Data compression-Yuze
– algorithms of compression strategy of video

As the internet grows and spreads among the world where we are, our life is filled and surrounded by enormous amounts of information. Whereas, data needs a complex processing process before becomes the information that you see. Data, known as raw information, without being decrypted by your device, is a simple combination of 1 and 0. But in order to play 1 a second of 4K 60 frames/s video, which may teach you how to create a nuclear bomb or smash a potato, will take approximately 44 gigabytes of storage. Obviously, its size needs to be reduced for transmission or storage.

The video compression types vary but are mainly based on two different degrees of retention of the quality of video: lossless and lossy. (Alibaba cloud, 2024) Recurring colors and sounds may be excluded in the lossy form to maximize size reduction; while lossless allows the data in a compressed file to be rebuilt after encoded. (Alibaba cloud, 2024)

In the video compression algorithm that video platforms are using, the pixels of each frame in the video will be associated and cut into chunks depending on their similarity to pixels nearby. Generally, the system analyzes videos based on its algorithm that focuses on similarity and complexity. Chunks with less complexity (for instance, the sky) will be grouped and saved with fewer resources (Media storm, 2024), and vice versa for more complex pixel chunks. This algorithm is known as spatial compression, however, for multiple consecutive frames which is how video is formed, other strategies are required.

Interframe compression, basically a comparison between consecutive frames, will analyze the similarity between frames. Generally, It records moving parts in the scene, while the rest of the unchanged background would be comparatively ignored and thus get less resource distribution, in extreme situations, a totally unchanged scene may just be recorded once in order to save file size. (Media storm, 2024)

However, the two intraframe and interframe algorithms mentioned above are lossy, determined by limitations from many aspects. For example, the user's wireless internet velocity is unstable and limited, it may take several times of time to load the original uncompressed video than the time we watched. For the platform, storing video is an unignorable expenditure. Therefore, many encoding methods that based on different computing powers and resolutions are proposed such as H.264, H.265, H.266, and AV1. (Wiki,2024) In a nutshell, these encoding methods provide different quality of the video, but some of them, like H.266, require a more complex and detailed "chunking" process, and therefore more calculating resources for both encryption and decryption are required and not used for most of the platforms.

The learning and analyzing of videos processed by the algorithm are at the technical level, but we, the users, have limited perceptual ability in comparison to the wide color gamut that the camera can catch and our monitor can show. As a result, perceptual redundancy, which refers to the extra parts of the video that we can't identify, will be processed and cut as well to smaller the size of the video before it is transmitted to watchers. A similar approach, which is the cut down of certain hertz of audio that humans can't receive or distinguish, is used for audio processing， and therefore the video is compressed and the watchers can't perceive it while watching or listening. (Wiki,2024)

In conclusion, video compression is necessary for video transmission with the limited transmission and storage resources we have. With the advancement in storage techniques, optimization in video encoding algorithms, or proposal of different-based new compression algorithms, the data transmission efficiency and user experience will have a promising future.

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