Compression Efficiency Evaluation of HEVC/H.265, AV1, and VVC/H.266 Video Codecs

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ABSTRACT

Recently, digital compression has received a lot of attention. In this paper, we will compare and evaluate the performance of the latest standards HEVC, AVI and its successor VVC, which is determined by the nature of the video, its capabilities, quantization parameters, video content, image quality, and video size, The results show that each standard has characteristics that sometimes make it superior to others. Compared to H.265/HEVC, AV1 is more efficient at compressing HD and FHD video, and more efficient for SD video. In addition, experiments show that VVC/H.266 has higher compression efficiency.

Keywords: HEVC, AV1, VVC.

1 Introduction

Nowadays, video is considered one of the things that are taken for granted in reality, as it has come to dominate all aspects of the display of moving pictures. Video is one of the most important media for communications, entertainment, and many other applications [1], [2]. The video compression format is a content representation format for storing or transmitting digital video content (such as in a data file or bitstream). It usually uses the standard video compression algorithm [2]- [4]. In this paper, a comparison of common methods and norms of compressing digital video and how it's possible for large videos to become much smaller without major loss of quality or detail. We will compare some of these standards, namelyHEVC, AV1 and VVC, making comparisons in terms of bitrates, video content and encoding quality. PSNR (Peak Signal-to-Noise Ratio), VMAF (Video Multi-Method Assessment Fusion) and CRF (constant rate factor) are used to measure of video quality is produced.

2 Methodology

The provided video content types and different CRF values are used to simulate the effect of the HEVC,AV1, and VVC encoding process in different test scenarios. JCT-VC [5] recommends encoding video sequences using the full CRF range (14 to 42).

We used video compression standards: • HEVC / H.265: x265 codec (FFmpeg), • AV1: AOM codec (AOMedia), • VVC: VTM reference software codec.

The video compression standards HEVC, AV1, and VVC test conditions aim to obtain various objective metrics, such as PSNR, VMAF, etc. The expected scenario is shown in Figure 1. We used five videos with distinct characteristics.

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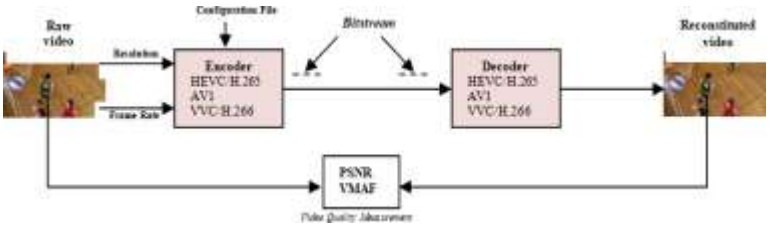

Figure 1: *Scheme assessment of different video sequence*

The video quality assessment method is divided into four steps:

1. Selection of video reference (YUV).
2. Video compression standards (HEVC/AV1/VCC).
3. Refer to video decompression.
4. Evaluate the video sequence.

3 Results and Discussion

This paper compares and evaluates the performance of three digital video compression standards: HEVC, AV1, and VVC. The comparison is based on factors such as video nature, quantization parameters, video content, image quality, and video size. The results show that each standard has its own characteristics that make it superior in certain aspects [1]- [3]. AV1 is found to be more efficient at compressing HD and FHDvideo, while HEVC performs better for SD video. VVC demonstrates higher compression efficiency compared to HEVC. Measurement of Video Quality Metrics The paper discusses the measurement of video quality using three metrics: PSNR, VMAF, and CRF. PSNR measures the distortion between the raw and decoded video signals, while VMAF evaluates perceptual video quality. The CRF is used to simulate the effect of the encoding process. Significance of Video Compression in Increasing Internet Video Streaming The article highlights the significance of video compression in the context of increasing internet video streaming and higher camera resolution [3]- [5]. HEVC and AV1 are identified as the most efficient videocodecs, with HEVC introduced to reduce data requirements for 4K and 8K Ultra HD content. AV1 andVVC are more efficient for videos with high spatial detail.

4 Conclusion

AV1 and VVC are found to be more efficient for compressing HD and FHD video. VVC demonstrates higher compression efficiency overall. The perception of video depends on the nature of the video and its intended use. VVC and AV1 are expected to replace HEVC in many networks in the future.

How to Cite

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