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Theoretical concept of the concept of video and video Stream

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Abstract - *As time progresses, the demand for digital data is increasing. As a graphic engineer, our task is to make a proposal that meets these requirements. We can provide information and data in various forms. The most optimal type is video. This article covers the concept, features, standards, and video quality of video. This article explores the fundamental concepts of video, its key features, industry standards, and factors affecting video quality, such as resolution, compression, and frame rate. Additionally, we discuss various video formats, their advantages, and their applications in different fields, including streaming, broadcasting, and digital marketing. The rapid advancement of video processing technologies, such as artificial intelligence (AI)-powered enhancements, real-time rendering, and high-efficiency codecs, further expands the possibilities of video usage. By understanding these aspects, we can optimize video content to meet diverse needs across different platforms and applications while ensuring high quality and efficiency in data transmission.*

Keywords - video, video stream, interlays, NTSC, PAL, SECAM.

I. INTRODUCTION

Video (from the Latin "video" - I look, I see) - a set of technologies for recording, processing, transmitting, storing, and displaying visual or audiovisual materials, as well as a common name for a video material, television signal, or film. This term also includes materials recorded on physical media (video cassettes, video discs, etc.). Video differs from cinematography only in that it uses media other than film for recording and/or display. However, due to the increasing prevalence of digital technologies and digital film projectors in filmmaking, the boundary between cinema and video is almost disappearing, and traditional cinema is gradually moving to the background.

The number of frames per second (frequency) is the number of fixed images that replace each other in 1 second of the video material and create the effect of object movement on the screen. The higher the frame rate per second, the smoother and more natural the movement will seem. The minimum indicator for which movement is perceived as the same is approximately 16 frames per second (this value is individual for each person). In traditional filmmaking, a frequency of 24 frames per second is used. PAL and SÉCAM television systems use 25 frames per second (25 fps or 25 hertz), while the NTSC system uses 30 frames per second

(more precisely 29.97 fps). High-quality computerized video materials typically use 30 frames per second. The upper threshold frequency of flickering, perceived by the human brain, averages 39-42 hertz and is specific to each person[1]. Some modern professional cameras can shoot at speeds of up to 120 frames per second. For ultra-fast photography, special cameras are used at a frequency of up to 1000 frames per second and higher, which is necessary, for example, for a detailed study of the trajectory of the bullet's flight or the structure of the explosion. High-speed filming equipment can capture several million frames per second. In them, the film is stationary and fixed to the inner surface of the drum, and the image is unfolded by a rotating prism. There is also a frameless video. The operating principle is as follows: photosensitive sensors transmit information about their state at high frequencies, which are recorded in parallel on the carrier.

The propagation (splitting) of the video signal can be progressive (row by row) or interlinear. In a progressive development, all horizontal lines (rows) of the image are shown sequentially. In interlinear expansion, even and odd rows are shown alternately. Together, they form a frame or half-frame space. Interline spacing is often called "interleys" (from the English "interlace") or "interleasing." Interlinear expansion was invented for displaying images on kinescopes. Its purpose is to increase the flickering frequency of the kinescope (monitor) to a level imperceptible to the human eye. Similarly, in film projectors, a two-bladed obturator was used, which increases the flickering frequency on the screen from 24 to 48 Hz. Due to the widespread availability of televisions that only support such standards, linear sweep is still used in standard definition television to this day.

New digital television standards, such as HDTV, imply progressive diffusion. The latest technologies allow for the simulation of progressive expansion when displaying interlinear video. The latter is usually denoted by the "i" symbol after the vertical solution is indicated, for example, 720 × 576i × 50. Progressive unfolding is denoted by a "p" symbol, for example, 720p (meaning a 1280×720 video with progressive unfolding). Also, to distinguish the frequency of frames or fields, frame frequency can be denoted by the same symbols, for example, 24p, 50i, 50p.

Kinescope televisions, equipped with a 100 Hz sweep, flash at a frequency invisible to the eye. In such receivers, the image with interline sweep is displayed in double frames. Liquid crystal and LED monitors (TVs) are completely devoid of flickering. In such devices, it is only possible to talk about the rate of image renewal, therefore, in them, interlinear expansion is only a measure of conditionality and does not affect the image. Special mathematical methods called deinterleasing are used to eliminate the adverse effects that arise when viewing interlinear video on a screen with progressive unfolding. Such effects are usually the splitting of the vertical boundaries of horizontally moving objects (the "carving" effect).

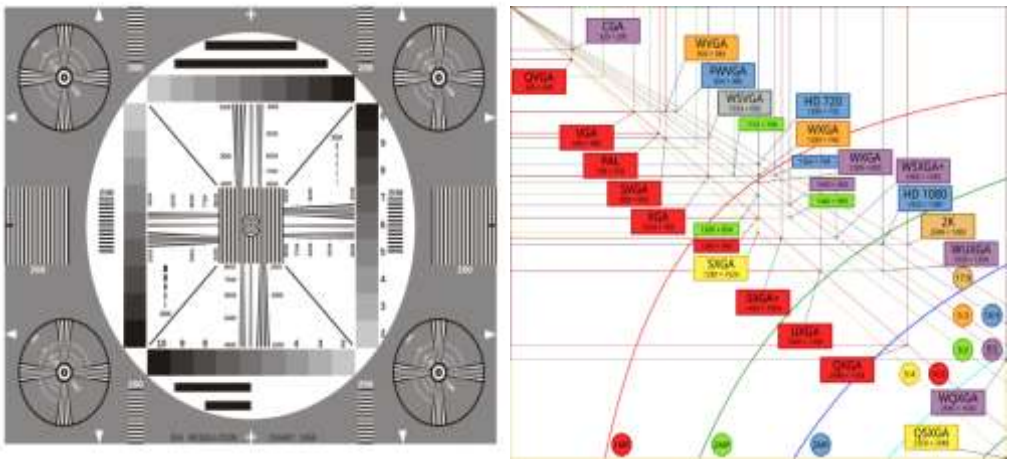


Figure 1. Compare default video permissions

Before the beginning of the digital video era, the horizontal resolution of the analog video recording system was measured on vertical television lines (TVL) using special television test tables, and the number of elements in the video image line was determined depending on the frequency characteristics of the recording device. Vertical resolution in the image is included in the expansion standard and is determined by the number of lines.

Any digital video signal, like a computer monitor solution, has dimensions measured in pixels, both horizontally and vertically. In analog video digitization with standard resolution, the resolution is 720 × 576 pixels for PAL and SÉCAM standards, frame rate 50 Hz (one field, 2 × 25); and 720 × 480 pixels for NTSC, frequency 60 Hz (one field, 2 × 29.97). In the expression 720*480, the first number denotes the number of points on the horizontal line (horizontal solution), and the second number denotes the number of lines themselves (vertical solution). The new standard of high-definition HDTV digital television (Eng. high-definition) includes dimensions up to 1920×1080 at a 60 Hertz refresh rate with progressive unfolding. That is, 1920 pixels per line, 1080 lines.

For three-dimensional video, resolution is measured in voxels - image elements representing points (cubes) in three-dimensional space. For example, for a regular three-dimensional video, 512 × 512 × 512 sizes are currently mainly used, such video demonstration samples are even available in PDA today.

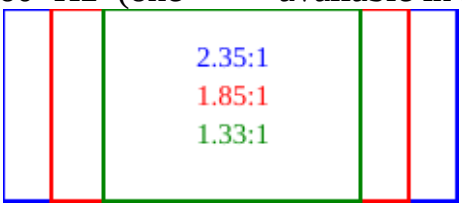


Figure 2. Comparison of film and traditional television formats

The aspect ratio is one of the most important parameters of any video material. Starting in 1910, the ratio of film screen sides was 4:3 (4 units in width, 3 units in height; sometimes written as 1.33:1, or simply 1.33). Considering that a person has two eyes, it was considered convenient for viewers to watch a film in this form. With the advent of television, it also adopted this ratio, and in almost all analog television systems (and consequently in televisions), the screen-side ratio was 4:3.Computer

monitors also adopted the television standards of the parties. However, by the 1950s, this notion of 4:3 had fundamentally changed. In reality, a person's field of vision does not have a 4:3 ratio. Because a person's two eyes are located on the same horizontal line - therefore, a person's field of vision is closer to 2:1. The 16:9 (1.78) standard was introduced to bring the frame form closer to the natural human field of vision (and therefore to enhance film perception). Digital television is also mainly oriented towards a 16:9 ratio. By the end of the 20th century, after a series of additional studies in this area, more radical ratios of personnel aspects began to appear: 1.85, 2.20, and 2.35 (almost 21:9). All this, according to the creators, is aimed at deepening the viewer's immersion in the environment of the video material under consideration. There are alternative reasons for the transition to a broad format: the possibility of renting in theaters that were not originally adapted for film, piracy.

The number of colors and the color resolution of the video signal are represented by color models. The YUV color model is used for the PAL standard, the YDbDr model for SÉCAM, and the YIQ model for NTSC. Computer technology mainly uses RGB (and αRGB), less often HSV, and printing technology uses CMYK. The number of colors that a monitor or projector can display depends on their quality. According to various estimates, the human eye can perceive from 5 to 10 million colors. The number of colors in the video material is determined by the number of bits allocated to encode the color of each pixel (in English bit per pixel, bpp). 1 bit allows encoding 2 colors (usually black and white), 2 bits 4 colors, 3 bits 8 colors,..., 8 bits 256 colors (28 = 256), 16 bits 65 536 colors (216), 24 bits 16 777 216 colors (224). There is also a 32-bit (αRGB) standard per pixel in computer technology, but this additional α-byte (8 bits) is used to encode the pixel's transparency coefficient (α), not for color encoding.

Video streamwidth (or speed) or bitrate (from English "bit rate") is the amount of video data bits processed per second (measured in bits per second or often "Mbit/s" - megabits per second; in English it is denoted as "bit/s" and "Mbit/s" respectively). The larger the video streamwidth, the better the overall video quality. For example, for the VideoCD format, the video streamwidth is only about 1 Mbit/s, and for the DVD - about 5 Mbit/s. Of course, the difference in quality cannot be subjectively assessed as fivefold, but objectively it is so. The HDTV format of digital television uses a video streaming bandwidth of about 10 Mbit/s. It is also very convenient to evaluate the quality of video when transmitting it over the Internet using the video stream speed.

There are two types of stream width control in the video codec - constant bit rate (CBR) and variable bit rate (VBR). The VBR concept, which is currently very popular, is aimed at maximizing video quality.

At the same time, in fast-moving scenes, the width of the video stream increases, and in slow-moving scenes, when the image changes slowly, the width of the stream decreases. This is very convenient for transmitting buffered video broadcasts and stored video material over computer networks. However, this is not suitable for bufferless real-time systems and live broadcasting (for example, for teleconferences) - in these cases, it is necessary to use a constant video stream speed.

Video quality

Video quality is measured using official metrics such as PSNR or SSIM, or subjective comparison involving experts.The subjective quality of the video is measured in the following way:

- Selecting video sequences for trial use
- Parameters of the measurement system are selected
- Select the method for displaying the video and calculating the measurement results
- The required number of experts will be invited (usually at least 15 people).
- The test itself is being conducted
- An average score is calculated based on expert assessments.

Several subjective assessment methods are described in the ITU-T BT.500 recommendations. One of the widely used assessment methods is the DSIS (Double Stimulus Impairment Scale), in which experts are shown the original video material, and then the processed video material. Then experts evaluate the processing quality from "processing is imperceptible" and "processing improves the video image" to "processed video material is very irritating."

STEREOSCOPIC VIDEO

Stereoscopic video, or simply stereo video (Eng. stereoscopic video or 3D video), was very popular at the end of the 20th century, and now waves of interest in it are constantly appearing. Throughout the world, there are cinemas that demonstrate stereoscopic video using various technologies. Stereo video requires two video channels, often called layers: one for the left eye and the other for the right eye. You also need to ensure that your own image falls into your "own" eye. Thus, the viewer experiences the volume, three-dimensionality of the video material, and the realism of the visual sense increases.Approximately the same, but weaker in quality, effect is provided by watching video in plastic glasses, where a red light filter is used for one eye and a green-blue color for the other. This is an old principle of anaglyph stereophotography. New technologies introduced in 2006, in particular, HD DVDs and Blu-Ray discs, allow for the transfer of more stereo video materials and are designed to make home stereoscopic videos more convenient.

DIGITAL VIDEO

Digital video is based on the technologies of recording, processing, transmitting, storing, and displaying visual and audiovisual information in digital form. The concept of "digital video" should not be confused with digital television. Digital television defines the standards for transmitting video and audio signals from a transmitter to a television receiver, using digital modulation, i.e., transmitting digital video over a distance via satellite, ground, mobile, or cable networks.

For professional video recording, a three-matrix method is used. Systems in which optical color separation is carried out using a dichroidal prism. Each colored image falls into a separate matrix, from which the frame elements are read, and then a video signal of a separate component is generated. R, G, B signals are converted to the YCbCr model after gamma correction. The obtained Y, Cr, Cb components are quantized with an 8-bit or 10-bit bit rate. However, in 8-bit encoding, only 220 out of 256 available levels (from 16 to 235) are used for transmitting the Y component, while the rest are used for synchronization signals. 877 degrees are used in 10-bit encoding; For the color components Cr, Cb, 225 degrees are used in the 8-bit system and 897 degrees in the 10-bit system.

The base ratio is accepted for digital video standards.

4:2:2, which means that the components of the color difference Cr, Cb are transmitted with twice less spatial accuracy than the brightness signal Y, since the human eye is more sensitive to changes in brightness than colors. In this case, the sampling frequency for the brightness signal Y is set equal to 13.5 MHz, which is several times greater than for the color difference signals Cr and Cb - 6.75 MHz.

For high-definition television signals, brightness (74.25 MHz) and chromaticity (37.125 MHz) signal discretization frequencies are established.

For the PAL European video standard, the frame size is 720x576 pixels, for the North American NTSC standard - 720x480, for high-definition video (HD 720 p) - 1280x720, for the HDTV (Full HD) standard - 1920x1080 pixels.

CONCLUSION

To accommodate a 60-second video with a frequency of 30 frames per second, a resolution of 720x576 pixels, and a light depth of 16 bits, about one and a half gigabytes of volume are required, excluding the soundtrack. There are dozens of compression algorithms that use different compression options. For video signal coding, MPEG-2, MPEG-4, H.264, DV, AVC, and others are used. At the same time, using a certain algorithm for data transformation, it is possible to compress the video using various software tools, which leads to different results. These differences are determined by the codec program that implements the initial signal compression algorithm. Each codec uses its own algorithm, which affects the quality and speed of encoding. The 1.5-hour film, written in DV format, occupies 20 GB, in MPEG-2 - 4.7 GB, and in MPEG-4 - 700 MB.

REFERENCES

1. Bekmirzayeva,M.(2024).VIZUALLASH TIRISH TIZIMLARIDA YOMG‘IR VA QOR MUAMMOLARINI TASVIRGA DASTLABGI ISHLOV BERISH YORDAMIDA BARTARAF ETISH. *DIGITAL TRANSFORMATION AND ARTIFICIAL INTELLIGENCE*, *2*(1), 120-124.
2. Beknazarova, S. S., & Bekmirzayeva, M. S. (2024). Study of the Degree of Influence of Fog on Images in Visualization Systems.
3. Beknazarova,S.S., and Bekmirzayeva M.Sh. "TASVIRLARDAGI YOMG‘IR IZLARINI TASVIRGA ISHLOV BERISH ALGORITMLARI YORDAMIDA OLIB TASHLASH."*Science and Innovation* 3.Special Issue (2024): 175-178.
4. Bekmirzayeva, M. Sh. "Videokuzatuv tizimlari ma’lumotlarini sun’iy intellekt yordamida tahlil qilish: Videokuzatuv tizimlari ma’lumotlarini sun’iy intellekt yordamida tahlil qilish." *MODERN PROBLEMS AND PROSPECTS OF APPLIED MATHEMATICS* 1.01 (2024).
5. Norqulova, Z. (2023). MA’LUMOTLARNI VIZUALIZATSIYA QILISH UCHUN ASOSIY TEXNOLOGIYALAR HAMDA ULARNING ONLINE PLATFORMALARDA QO’LLANILISHI. VIZUAL DATA MINING. *DIGITAL*

TRANSFORMATION AND ARTIFICIAL INTELLIGENCE, *1*(2), 179-184.

6. Bekmirzayev, O. N., & Bekmirzayeva, M. S. (2016). Recognize faces by the selecting degree of security. *Информатика: проблемы,методология,технологии* (pp. 3-7).
7. Norqulova, Z. (2024). DATA VISUALIZATION STEPS TO SORT DATA BY REMOVING MISSING VALUES AND CONVERTING DATA TO NUMERIC TYPE. *DTAI–2024*, *1*(DTAI), 37-39.
8. Norqulova, Z. (2024). DATA VISUALIZATION STEPS TO SORT DATA BY REMOVING MISSING VALUES AND CONVERTING DATA TO NUMERIC TYPE. *DTAI–2024*, *1*(DTAI), 37-39.