

iSIZE BitSave: High-Quality Video Streaming at Lower Bitrates

iSIZE's innovative BitSave technology comprises an AI-based perceptual preprocessing solution that allows conventional, third-party encoders to produce higher quality video at lower bitrate. BitSave achieves this by preprocessing the video content **before it reaches the video encoder** (Fig. 1), such that the output after compressing with any standard video codec is perceptually optimized with less motion artifacts or blurring, for the same or lower bitrate. BitSave neural networks are able to isolate areas of perceptual importance, such as those with high motion or detailed texture, and optimize their structure so that they are preserved better at lower bitrate by any subsequent encoder. As shown in our [recent paper](#), when integrated as a preprocessor prior to a video encoder, BitSave is able to **reduce bitrate requirements for a given quality level by up to 20% versus that encoder. When coupled with open-source AVC, HEVC and AV1 encoders, BitSave allows for up to 40% bitrate reduction at no quality compromise in comparison to leading third-party AVC, HEVC and AV1 encoding services.** Lower bitrates equate to smaller filesizes, lower storage, transmission and distribution costs, reduced energy consumption and more satisfied customers.

-  Fast and easily integrated with any encoder including AVC, HEVC, VP9 and AV1, without breaking standards or requiring any changes on the client device
-  Single-pass through the content with frame latency
-  Supports multi-codec, multi-recipe, multi-bitrate and multi-resolution ABR ladders
-  Deep neural network models provide 10 to 25% bitrate savings on top of the codec
-  Next generation sustainable results and a significant reduction in costs for video delivery



-  AI-based pre-processing prior to encoding (AVC, HEVC, VP9, AV1)
-  One frame latency
-  Single pass processing per content for an entire ABR ladder
-  Improves encoding quality as measured by standard perceptual quality metrics (VMAF, SSIM, VIF)
-  Integrated within Intel OpenVINO, ONNX and Dolby Vision, easy to plug&play within any existing workflow

Figure 1. iSIZE's BitSave pipeline for preprocessing and encoding with third-party encoders.

- **Simple integration**–BitSave pre-processes video content without changing the encoding; consequently these gains are attainable without any of the disadvantages associated with replacing components of encoders, streaming infrastructures, or client devices. The BitSave pre-processor can simply be plugged in just before the encoding pipeline without disrupting the existing pipeline.
- **Codec independent**–BitSave is compatible with any existing codec (including MPEG AVC/H.264, HEVC/H.265, EVC, VVC and AOMedia VP9, AV1, AV2), and supports all resolutions up to 8K. The preprocessing accepts all video formats as input and outputs same-resolution lossless video or a transport stream, which can be optionally downsampled, before passing to any standard video encoder. Only a single pass over the content is required (with single frame latency), prior to any number of subsequent encodings with any video encoder.
- **Realtime**–iSIZE's proprietary deep learning-based models can run on all CPU and GPU hardware. The current generation of BitSave models is able to run on 4 CPU cores or higher, achieving real-time preprocessing and AVC encoding on most cloud instances with 12% average bitrate saving versus x264 'slow' preset and 33% average bitrate saving versus a leading quality-based variable bitrate (QVBR) encoding service.

Average bitrate savings on typical HD (720p), full-HD test (1080p) and 4K (2160p) videos are reported in Figure 2 across multiple encoders (AVC, HEVC, AV1) and VMAF, VMAF_NEG and SSIM. Importantly, all encoded bitstreams are fully standard-compliant and do not require any changes in content packaging, delivery or client side. This means they can be decoded by any device that supports AVC, HEVC or AV1 decoding without requiring any downscaling or upscaling on the client device.

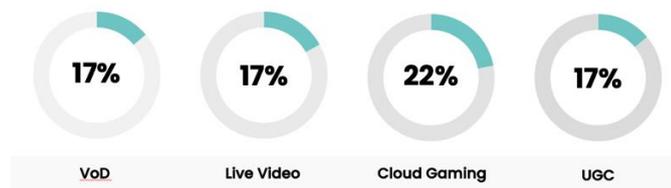


Figure 2. BitSave bitrate saving results delivered on top of any existing codec savings: <http://demo.isize.co/>



Figure 3. Visual comparison of encodings corresponding to Table 1 and Table 2 (top: 'crowd run'; bottom: 'rush field cuts'). x264 and BitSave + x264 is at approx. 8% lower bitrate than the third-party AVC QVBR.

iSIZE BitSave Performance

Frames-Per-Second (FPS)			
Resolution	Intel Xeon 8275CL	Nvidia T4 GPU	AMD EPYC 7R32
540p	1428	4347	1123
720p	787	1960	602
1080p	337	925	251
1440p	189	529	142
2160p	87	235	64

Table 1: Runtime (FPS) for single-socket CPU/GPU processing of common input resolutions.

# of streams at 60 FPS per single-socket CPU/GPU			
Resolution	Intel Xeon 8275CL	NVIDIA T4 GPU	AMD EPYC 7R32
540p	20	50	18
720p	12	31	9
1080p	5	14	4
1440p	3	8	2
2160p	1	3	1

Table 2: Number of concurrent streams at 60 FPS for CPU/GPU processing of common input resolutions.

iSIZE BitSave Specification

Inputs and output containers

yuv, y4m, mp4, webm, mov, ts, m2ts, mkv, streaming (http, tcp, udp, m3u8)

Input and output video codecs

raw YUV, AVC, HEVC, VP9, ProRes

Input & output audio codecs

passthrough (optional)

Deliverable/Integration

- Linux binary
- Docker container
- C/C++ Library

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