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Digital Video Coding Principles, Standards and Techniques : A Review

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ABSTRACT

Uncompressed digital video needed high storage and bandwidth. Video coding is thus necessary for increasing bandwidth and storage space capacities. In the recent past a plenty of years video coding techniques and standards were developed to provide significant data compression. This paper provides the useful information on digital video coding principles, methods, protocols and techniques used in various research fields and real time applications. This review is also focused on satisfying the users by providing the various standards information's on digital video coding.

Keywords : Video Coding, MPEG, H.261, DVD, SDTV, NTSC, HDTV

I. INTRODUCTION

Video is a set of serial images developed electronically into an analogy or digital format and exhibited on a screen with enough speed as to make the illusion of motion and continuity. Video is generally synchronised with the audio tools that are proportional to the pictures or images which is to be displayed on the screen [1]. As we enter into the new millennium, video has been more and more an inseparable element in our society. People are accustomed to video applications that did not even exist merely a decade ago. Just to name a few, the digital versatile disk (DVD), digital video camcorder, and video on demand are common applications used by most consumers. Many more new video applications and devices are emerging and evolving. Advances in software and hardware, as well as standardization actions and research in industry and academia, are making it much easier and affordable to capture, store and transmit video signals. The digital signal from the video camera for an hour occupies approximately 97 GB of disk space. Storing, processing and transmitting such a huge volume of data is tedious and very complicated. To solve this problem, researchers have developed different video compression methods for reducing the size of the digital data.

II. METHODS AND MATERIAL

DIGITAL VIDEO

The motion picture experience works on the phenomenon of resolution of visualization of the human eye. A series of still photographs, when shown to a viewer at a sufficiently high frequency (15-60 frames/second), gives semblance of watching a real movement. Thus, thousands of frames are needed even for a short video clip. Video data in raw format needs an enormous amount of storage. Digital video is an arranged set of serial images. Each image is a two dimensional frame of picture elements usually mentioned as pixels. Each pixel is a combination of two values, luminance (luma) and chrominance (chroma). Pixel intensity is denoted as luminance. Pixel colour is denoted as chrominance.

The value of continuous range from an input signal is classified as a non-overlapping discrete range forms the process of quantization. Every range is given a different symbol. In each digital video signal, the number of bits used to prefect the unique symbols is known as the pixel depth. A number of variables that listed below characterized the digital video.

A. Frame Rate

Frame rate is defined as number of frames produced on the screen or display per second. When the frame rate reduced to less than 12 frames/second, the illusion of motion will be perceived. The frame rate of modern cinema is 24 frames/second. Phase Alternating Line (PAL) television uses 25 frames/second, and high-end high-definition television (HDTV) systems use 50 or 60 frames per second. Digital cameras capture video data at 30 frames/second.

B. Frame Dimensions

The variable frame dimension deals with the distance across elevation of the image projected in quantity of pixels. Digital video associated to television needs the dimensions about 640 x 480 pixels, National Television System Committee (NTSC), Standard Definition Television (SDTV). It requires 720 x 480 pixels dimension, and HDTV 1080p requires dimensions about 1920 x 1080 pixels.

C. Pixel Depth

The number of bits in a pixel is denoted as pixel depth. Typically 16 or 24 bits are used per pixel.

THE COLOR REPRESENTATION OF DIGITAL VIDEO SIGNALS - RGB COLOR MODEL

The pixel value can be represented in RGB, where three numerical values give the mixture of RGB elements of the colour. In computer graphics the RGB colour space is utilized broadly. Red, green and blue are three basic linear colours (to make an expected colour the individual elements are mixed together) and as represented in the figure.1 by 3D and Cartesian co-ordinate system. The most common choice for computer graphics is the RGB colour space due to the utilization of RGB in colour displays to make the expected colours [7].

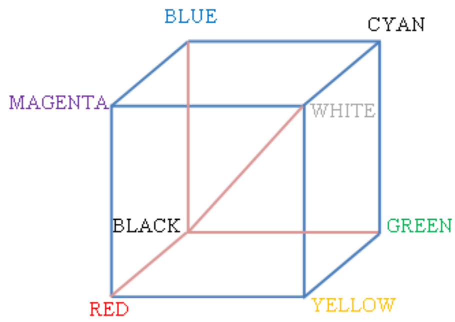

Figure 1. RGB Colour Cube

A. YCbCr Colour Model

The YCbCr [7] colour space was originated as a constituent of International Telecommunication Union Radio Communication sector BT.601 was occurred in the developing period of a worldwide digital video standard. In the YCbCr format and its variations (sometimes called as YUV), luminance is given by the Y component and chrominance of the pixel is represented by the colour difference components, Cb and Cr. The YCbCr colour space is lightly enclosed in opening phase of the YUV colour space. That minimal 8 bit range of 16 and 235; C_b and C_r is defined to have a minimal series between 16 and 240 at Y component. [17].

THE NEED FOR DIGITAL VIDEO CODING

Digital videos are utilized in the broad range of applications such as DVD, video telephony, SDTV, HDTV and teleconference etc. [9] That standard definition of Television pictures dimensions of 720 x 480 and has the edge rate of 30 frames of a second, in that DVD sequence. It required 3 bytes per pixel and the size of each frame is 720 x 480 x 3 bytes. When the picture is explored for Red, Green and Blue, For

storing one second of video, the disk space required is 31.1 MB (720 x 480 x 3 x 30) and one hour is 112 GB[18]. For transmit the data over wired or non-wired medium or channels the total frequency / bandwidth requiredare249 Mbps (31.1 x 8). Using uncompressed video required high storage and bandwidth, it will add extensive expenditures to the hardware and tools that process the digital video. Consequently the video coding is essential for expanding data transfer capacity and capacity limits. Over the most recent couple of years various video coding methods and measures have been made, that abuse the natural repetition in still pictures and moving video arrangement to give adequate information pressure. In view of a lot of standards video coding procedures and benchmarks are created to lessen the redundancy in digital video.
Still image coding and motion video coding are the two main categories of image coding. Still image coding takes into account the spatial redundancy within the images (intra-frame). Motion video coding exploits the temporal as well as spatial redundancy (inter-frame). Several kinds of video and audio compression formats, codecs are MPEG-1, MPEG-2, MPEG-4, H.261, H.263 and H.264 [2, 8]. Different methods are utilized in different video coding standards for reducing data, and hence, results differ in bit rate, quality and latency.

Hence, all the video information is stored and delivered in a compressed form and is decompressed at the time of playback. Neighbouring frames are very similar to each other. They typically differ only by small movements of objects observed in a fraction of a second. Hence, a very good compression can be achieved by eliminating redundancy between the neighbouring frames.

The motion estimation process detects the movements of small regions of each frame and calculates motion vectors from one frame to another and uses that information to eliminate redundancy. During the process of motion estimation, a frame to be compressed and a reference frame are spitted into many non-overlapping sections called microblocks. Every microblock from the frame to be compressed is then compared against microblocks in the reference frame to identify the finest matching microblock in the reference frame. The process of computing for motion estimation has several simple arithmetic operations, like addition, subtraction, and absolute value calculation on integer data, to calculate the Sum of the Absolute Differences (SAD) between the pixels of current frame microblock and the reference frame microblock. Coding redundancy, Interpixel (spatial) redundancy and Psychovisual redundancy are the types of redundancies in image coding.

A. Coding Redundancy

More symbols are used than the necessities to represent them, to encode the video data and so the video data is considered to have coding redundancy [9]. The number of bits which is used to represent grey level values determines the coding redundancy. Coding redundancy is the result of natural binary coding of the grey levels assigned to same number of bits belong to the same number, both the highest and lowest possible values. Coding redundancy which leads to higher data compression will be removed by assigning less number of bits to the most possible values than to the less possible values. This practice is called variable length coding. The average number of bits needed to prefect each pixel is defined in Equation (1) [9]. Huffman and the arithmetic coding technique typically stand for image coding schemes which discover coding redundancy.

$$L_{avg} = \sum_{k=1}^{L=1} l(rk) p_r(r_k) \tag{1}$$

Where $l(r_k)$ denotes the number of bits needed to symbolize the pixel intensity r_k and $p_r(r_k)$ denotes the probability of the pixel intensity r_k in the image.

B. Interpixel Redundancy

Interpixel redundancy is seldom mentioned as spatial redundancy, inter-frame redundancy or even as geometric redundancy. It makes the most of the fact that an image carries strongly correlated pixels rather frequently. In other terms, large regions which possess the same pixel values are the same or nearly the same. Investigation of this redundancy can be in several ways. One of the ways is predicting a pixel value based on the value of its adjacent pixels. To implement this way, the original 2-D array of pixels is generally mapped into a dissimilar format, (an array of diversity between adjacent pixels). The map is believed to be reversible if the original image pixels are able to be reconstructed.

C. Psychovisual Redundancy

For the quality of image perception some information are comparatively less significant. This information is mentioned to be psycho visually redundant. The psychovisual redundancy is interconnected with the real/ quantifiable visual information thus it differs from the coding and interpixel redundancies. Quantitative information loss is the result of its elimination. But the loss is insignificant psychovisually. Removing this sort of redundancy will be resulted in loss and the lost information cannot be recovered. Quantization is the method used to remove this type of redundancy. It means the mapping of a wide range of input values to a narrow number of output values.

WORKING PRINCIPLES OF DIGITAL VIDEO CODING

Video coding is the process of reducing and removing redundant video data to send and store a digital video file effectively. To create a compressed file which is ready to be transmitted or stored, the process of applying an algorithm to the source video is employed. To play the compressed file, a video that displays virtually the same content as the original source video would be produced by applying an inverse algorithm. Latency is used to denote the time it takes to compress, send, decompress and display a file. Video codecs (encoder/decoder) is a pair of algorithms that works together [19]. Video codecs may implement different standards and they are normally not compatible with each other. For example H.264 encoder and an MPEG-4 Part 2 decoder will not work mutually. An algorithm is not able to decode the output from another algorithm accurately. But it is feasible to apply many a variety of algorithms in the same software or hardware and that would be enabling multiple formats to be compressed.

The designer of an encoder is able to opt to employ diverse sets of tools that are defined by a standard, so that the results from encoders using the same compression standard also may differ. Producing diverse implementations are possible till the output of an encoder conforms to the format and decoder of a standard. Different implementations are meritorious due to its different goals and budget. Professional non-real- time software encoders for mastering optical media should possess the choice of being able to convey better encoded video than a real-time hardware encoder for videoconferencing that is incorporated in a hand-held device. Thus a given standard cannot assure a given bit rate or quality. In addition to it, the performance of one standard cannot be accurately compared with another standard, or even with the other implementations of the same standard, without defining how the implementation was.

Restoring every bit of a compressed video by a decompression algorithm is precisely specified by a standard. Due to it, unlike an encoder, a decoder should apply all the required parts of a standard in order to decode a compliant bit steam.

VIDEO CODING STANDARDS

The International Telecommunications Union (ITU) has launched quite a few standards targeted at coding video for real time applications, like video conferencing [4, 10, 11]. The brief notes on video coding standards are given below.

A. MPEG-X family of Video Coding Standards

The MPEG [6, 13] is a working group of ISO/IEC stimulating with the progress of video and audio encoding standards. In 1988 MPEG committee started its actions. Each coding standard was developed with a definite application and bit rate in mind, even though MPEG coding scales fine with increased bit rates. MPEG is adequate for all the main TV standards, as well as NTSC and HDTV.

1) MPEG-1: MPEG – 1 video coding was principally developed to make use in the video CD which is the predecessor of the DVD. In 1991 MPEG-1[23,26] was finalized. It was in the beginning optimized to work with video resolutions of 352 x 240 pixels at 30 frames/second(NTSC based) and 352x288 pixels at 25 frames/second (PAL based) which is generally referred to as Source Input Format (SIF) video. DCT and inter-frame motion compensation based algorithm is used in MPEG-1.

2)MPEG-2: Compression, audio compression, multiplexing as well as a range of other related functions are defined by a series of standards known as MPEG-2 [3, 21, 24, 25]. The ITU-T and the ISO/IEC in cooperation with one another developed a joint standard MPEG-2 video. It is a collaborate publication launched as ISO/IEC 3818–2 and as ITU–T Rec. H.262. In 1994 the MPEG-2 was finalized. It addressed issues straightforwardly in connection with digital television broadcasting, similar to the efficient coding of field-interlaced video and scalability. Potentially very high quality video was the result of the raise in the target bit rate between 4 and 9 Mb/Sec. profiles and levels are the constituents of MPEG-2. The bit stream scalability and the colour space resolution are defined by profile and also the image resolution and the maximum bit rate per profile are defined by level.

3)MPEG-3: MPEG-3 is a design developed to handle HDTV signals at 1080p between the range of 20 and 40 Mb/Sec. work on MPEG-2 was unearthed underway. So the effort to address the need of an HDTV standard was required, and MPEG-3 was launched. But in the recent future it was found that MPEG-2 would also accommodate HDTV at high data rates. Consequently HDTV was integrated as a separate profile in the MPEG-2 standard and MPEG-3 was rolled into MPEG-2 , in 1992.

4) MPEG-4:MPEG-4 has appeared into sight as a standard ahead of a video and audio compression and decompression standard. The MPEG [14] committee while designing the MPEG-4, strived to launch it as a single standard which can cover the entire digital media workflow from capture, authoring and editing to encoding, distribution, and playback and archiving.

It carries all types of items known as “media objects” ahead of audio and video. Text, still images, graphic animation, buttons and Web links can be categorized under media objects. Polished interactive presentations are the outcome of the collaboration of the media objects. MPEG-4 standard aimed to solve two video transport problems, low bandwidth channels are used for sending videos such as the internet and video cell phones, and attain improved compression than MPEG-2. Bit rates used in MPEG-4 are 64 Kbits/s to 1,800 Mbits/s.

B. H.26x family of Video Coding Standards

The Video Coding Engineering Group (VCEG) has standardized the subsequent video coding formats [8, 9, 27].

1) H.120: The first digital video coding technology standard H.120 is recommended by ITU in 1984. Differential Pulse Code Modulation (DPCM), scalar quantization and variable-length coding techniques are used to broadcast NTSC/PAL videos over dedicated point-to-point data transportation lines in H.120.

Video conferencing is the targeted application of all ITU H.xxx standards.

2) H.261: The first realistic digital movement video coding standard was H.261 [27, 28]. In the year 1990, H.261 movement video coding algorithm was urbanized to give video conferencing through ISDN telecommunications networks at a regular data rates from 56 Kbps to 2 Mbps. Common Interchange Format (CIF - 352 x 288 pixels) and Quarter Common Interchange are the two supporting resolutions of H.261 and it use the 4:2:0 YC_bC_r Chroma sampling scheme.

3) H.262: ITU-T Video Coding Experts Group (VCEG) and ISO/IEC Moving Picture Experts Group (MPEG) were collectively built a digital video compression and encoding called H.262 or MPEG-2 Part 2 [27].

4) H.263: H.263 was developed by ITU-T Video Coding Experts Group (VCEG) with low-bitrate compressed format for videoconferencing [27]. H.263 video coding algorithm is identical to H.261 with several enhancements and modifies to get better performance and error recovery. The first version of H.263 was produced in the year 1995 and gives the appropriate substitute of H.261 at all bit rates and framed the basic work for MPEG-4 and H.264. QCIF, CIF, SQCIF, 4CIF, 16CIF resolutions were supported in H.263.

5) H.263v2: The second edition of the H.263 international video coding standard is informally known as H.263+ or 1998 version of H.263 [20, 22]. It enlarges H.263 possibilities by including various additions that considerably advance encoding viability and offer different possibilities like upgraded power against information misfortune in the transmission channel other than the whole specialized substance of the first form of the standard. The late 1997 or the mid 1998 was set apart as the fulfilment time of the H.263+ undertaking and it was trailed by a marginally improved H.263++ venture in late 2000.

6) H.264/AVC: The H.264 [1, 2, 10, 12, 15, and 16] video coding standard is known in other terms as MPEG-4 Part 10 or AVC. Preceding compression algorithms were improved considerably. As an example, H.264 is able to provide the similar video quality as MPEG-2 at about one-half the data rate. In 2001 a JVT consists of experts from ITU-T, Video Coding Experts Group (VCEG) and ISO/ IEC's Moving Picture Experts Group (MPEG) was started off and the H.264 was the product of the JVT. In the technical facet, both the ITU-T H.264 and the ISO/IEC MPEG Part 10 standards are identical. May 2003 was the completion period of the final drafting of the first version of the standard. H.264 [3, 4] is flexible to support an ample application range with extremely varied bit rate necessitates. As an example we can state that in entertainment video applications including broadcast, satellite, cable and DVD. H.264 will be capable of providing a simulation of among 1 and 10 Mbit/s with maximum latency, although for telecom services. H.264 is able to provide bit rates of less than 1 Mbit/s by minimum latency.

7) H.265: The first edition of the High Efficiency Video Coding (HEVC) [8] was concluded in January 2013. HEVC possesses approximately double compression capability of its H.264/MPEG-4 AVC predecessor. It was similarly developed with MPEG in a collaborative team known as Joint Collaborative Team on Video Coding (JCT-VC). It is standardized as ISO/IEC 23008-2 (MPEG-H Part-2).

III. RESULTS AND DISCUSSION

VIDEO CODING TECHNOLOGIES

Video coding technologies can be divided into two groups namely, Interframe Video Coding and Intraframe Video Coding [5].

A. Interframe Video Coding

A video scene which is captured as a succession of frames can be proficiently coded by estimating and compensating for motion between frames prior to generating interframe difference signal for coding [6]. In most video coders motion remuneration is used as a key part. Comprehension of the fundamental ideas in this preparing step is helpful. For preparing each structure of video is unvaryingly separated into littler units known Macroblocks (MBs). Every MB is a blend of a 16 x 16 square of luma and comparing chroma blocks.

Figure 2 illustrates the working pattern of motion estimator. Every block of pixels (16 x 16 luma block of a MB) in the current frame is compared with a set of candidate blocks of similar size in the preceding frame to decide the one that best guesses the current block. The set of blocks comprises those within a search region in preceding frame centered on the location of current block in the current frame. During the finding of the best matching block, a motion vector is determined, that states the reference block.

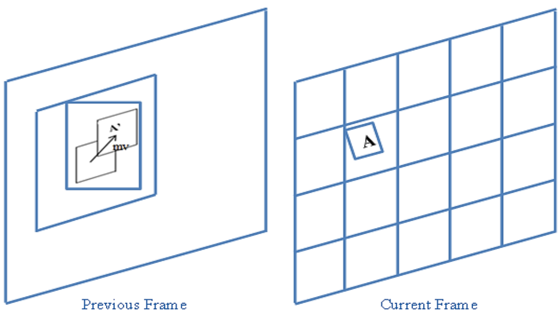

Figure 2. Motion compensation of interframe blocks

Figure 3 shows the block diagram of a motion compensated encoder and figure 4 displays decoder for interframe coding. Combining transform coding (in the form of Discrete Cosine Transform-DCT of 8 x 8 pixel blocks) with predictive coding (in the form of differential Pulse Code Modulation-PCM)) is the chief idea in order to lessen storage and computation of the compressed image, and simultaneously to give a towering degree of compression and adaptability. de.

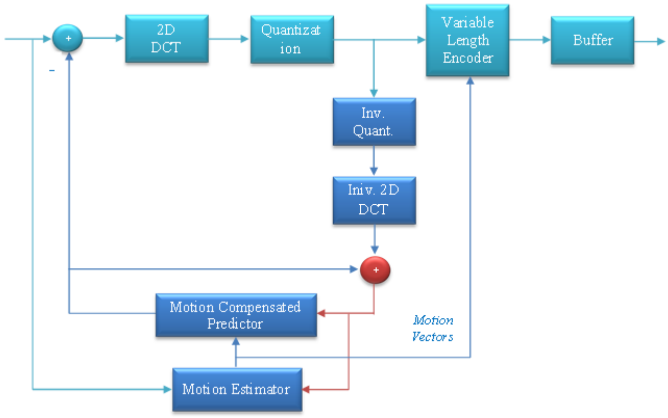

Figure 3. Motion compensated Encoder for inter-frame coding

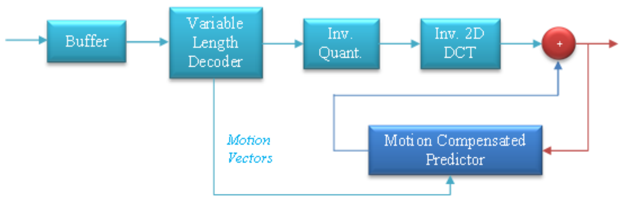

Figure 4. Motion compensated Decoder for inter-frame coding

As motion compensation is hard to perform in the transform domain, the primary step in the interframe coder is to generate a motion compensated prediction error in the pixel domain. For every block of current frame, a prediction block in the reference frame is found using motion vector during motion estimation, and differenced to produce prediction error signal. A sole frame store in the encoder and decoder is required by this computation. Using 2D DCT the resulting error signal is transformed, quantized by an adaptive quantizer, entropy encoded using a Variable Length Coder (VLC) and buffered for transmission over a fixed rate channel.

B. Intraframe Coding

The expression interframe coding [6, 18] denotes the verity that the a variety of lossless and lossy compression techniques are carried out in connection with information that is contained only within the current frame and not connected to any other frame in the video sequence. In further lexis, no temporal processing is carried out exterior to the current picture or frame.

IV.CONCLUSION

This research paper focused on the fundamentals of digital video coding like Colour Representation of Digital Video Signals, video coding principles, video coding standards and video coding technologies which would be very useful.

V. REFERENCES

[1]. L. C. Manikandan, S.Anu H.Nair, K.P.SanalKumar, and R.K.Selvakumar. 2017. “A study and analysis on block matching algorithms for motion estimation in video coding,” Cluster Computing © Springer Science+Business Media, LLC, part of Springer Nature. (2017)

[2]. L.C.Manikandan, and R.K.Selvakumar. 2014. “A new review on H.264 video coding standard,” Int. J. Sci. Res. 3(9), 139–141. (2014)

[3]. L.C.Manikandan, and R.K.Selvakumar. 2014. “Video coding based on H.264 interframe predictions using fibonacci spiral blockmatching algorithm with DCT,”. Int. J. Appl. Eng. Res. 9(22), 16445–16454. (2014).

[4]. Iain E. G. Richardson. 2013. “H.264 and MPEG-4 Video Compression,” John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England, ISBN 0-470-84837-5. (2013)

[5]. RajeshwarDass, and Lalit Singh, SandeepKaushik. 2012. “Video Compression Technique,” International Journal of Scientific & Technology Research, Vol 1, Issue 10, pp. 114-119. (November 2012)

[6]. L.Chiariglione (ed.). 2012. “The MPEG Representation of Digital Media,” ©Springer Science + Business Media, LLC. (2012)

[7]. Prathibha. E, Dr.SivaYellampalli and A. Manjunath. 2011. “Design and Implementation of Colour Conversion Module RGB to YCbCr and Vice Versa,” International Journal of Computer Science Issues, Special Issue, ICVCI-2011, Vol. 1, Issue 1, pp 13-18. (November 2011)

[8]. S.Vetrivelet. Al. 2010. “An Overview of H.26x Series and its Applications,” International Journal of Engineering Science and Technology, Vol. 2(9), pp 4622-4631. (2010)

[9]. Verbist.F, Munteanu.A, Cornelis.J, and Schelkens.P. 2008. “Intra-frame video coding using an open-loop predictive coding approach,” IEEE Workshop on Multimedia Signal Processing, pp 273-277. (2008)

[10]. H.Kalva. 2006. “The H.264 video coding standard,” MultiMedia, IEEE. (2006)

[11]. Khalid Sayood. 2005. “Introduction to Data Compression,” Second Edition, ELSEVIER, ISBN-10:81-8147-191-1. (2005)

[12]. G.J.Sullivan, and T.Wiegand. January 2005. “Video compression from concepts to the H.264/AVC standard,” Proceedings of the IEEE, Vol. 93, No. 1. (January 2005).

[13]. John Watkinson. 2004. “The MPEG Handbook,” 2nd Edition, Chapter 5, Elsevier Ltd., pp. 230-352. (2004).

[14]. E.Richardson. 2004. “H. 264 and MPEG-4 video compression: video coding for next-generation multimedia,” Wiley.com. (2004).

[15]. ITU-T and ISO/IEC. 2003. "Advanced Video Coding for Generic Audiovisual Services," H.264, MPEG, 14496-10. (2003).

[16]. Joint Video Team of ITU-T and ISO/IEC JTC 1. 2003. “Draft ITUT Recommendation and Final Draft International Standard of Joint Video Specification (ITU-T Rec. H.264 | ISO/IEC 14496-10 AVC),” Joint Video Team (JVT) of ISO/IEC MPEG and ITU-T VCEG, JVT-G050. (Mar. 2003).

[17]. R.L.Hsu, M.Abdel-Mottaleb and A.K.Jain. May 2002. “Face Detection in Color Images,” IEEE

Trans. Pattern Analysis and Machine Intelligence, Vol. 24, No. 5, pp. 696-707, (May 2002).

[18]. Morris.T, and Britch.D. 2000. “Biorthogonal wavelets for intra-frame video coding,” International Workshop on Image and Signal Processing and Analysis, pp 209-214. (2000).

[19]. Iain Richardson. 2007. “An overview of H.264 Advanced Video Coding,” Vcodex White Paper. (2007).

[20]. G.Cote, B.Erol, M.Gallant and F.Kossentini. 1998. “H. 263+ Video coding at low bit rates,” Circuits and Systems for Video Technology,” IEEE Transactions on. (1998).

[21]. B.G.Haskell. 1997. “Digital video: an introduction to MPEG-2,” Springer. (1997).

[22]. Cote.G,Erol.B,Gallant.M., and Kossetini.F. 1997. “H.263+ Video Coding at Low Bit Rates,” Vancouver: University of Bri-tish Columbia. (1997).

[23]. W.B.Pannebaker, D.J Le Gall, and W.B.Pennebaker. 1995. “MPEG1: Video compression standard,” . (1995).

[24]. ISO/IEC 13818-2 I ITU-T H.262 (MPEG-2 Video). 1995. “Information technology-Generic coding of moving pictures and associated audio information: Video,”. (1995).

[25]. MPEG-2. 1994. “Information technology-generic coding of moving pictures and associated audio,” Tech. Rep., ISO/IEC 13818-2, Committee Draft. (March 1994).

[26]. ISO/IEC 11 172-2 (MPEG-1 Video). 1993. “Information technology Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbit/s: Video,” . (1993).

[27]. Marco Jacobs and Jonah Probell. 2009. “A Brief History of Video Coding,” ARC International. (January 2009).

[28]. CCITT SGXV. June 1989. “Description of reference model 8 (RM8),” Document 525, Working Party XV/4, Specialists Group on Coding for Visual Telephony, (June 1989).

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