HERO DIVA Encoding

mediaexcel White Paper

Introduction

The growth of digital multimedia services began with the standardization of the MPEG1 & 2 video codecs. Ever since that growth, there has been an increase in service diversification, and customer demands for better visual quality close to the real world. The demand for higher resolution and better frame rates in the industry followed accordingly. However, these advancements naturally required more bits and increased video data traffic, posing significant challenges to existing network infrastructure.

In response to this issue, international standardization bodies and industry consortia made efforts to develop video codecs with higher compression ratios than existing codecs while supporting higher resolutions. As a result, the H.264/AVC codec was developed to support FHD (Full High Definition) video and OTT services. The H.264/AVC codec provided approximately 50% higher compression than the MPEG-2 video codec, revitalizing the media market. Following that, the standardization of the HEVC codec, which offered roughly 50% higher compression than H.264/AVC, was undertaken to facilitate UHD (Ultra High Definition) services surpassing FHD.

In response to challenges encountered by HEVC in web media services, the more web-friendly AV1 codec was developed in accordance with market needs. Moreover, to accommodate diverse media services, including 8K UHD beyond the preceding 4K UHD, the VVC video codec was standardized, delivering an approximate 50% higher compression rate than HEVC.

Challenges

The adoption of a new video codec not only results in simple enhancements in visual quality but also contributes to cost savings in data transmission and enables the provision of high-quality services with reduced bandwidth requirements. However, the introduction of such high-performance video codecs necessitates the replacement of the existing service chain, incurring significant costs for this replacement. Due to the magnitude of these replacement expenses, which are similar in scale to the initial costs of building the service chain, service providers are left with considerable deliberations when deciding to transition to a new video codec. Furthermore, considering the trend of shorter video codec replacement cycles, addressing the rapidly evolving digital media market and diverse customer demands requires a careful assessment of the timing of replacements and the cost-effectiveness in comparison to the expenses incurred.

What if it were possible to achieve performance similar to that of a new video codec using the existing codec? In such a scenario, it would be feasible to satisfy market and customer demands by only replacing relatively low-cost components within the entire service chain, such as encoders or transcoders. This approach could serve as an alternative for enhancing service quality without requiring the costly replacement of display terminals.

HERO's DIVA Encoding Solution: Unlocking New Possibilities with AI Technology

Media Excel approached enhancing efficiency through two aspects by utilizing existing video codecs as they are.

Fixed vs. Variable Target Bitrate

The consideration of the Target Bitrate for encoding was our first approach. While most services fix the Target Bitrate regardless of the type and characteristics of the video, we questioned whether it would be efficient to uniformly set the Target Bitrate without considering the original source's diverse attributes.

The untrained human eye doesn't distinguish differences in video qualities beyond a certain quality threshold. Videos with minimal motion or less complexity can maintain high-quality visuals with fewer bits. In that case, rather than providing the same bitrate to content with varying characteristics, it would be more efficient to set different bitrates based on the content's attributes, as depicted in the right side of Figure 1.

Figure 1. Fixed Target Bitrate (Left) vs. Variable Target Bitrate (Right)

Bitrate Control Method

Secondly, we have considerations about the bitrate control method. As most OTT services are transitioning from MPEG-TS to MP4-based formats and network environments are evolving towards 5G, the need to adhere to traditional CBR (Constant Bit Rate) bitrate control has diminished. Consequently, we pondered whether utilizing the more advantageous VBR (Variable Bit Rate) in terms of video quality would be more efficient.

As shown in Figure 2, with CBR, a consistent bit rate is maintained regardless of the video's complexity, resulting in lower quality for intricate segments and inefficient allocation of bits for less complex portions. Utilizing VBR, which maintains an average bit rate, could lead to more efficient encoding compared to CBR, as it adapts to varying complexity. However, since using more bits than necessary to meet the average bit rate is a concern, setting VBR bitrate control criteria based on quality rather than bit occurrence would likely be more efficient.

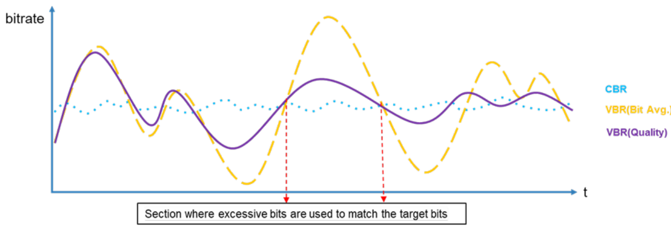

Figure 2. Characteristics of Bitrate Control Method

AI based deep learning encoding

We determined that utilizing two approaches would enable efficient encoding. As a solution to this, we employed AI-based deep learning. We analyzed various content to understand the characteristics of the videos and modeled them. Through this process, we aimed to create a reference (labeled) dataset that closely resembles exemplary solutions, allowing us to find optimal encoding parameter values for videos with diverse attributes. Using this dataset, we initiated learning through deep learning techniques, resulting in the creation of a model capable of finding the optimal encoding settings based on the characteristics of the content.

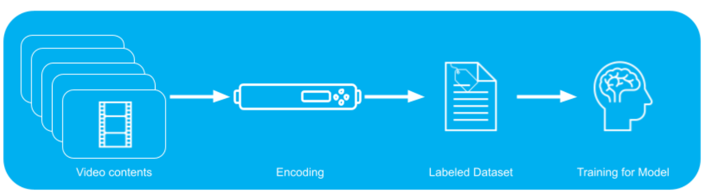

Figure 3. Implementation of training model through deep learning

The technology applied to the HERO encoder and transcoder using this learning model is called DIVA (Dynamic Intelligence Video Adaptive) Encoding.

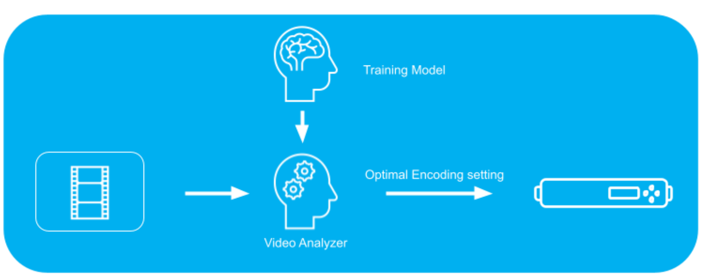

Figure 4. DIVA Encoding

We utilized the learning model to implement a video stream analyzer, and based on the analysis results, we derived the optimal encoding parameter values for delivering the best possible service for this video. The outcome of encoding with these parameters is a higher-quality encoding output, as demonstrated in Figure 5. See our DIVA encoding in action by accessing the QR code at the end of the page.

Figure 5. Result of DIVA Encoding

Conclusion

The core advantage of DIVA Encoding technology is the ability to achieve the highest level of video quality while maximizing the utilization of existing infrastructure. Adopting HERO's DIVA encoding technology makes it possible to provide higher quality services without the need for additional large-scale investments, as it requires only the replacement of existing encoders or transcoders while maintaining most of the existing service chain. Moreover, this replacement enables swift adaptation to market changes, allowing the generated revenue to be used to cover the costs of the future adoption of new video codecs.

In conclusion, the adoption of HERO DIVA Encoding is a strategically significant choice for media service providers. This decision allows them to provide exceptional quality services while retaining their current infrastructure, enabling swift adjustments to market dynamics, and establishing a foundation for continuous growth and competitiveness.