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A Review on Different Video Coding Standards

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Abstract- Social and network computing demands effective, offering and sparing of image data, which has dependably been an incredible test. Individuals are imparting, transmitting and putting away a great many images every moment. Video coding is a process of compressing and decompressing a digital video signal. The transmission of large size video is facing limitation due to the limited bandwidth and storage capacity. The solution for this is the video compression. In video coding for compression, the basic idea is to exploit redundant data. High Efficiency Video Coding (HEVC) is currently being prepared as the newest video coding standard of the ITU-T Video Coding Experts Group and the ISO/IEC Moving Picture Experts Group. The fundamental goal of the HEVC standardization effort is to enable significantly improved compression performance relative to existing standards. Thus, this paper reviews various standards and techniques and highlight the need for compression.

Keywords- *Advanced video coding (AVC), H.264, High Efficiency Video Coding (HEVC), Joint Collaborative Team on Video Coding (JCT-VC), Moving Picture Experts Group (MPEG).*

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I. Introduction

The use of video data in our daily life is increasing day by day. Video Coding is an important function of Recording Video and TV signals onto a Computer Hard Drive. since raw Video footage obliges bunches of space, without Video Coding, Video records would rapidly gobble up gigabytes of hard commute space, which would bring about just short measures of Video or TV recorded onto the Computer's Hard Drive[1]. With Video Coding, smaller Video files can be put away on your PCs Hard Drive, bringing about significantly more space for Video documents. There are several kinds of video and audio coding formats, also known as codecs. Familiar coding formats are MPEG-1, MPEG-2, MPEG-4, H.261, H.263 and H.264/AVC. The transmission of large size video is facing limitation due to the limited bandwidth and storage capacity. The solution for this is the video compression. In video coding for compression, the basic idea is to exploit redundant data[1]. There are two types of redundancies in a moving picture (temporal redundancy and spatial redundancy). In a single frame, nearby pixels are often correlated with each other. This is called spatial redundancy, or the intra frame correlation. Another one is temporal redundancy, which means adjacent frames are highly correlated, or called the inter frame correlation. Therefore, our goal is to efficiently reduce spatial and temporal redundancy to achieve video compression[2].

New applications in the field of communication, multimedia, and digital television broadcasting [1] require highly efficient, robust and flexible digital video compression and encoding techniques[2]. Multimedia applications range for example from desktop videoconferencing and computer-supported cooperative work to interactive entertainment networks where video-on-demand, video games, and teleshopping are provided. The combination of motion video as an indispensable part of multimedia environments is innovatively a standout amongst the most requesting undertakings, because of the high information rates and continuous limitations. Agreeing to the importance of the problem, there is a significant amount of ongoing research in the area of video compression. In a parallel effort, international standardization organizations are actively developing standards for video compression, which facilitate interoperability among different video systems and motivate the development and production of VLSI systems and devices in addition to software solutions. Since standards reflect the state of the art, they serve as references on developing compatible extensions and novel algorithms[3].

II. Need for Compression

Digital video has gotten to be standard and is being utilized as a part of an extensive variety of uses including DVD, digital TV, HDTV, video telephony, and teleconferencing. These advanced video applications are achievable in view of the advances in processing and communication innovations and additionally proficient video compression algorithms. The fast arrangement and reception of these innovations was conceivable essentially due to standardization and the economies of scale brought about by rivalry and standardization[4]. The majority of the video compression

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measures are taking into account a situated of standards that reduce the redundancy in digital video. Digital video basically an arrangement of pictures displayed overtime. Each picture of a digital video sequence is a 2D projection of the 3D world.

To deliver video over wired and/or wireless networks, bandwidth requirement is very high. In addition to these extremely high storage and bandwidth requirements, using uncompressed video will add significant cost to the hardware and systems that process digital video. Digital video compression is thus necessary even with exponentially increasing bandwidth and storage capacities.

Fortunately, digital video has significant redundancies and eliminating or reducing those redundancies results in compression. Video compression can be lossy or loss less[5]. Loss less video compression reproduces identical video after de-compression. Video compression is typically achieved by exploiting four types of redundancies: 1) perceptual, 2) temporal, 3) spatial, and 4) statistical redundancies.

III. Video Coding

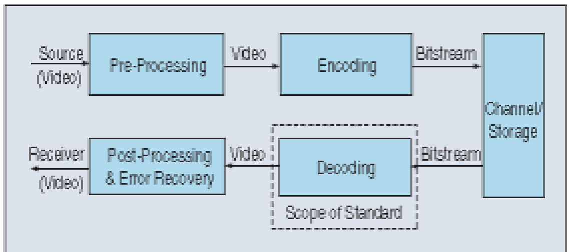

Figure 1. Scope of video coding standardization: Only the syntax and semantics of the bitstream and its decoding are defined.

In fig. 1, the sender might choose to pre-process the video using format conversion or enhancement techniques. Then the encoder encodes the video and represents the video as a bit stream. After transmission of the bit stream over a communications network, the decoder decodes the video which gets displayed after an optional post-processing step which might include format conversion, filtering to suppress coding artifacts, error concealment, or video enhancement. The standard defines the syntax and semantics of the bit stream as well as the processing that the decoder needs to perform when decoding the bit stream into video. Therefore, manufactures of video decoders can only compete in areas like cost and hardware requirements[6]. Optional post-processing of the decoded video is another area where different manufactures will provide competing tools to create a decoded video stream optimized for the targeted application. The standard does not define how encoding or other video pre-processing is performed thus enabling manufactures to compete with their encoders in areas like cost, coding efficiency, error resilience and error recovery, or hardware requirements. At the same time, the standardization of the bit stream and the decoder preserves the fundamental requirement for any communications standard—interoperability. For efficient transmission in different environments not only coding efficiency is relevant, but also the seamless and easy integration of the coded video into all current and future protocol and network architectures. This includes the public Internet with best effort delivery, as well as wireless networks expected to be a major application for the new video coding standard. The best quality of MVC is that it have high degree of temporal statistical correlations between temporally succeeding images.

S. No	Standardization Period	Organization	Standards	Applications
1	1984 – 1990	ITU-T	H.261	Video Conferencing
2	1988 –1993	MPEG	MPEG-1	CD-ROM
3	1990-1994	JVT	H.262/MPEG-2	DVD, Digital Terrestrial TV, Satellite
4	1993-1995	ITU-T	H.263	Video Conferencing, Surveillance
5	1993-2000	MPEG	MPEG-4	Surveillance, DVD, Digital Still Cameras, Digital Video Camcorders and Cellular Media.
6	1995-1998	ITU-T	H.263+	---
7	1998-2001	ITU-T	H.263++	---
8	1997-2003	JVT	H.264/MPEG-4 AVC	Surveillance, Video conferencing, DVD, Satellite, DSL-based Video On Demand, Digital Still Cameras, and Cellular Media.
9	2013	JVT	HEVC(High Efficiency Video Coding)/ H.265	Mobile, HDTV, Surveillance, Videoconferencing, DVD, Satellite, DSL-based Video On Demand, Digital Still Cameras, and Cellular Media.

IV. Standards

Standards define a common language that different parties can use, so that they can communicate with one another. Standards are thus, a prerequisite to effective communication. Video coding standards define the bitstream syntax, the language that the encoder and the decoder use to communicate[7]. Besides defining the bitstream syntax, video coding standards are also required to be efficient, in that they should support good compression algorithms as well as allow the efficient implementation of the encoder and decoder.

High Efficiency Video Coding (HEVC) is presently being arranged as the newest video coding standard of the ITU-T Video Coding Experts Group and the ISO/IEC Moving Picture Experts Group. The fundamental goal of the HEVC standardization effort is to enable significantly improved compression performance relative to existing standards—in the range of 50% bit-rate reduction for equal perceptual video quality. High Efficiency Video Coding (HEVC) standard is the most recent joint video project of the ITU-T Video Coding Experts Group (VCEG) and the ISO/IEC Moving Picture Experts Group (MPEG) standardization organizations, working together in a partnership known as the Joint Collaborative Team on Video Coding (JCT-VC) [8]. The first edition of the HEVC standard was finalized in January 2013, resulting in an aligned text that was published by both ITU-T and ISO/IEC. Additional work is planned to extend the standard to support several additional application scenarios, including extended-range uses with enhanced precision and color format support, scalable video coding, and 3-D/stereo/multiview video coding. In ISO/IEC, the HEVC standard will become MPEG-H Part 2 (ISO/IEC 23008-2) and in ITU-T it is likely to become ITU-T Recommendation H.265.

Video coding standards have evolved primarily through the development of the well-known ITU-T and ISO/IEC standards. The ITU-T produced H.261 [2] and H.263 [3], ISO/IEC produced MPEG-1 [4] and MPEG-4 Visual [5], and the two organizations jointly produced the H.262/MPEG-2 Video [6] and H.264/MPEG-4 Advanced Video Coding (AVC) [7] standards. The two standards that were jointly produced have had a particularly strong impact and have found their way into a wide variety of products that are increasingly prevalent in our daily lives. Throughout this evolution, continued efforts have been made to maximize compression capability and improve other characteristics such as data loss robustness, while considering the computational resources that were practical for use in products at the time of anticipated deployment of each standard. The major video coding standard directly preceding the HEVC project was H.264/MPEG-4 AVC, which was initially developed in the period between 1999 and 2003, and then was extended in several important ways from 2003–2009. H.264/MPEG-4 AVC has been an enabling technology for digital video in almost every area that was not previously covered by H.262/MPEG-2 Video and has substantially displaced the older standard within its existing application domains. It is widely used for many applications, including broadcast of high definition (HD) TV signals over satellite, cable, and terrestrial transmission systems, video content acquisition and editing systems, camcorders, security applications, Internet and mobile network video, Blu-ray Discs, and real-time conversational applications such as video chat, video conferencing, and telepresence systems. However, an increasing diversity of services, the growing popularity of HD video, and the emergence of beyond- HD
formats (e.g., 4k×2k or 8k×4k resolution) are creating even stronger needs for coding efficiency superior to H.264/ MPEG-4 AVC's capabilities. The need is even stronger when higher resolution is accompanied by stereo or multiview capture and display. Moreover, the traffic caused by video applications targeting mobile devices and tablet PCs, as well as the transmission needs for video-on-demand services, are imposing severe challenges on today's networks. An increased desire for higher quality and resolutions is also arising in mobile applications.

V. Survey of Techniques

There are various compression techniques intended to store graphic images in a much smaller space[9]. Image compression likewise enhances throughput when images files are transmitted with one spot then onto the next. Several compression techniques are examined beneath.

- **DCT (discrete cosine transform) :**
  DCT is a typical compression technique in which information is represented as a progression of cosine waves. On account of video, this procedure replaces nonstop sampling with an equation that represents the data. On account of a still image, 8 × 8 blocks of data are changed over into a wave that depicts the quantity of color shifts and the degree of progress in those color shift.
- **Fractal compression:**
  Today, a great many people are acquainted with fractals and fractal geometry somehow. You have probably seen the "development" of a fractal tree or coastline on a PC screen. Some researcher pondered whether fractal arithmetic could be utilized as a part of the opposite heading to compress an image. Michael Barnsley of Georgia Tech learly tackled this issue, sought a patent, and began Iterated Systems Incorporated in 1987. A few different licenses took after and the organization started showcasing fractal pressure items. The essential thought is to separate a picture into smaller and smaller tiles. The

compression engine (a dedicated board) hunt down coordinating examples in the image utilizing a scientific change that controls tiles in different ways. Dreary examples are spared to remake the first, and unmatched information that is viewed as insignificant is disposed of. All the more as of late, Iterated Systems has incorporated wavelet innovation, examined next, in its most recent items.

- **Wavelet transform:**
  At the point when utilizing a wavelet transform to depict an image, a normal of the coefficients-for this situation, pixels-is taken. At that point the subtle element coefficients are ascertained. An alternate normal is taken, and more detail coefficients are figured. This procedure proceeds until the image is totally depicted or the level of subtle element important to speak to the image is attained to. As more detail coefficients are portrayed, the image becomes clearer and less blocky [10]. Once the wavelet transform is finished, a picture an be shown at any determination by recursively including and subtracting the point of interest coefficients from a lower-resolution variant. This strategy is used by Iterated Systems.

VI. Conclusion

The past decades have seen the growth of wide acceptance of multimedia. Video coding plays an important role in archival of entertainment based video (CD/DVD) as well as real-time reconnaissance / video conferencing applications. Hence, this paper reviews various standards and techniques for video coding. This new international video coding standard has been jointly developed and approved by the MPEG group ISO/IEC and the VCEG group of ITU-T. Compared to previous video coding standards, H.264/AVC provides an improved coding efficiency and a significant improvement in flexibility for effective use over a wide range of networks. Future efforts are intended to be put on the development of an efficient compression algorithm for reducing the drawbacks of existing algorithms and aggregating the advantages of most of the techniques. In future we wish to increase upon the speed and compression ratio. Also to make it more accurate with more moving objects.

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