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A REVIEW ON VIDEO PROCESSING

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ABSTRACT

Video has become a very popular research area in the last decade. In other words, a video is a visual sequence that is represented by a time series of static photos. A good example of digital video is encoded digital data in the form of moving visual images. Digital video standards are required for digital video to be exchanged between products, devices, and applications. Consumer applications for digital video include digital TV broadcasts, DVD video playback, digital cinema, videoconferencing, and video streaming over the Internet. A lot of literature involving video processing is used in this work, and different features such as compression and video enhancement are analyzed. Many issues and obstacles remain about video processing, including security concerns, which are briefly explored in this paper.

Keywords: *Video Processing, Enhancement, Compression, Recognition, Security.*

I. INTRODUCTION

Mechanical television systems were the initial development of video technology, which was quickly overtaken by cathode-ray television systems (CRT). The technology side of video processing expands as new display devices become available. The transmission case provides a good example of the advent of new media, mobile media, and social media, and micro-video as a new kind of network video. Video transmission via various network modes has become quite popular in recent years. It is preferable to use less bandwidth of the medium and less time for transmission purposes. With the rapid speed of growth in the wireless industry in the present period, video communication via video phone, video streaming, and video broadcasting has become increasingly appealing. To send such rich multimedia content while using less bandwidth, the size of the original video signal must be decreased using a compression approach that does not degrade video quality or cause data loss.

Video is a pictorial representation of visual information of any real scene. A video sequence is made up of time varying images and still images. Spatial distributions of still image intensity values are constant with varying time while it is not so where the intensity values of spatial distribution keeps changing with time in time-varying images. The temporary spatial intensity values (model) form a time-varying-image $S_c(x_1, x_2, t)$ where‘t’ is a

temporal variable, x_1 and x_2 are spatial variables. Conventionally, video is recorded, stored and transmitted in analog type format. After a brief description of analog video signals, the digital representation of video and its standards is introduced. The advent of digital videos has spawned a variety of services in communications which require a different type of digital processing of video at different levels.

Video compression techniques give efficient solutions to represent video data more compactly and robustly, allowing storage and transmission to be more efficient. Digital video has become an indispensable component of modern life. Aside from compression, it is commonly known that video enhancement has gotten a lot of attention in recent years as an active area in video processing. The goal is to improve the video's overall interface or to provide a better transform representation. Understanding the source of poor video quality is necessary for video enhancement. The most prevalent cause of erosion is a difficult problem due to a variety of factors such as low contrast, a low signal-to-noise ratio, and so on.

Image and video processing techniques are used to evaluate video sequences in traffic flow, traffic data gathering, and road traffic monitoring. The inductive loop, sonar, and microwave detectors are among the methods available, each with its own set of advantages and disadvantages. Video sensors are a relatively low-cost installation that causes minimal traffic [14] disruption during maintenance. They also manage wide-area monitoring, which includes traffic flow and turning movement analysis, speed measurement, multiple-point vehicle counts, vehicle classification, highway assessment.

A video signal is a series of 2D images collected by a video camera's image plane from a dynamic 3D scene. Essentially, the colour value obtained at every moment in a video frame stores the reflected light at a specific 3D location in the observed scene in a colour scene. It is commonly understood that light is made up of electromagnetic waves with wavelengths ranging from 380nm to 780nm and that the human eye is sensitive. The colour of light is determined by its spectral content, for example, “Red” light has its energy concentrated near 700nm, whereas “White” light has equal energy across the entire visible band. In general, “spectral colour” refers to light with a very narrow bandwidth. Achromatic light, on the other hand, is synonymous with white light. Sunlights, TV monitors, light bulbs, and other illuminating sources emit an electromagnetic wave. The perceived colour of a light source depends on the wavelength range in which the energy is emitted. The Illuminating follows the additive rule: the sensed colour of several mixed illuminating light sources depends on the sum of all the light sources' spectra.

II. LITERATURE REVIEW

V. Kastrinaki et al. proposed using video processing and analysis methods to apply video sensors in traffic management and monitoring. They suggested a review of image processing and analysis tools used in these applications, as well as a comparison of these tools to complete systems for specific traffic applications. It is based on the methodology of automatic lane finding. For their three purposes, there are three solutions. The first is to classify image-processing methods used in traffic applications[14]. Second, provide the benefits and drawbacks of

these algorithms. Third, based on this unified consideration, striving to evaluate deficiencies and general needs in this field of active research.

Alain Traimu and his peers worked on colour image and video processing. They have analyzed issues, controversies, and problems in colour image science in a variety of current scopes such as colour vision, perception, and interpretation, acquisition systems, consumer imaging applications, and medical imaging applications. The study of colour images and the application of scientific methods to their measurement, generation, analysis, and representation can be defined as colour imaging science. It encompasses all aspects of image processing, such as optical image production, sensing, digitalization, electronic protection, encoding, processing, and transmission over communication channels. They provided a comprehensive overview of the most recent techniques for colour image analysis and processing [5].

Yunbo Rao and Leiting Chen [8] discussed video enhancement. Video enhancement, according to them, is the most important and difficult component of video research. The goal of video enhancement is to improve the visual appearance of the video or to provide a better transform representation than before for future automated video processing, such as analysis, recognition, classification., automated traffic control systems, criminal justice systems. They have performed a brief survey of the existing video enhancement techniques, which can be divided into two broad categories: (i) self-enhancement and (ii) frame-based fusion enhancement. Finally, they can describe the benefits and drawbacks of image and video enhancement algorithms. They have discussed recent breakthroughs, video enhancing approaches, and prospective research prospects for future video enhancement research.

S. Ponlatha and R. S. Sabeenian evaluated the various video standards and found that video compression factors are always improving, new techniques and technologies are being developed, and new formats are on the horizon for H.265 and VP8: H.265 compression is still being developed, to achieve a 25% improvement in compression factor while minimizing computational overhead for the same apparent video quality, by 50% VP8 is a codec developed by On2 Technologies, which claims that it uses 40% fewer data and saves 40% on bandwidth compared to H.264. There is now a battle raging between VP8 and H.264 [4] to determine which standard will be used for Web video.

W. Puech et al. discussed robust signal processing and recent cryptographic issues in video processing in a brief manner. They've provided an overview of the methodologies and challenges involved in applying cryptographic primitives to major images and video processing tasks, such as content encryption, secure face recognition, and secure biometrics. Essentially, their research tries to assist the community in better understanding the utility and limitations of cryptographic techniques in image and video processing [9].

III. COMPRESSION TECHNIQUES FOR VIDEO

The phrase "video compression" refers to a technique for minimizing the quantity of data necessary to encode digital video material. For a video clip, this data reduction translates to benefits such as reduced storage requirements and lower transmission bandwidth requirements. Video compression generally means the exclusion of

information that is not considered critical to the viewing of the video content, and an effective video compression codec (format) provides the following benefits: without significantly reducing the visual experience of the video content, post-compression, and without requiring significant hardware overhead to achieve the compression. The most basic kind of video compression is performing two-dimensional image coding on each frame of a video temporal sequence independently. As a method of video compression, the JPEG baseline standard has been widely used. The video compression technology used in this application is known as motion JPEG. Since the early 1990s, the Geneva-based International Standards Organization (ISO) Motion Picture Experts Group (MPEG) has been working on video compression standards. All MPEG standards are founded on a set of principles that have allowed for a lot of innovation while keeping the standard compatible. The MPEG standards only specify the functioning of a reference decoder and the syntax of the bitstream it expects, not the encoders. As better motion compensation search algorithms are created, for example, encoder implementations can improve with time.

3.1 MPEG-1

In terms of functionality, the MPEG-1 video coding standard is universal. About the JPEG and H.261 activities, the MPEG-1 video algorithm has been enhanced. Frame-based random access to video, fast forward or fast reverse searches via compressed bitstreams, reverse streaming of video, and compressed bitstream editability are all important elements of MPEG-1. A Macroblock[2] structure, motion correction, and conditional replenishment of Macroblocks are the fundamentals of MPEG-1 video compression. The MPEG-1 algorithm uses a block-based methodology to process the frames of a video sequence [7]. Although MPEG-1 compresses progressively scanned media (such as film) well, it requires large bit rates (6 Mbps or more) to compress NTSC video. This is due to MPEG-1's lack of support for field-based coding.

3.2 MPEG-2

In 1991, MPEG launches a second phase (MPEG-2) to give a video coding solution for applications, which was previously unavailable in the MPEG-1 standard. MPEG-2 was given the task of implementing video quality that was not less than NTSC/PAL and up to CCIR 601 standard. The MPEG-2 standard has been a huge success. The television and cable businesses, as well as DVD, have all adopted it. MPEG-2 provides a toolbox with a variety of image-processing components; each application makes use of the standard in its way. The higher quality projected to arise from the upcoming MPEG-2 standardisation phase has been seen to aid digital cable TV distribution, networked database services via ATM, digital VTR applications, and satellite and terrestrial digital broadcasting distribution.

3.3 MPEG-4

MPEG-4 was originally intended for very-low-bit-rate coding but was renamed coding of audiovisual contents the following year 1993. MPEG-4 is distinct from previous MPEG standards in that it places a strong emphasis on multimedia and interactivity. Visual scenes are broken down into items and transferred as distinct layers to the decoder, where they are assembled. These include picture mapping onto a computer-generated mesh, it

is feasible to map facial emotions and transfer them separately from a humans image, with the dynamic face being reconstructed at the receiver. Many of the characteristics of MPEG-1 and MPEG-2 are carried over to MPEG-4.

3.4 H.264/AVC

The current H.264/AVC video compression standard is based on picture-by-picture processing and waveform-based coding [11]. The technology now being expressed for the new benchmarking project on high-efficiency video coding (HEVC) is a stereotype of this approach, which allows for significant improvements in intra prediction, larger block sizes, more flexible ways of decomposing blocks for inter and intra coding, and better exploitation of long-term correlations and picture dependencies through modernization. It will support a large number of encoder modes, most of which are optimised using mean squared-related distortion measures.

IV. VIDEO EDITING SOFTWARE APPLICATIONS

At this time, a variety of video-making tools are accessible. Nutshell, Videoshop, iMovie App, iMovie for Macs, Magisto, and Animoto are just a few of them. All of the technologies discussed above operate on different platforms, but their core principles are the same. Animoto saves several camera-captured images in its primary memory and then processes them to add filters and enhancements to create a video. It also provides the ability to add text and sound files to frames as needed during processing. Animoto has superior visuals that outperform any of the preceding technologies. Animoto, like Kizoa, is a cloud-based service that lets users make online slideshows that can be shared through URL or embedded, but it also allows for a low-resolution mp4 download. The main marketing message of Animoto is its ease of use: users upload images, add captions, select music, and choose their effect and transition choices for the program. The resulting presentation is made up of brilliant, advanced graphics, like fluttering butterflies.

V. MAJOR ISSUES AND COMPLICATIONS

5.1 Enhancement Related Difficulties

Enhancement is the process of information extraction to improve their quality. An image may be of poor quality because the contrast is low, the image is noisy, or the image is blurred, among other factors. Many techniques have been proposed to remove the degradation, but no algorithm that does not harm the signal has yet been devised. Noise reduction methods, for example, frequently use local averaging or smoothing, which blurs the edges of the frames. In this area, it must look ahead.

5.2 Compression Related Difficulties

As a result of the current trend, we are dealing with massive amounts of storage and the necessity to properly transport large amounts of data. Motion-compensated prediction, which predicts each frame-block by block from the previous frame, can improve compression performance. The prediction error can be compressed more effectively than the original frame data. We are still lagging in producing satisfactory results in terms of bit rate representation in video conferencing applications, which is a major challenge to deal with.

5.3 Recognition Related Difficulties

An effective recognition system to detect the generic device lying or a person having and acting suspiciously has not yet been devised. There is a lot to deal with in this field.

5.4 Security Related Difficulties

Secure signal processing is a new technology that allows genuine image/video processing to be done securely and privately. Due to the increased desire for beneficial functionalities for individuals' data stored online, it has attracted a lot of study attention. However, treating multimedia as conventional data and encrypting it using cryptographic ciphers like RSA and AES reduces information leakage, making this method ineffective for practical video processing applications. Computationally, cryptographic operations are frequently costly. As a result, making efficient use of cryptographic protocols is critical. Another issue could arise as a result of cryptographic approaches that cause cipher text to expand by two orders of magnitude, such as public-key image pixel encryption. Future research efforts to address the topic of how to correctly define security and the appropriate level of protection for multimedia data will be critical to success in this path.

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