first standard that is defined for both audio and video. It was basically designed to allow moving pictures and sound encoded into bit rate of compact disc. Later on, they extended their scope to provide audio-compression algorithms for a wide range of audio-visual applications at substantially higher bit rates not successfully covered or envisaged by the MPEG-l standard. Specifically, MPEG-2 is designed to provide video quality not lower than NTSC/PAL and up to CCIR 601 quality with bit rates targeted between 2 and 10 Mbit/s [1]. Emerging applications, such as digital cable TV distribution, networked database services via asynchronous transfer mode (ATM), digital video tape recorder (VTR) applications, and satellite and terrestrial digital broadcasting distribution, were seen to benefit from the increased quality expected to result from the emerging MPEG-2 standard. The MPEG-2 standard was released in 1994. Thereafter MPEG-4 was standardized in the year 1998. In addition to the features of MPEG-1 and MPEG-2, MPEG-4 Systems also contains standard technology to represent time-varying synthetic 3D information. A framework to deal with management and protection of rights arising from individual objects is also provided by MPEG-4 Systems [2]. Then they came up with MPEG-7, MPEG-21 and MPEG -U and MPEG-M are the latest one. Among all of them MPEG-4 is still popular among multimedia industry. Another important factor is the fact that the MPEG group only standardized the decoder structures and the bit-stream formats. This allows a large degree of freedom for manufactures to optimize the coding efficiency (or, in other words, the video quality at a given bit rate) by developing innovative encoder algorithms even after the standards were finalized [3]. Now lets us discuss the genesis for compression. Generally speaking, video sequences contain a significant amount of statistical and subjective redundancy within and between the frames. The ultimate goal of video source coding is the bit-rate reduction for storage and transmission by exploring both statistical and subjective redundancies and to encode a "minimum set" of information using entropy coding techniques [5]. This usually results in a compression of the coded video data compared to the original source data. The performance of video-compression techniques depends on the amount of redundancy contained in the image data as well as on the actual compression techniques used for coding. With practical coding schemes a trade-off between coding performance (high compression with sufficient quality) and implementation complexity is targeted. The MPEG compression algorithms employ discrete cosine transform (DCT) coding techniques on image blocks of 8 x 8 pixels to efficiently explore spatial correlations between nearby pixels within the same image. However, if the correlation between pixels in nearby frames is high, i.e., in cases where two consecutive frames have similar or identical content, it is desirable to use differential pulse code modulation (DPCM) coding techniques employing temporal prediction (motion-compensated prediction between frames). In MPEG video-coding schemes an adaptive combination of both temporal motion compensated

prediction followed by transform coding of the remaining spatial information is used to achieve high data compression (hybrid DPCM/DCT coding of video) [4].

PROPOSED STUDY

MPEG video is a group of images shows in a form of moving picture publishes as a standard OF ISO/IEC/11172 -2 INFORMATION TECHNOLOGIES. MPEG is supporting bandwidth up to 1.5Mbits/sec and supports resolutions up to 4095×4095 with a frame rate of 25 frames per second. MPEG video exploits perceptual compression methods to significantly reduce the data rate required by a video stream. The color-space is transformed to Y'CbCr (Y'=Luma, Cb=Chroma Blue, Cr=Chroma Red). Luma (brightness, resolution) is stored separately from chroma (color, hue, phase) and even further separated into red and blue components. The chroma is also sub sampled to 4:2:0, meaning it is reduced by one half vertically and one half horizontally, to just one quarter the resolution of the video. To encode an MPEG Video sequence, convert each RGB image frame to YUV Byte Images; perform a motion vector search on the Y Byte Image (for P and B frames); compress the Byte Images to Scrimmages; and finally encode the Scrimmages into a Bit stream. A MPEG Video starts with arbitrary number of bytes, followed by a sequence header, followed by zero, one or more alternating sequence of GOP (Group of Pictures) header and GOPs, followed by a sequence end marker. A GOP is an series of pictures (frames) each of which consists of a picture header and the actual picture data. A picture can be of type I (intracoded), P (predicted) or B (bidirectional-predicted). Each GOP must have at least one I frame. MPEG provides abstraction for each of these headers: Mpeg Sequence Header, Mpeg GOP Header and Mpeg Picture Header. Each header type supports the following basic primitives: find, dump, skip, parse, encode,

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3)

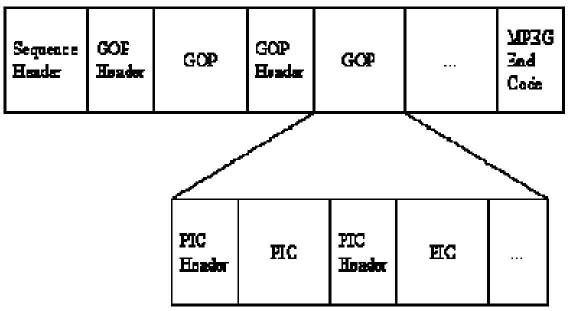

FIGURE 1: MPEG VIDEO FORMAT

TOOLS

MATLAB(matrix laboratory) is a numerical computing environment and fourth-generation programming language. Developed by Math Works corporation, MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including C, C++, Java, and Fortran. Although MATLAB is intended primarily for numerical computing, allowing access to symbolic computing capabilities. In the later paragraph we will discuss some of the MATLAB functions that are used to process a mpeg video. MMREADER constructs a multimedia reader object, object that can read video data from a multimedia file. Filename is a string specifying the name of a multimedia file. There are no restrictions on file extensions. mmreader supports different file formats that are avi, mpg, mpeg, wmv, etc. Its syntax is “obj= mmreader (path)”. obj = mmreader(path) constructs a multimedia reader object, obj, that can read video data from a multimedia file. Filename is a string specifying the name of a multimedia file. MMREADER supports the following properties of the video Duration, Name, Type, Bits Per Pixel, Frame Rate, Height, Width, Number Of Frames. READ reads video frame data from multimedia reader object. Its syntax is “video = read (obj, index)”. Video = read (obj, index) reads in video frame as specified by the index from the associated file. Video is an H-by-W-by-B-by-F matrix where H is the image frame height, W is the image frame width, B is the number of bands in the image (e.g., 3 for RGB), and F is the number of frames read in. The default behavior is to read in all frames unless an index is specified. The type of data returned is always UINT8 data representing RGB24 video frames. MOVIE Plays a recorded movie frames. Its syntax is “movie (M,n,fps)”. movie(M,n,fps) plays the movie at fps frames per second. The default is 12 frames per second. Computers that cannot achieve the specified speed play as fast as possible. In this paper we have used a built in function “mpgwrite” which was developed by Stephen Bond [6]. All the movie struct after being read and played have been written back into mpeg format using the inbuilt function. Its syntax is mpgwrite (M, map, 'filename', options). Where M: movie struct to be used.map: colormap to be used and filename: filename with which the file to be written.

EXPERIMENTAL ANALYSIS

In our project we have under gone through various video processing using Matlab tools such as playing in forward mode, playing in reverse mode, joining of two videos, video clipper, playing videos at different Frame Rate. Initially we have used the MMREADER function that construct a multimedia reader object which supports the properties such as number of frames, frame rate, height, width of video, video format, bits per pixel and duration. These properties are stored frame by frame in the fields of structure array. Now for a particular duration some video frames are stored in the array which represent clipping. With the help of READ function these array can be read frame by frame in forward mode or in a reverse mode. Joining of two video is done by starting the second video frames just after the position where the first video frames ends with a same frame rate. Then playing these video frames using MOVIE function which has the frame rate as an argument and hence the videos can be played at different frame rates.

Figure 2 : At t=2sec

Figure 3: At t=3 sec

Figure 2 and Figure 3 showing in forward direction

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Figure 4: At t=4 sec

Figure 5 : At t=6 sec

Figure 4 and Figure 5 showing in reverse direction

Figure 6 : At t=14 sec/15 sec

Figure 7: At t=12 sec/16 sec

Figure 8: at t=14 sec/33 sec

Figure 9: At t=28 sec/33 sec

Figure 6, Figure 7, Figure 8 and Figure 9 showing the clips of before and after joining two video

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