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Title **[MPEG-I Visual] Report on Asymmetric Quantization on MIV**
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1 Introduction

Frame packing or tile groups enable to pack different atlases sub-bitstreams, such as HEVC tiles or VVC subpictures, into single video sequences [1]. Thanks to the flexible syntax which allows multiple atlases within the same packed frame, it can reduce the number of decoder instantiations. At the same time, tiles allow the viewport-adaptive schemes in MIV. This contribution aims to provide the results of asymmetric quantization on MIV. In the common test conditions (CTC) in MIV, there are only QPs with texture and geometry. But further study is needed to investigate different quality of each sub-bitstream (tiles/subpictures) in viewport-adaptive schemes in MIV. Because of view synthesis processing in MIV, it can be hard to predict impact of low-quality tiles to the reconstructed views.

2 Asymmetric Quantization

This contribution studies asymmetric quantization for the basic view (BV) and additional view (AV). Figure 1 shows asymmetric quantization on MIV (AQMV). In this contribution, we report how reconstructed views can be affected when each atlas has different quality version, especially additional views have low quality.

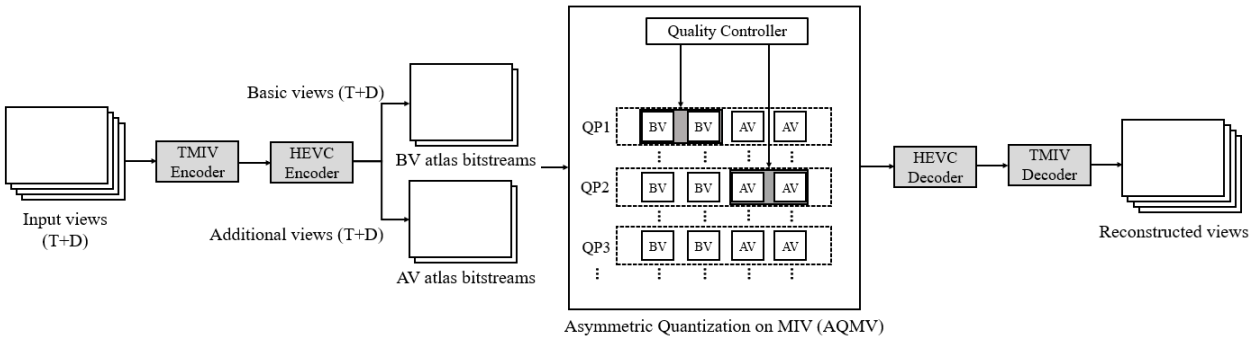

Fig. 1. TMIV with Asymmetric Quantization on MIV

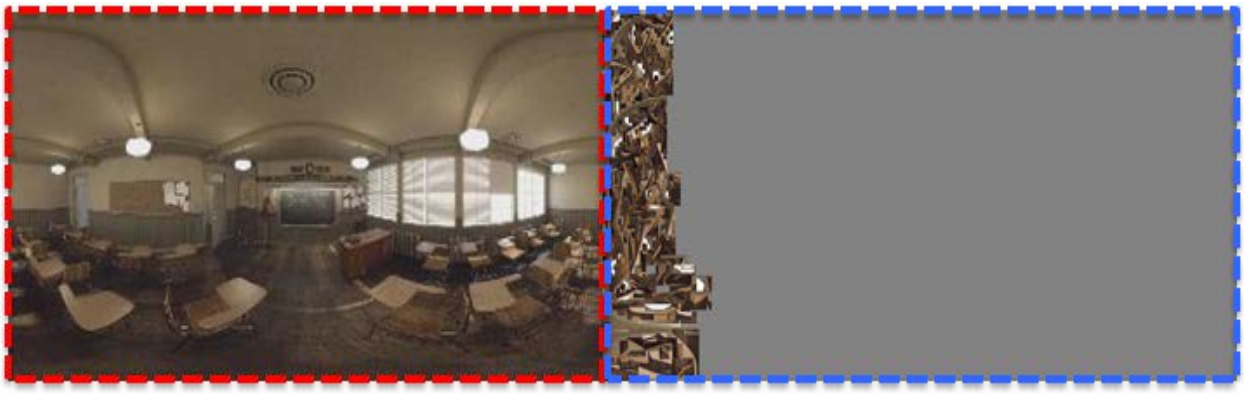

Fig. 2. 'ClassroomVideo' CG1-A sequence in TMIV 3.0
Left: Basic View (QP1), Right: Additional View (QP2)

3 Experimental Results

In the experiments, this contribution assigns the additional views to delta (QP+1) in TMIV 3.0 CTC [2]. In general, additional views contain many high-frequency textures and this contribution investigate impact of additional views' loss.

Table 1. AQMV QPs

Proposed QPs	Basic views	Additional views	Depth
AQMV1	QP1(22)	**QP2(27)**	QP1(9)
AQMV2	QP2(27)	**QP3(32)**	QP2(14)
AQMV3	QP3(32)	**QP4(37)**	QP3(21)
AQMV4	QP4(37)	**QP5(42)**	QP4(30)

Due to limitations on time and compute, could experiment only three CG sequence. Table 2 shows experimental results on three test sequences. These experiments are performed MIV anchor mode with "ff" configuration (97 frames), Performance of AQMV is evaluated over "high bitrate" (4 higher rates) in CTC. QPs are derived from [2]. AQMV achieves WS-PSNR BD-rate gain by 9.76%, 17.97%, 27.62% relative to anchor QPs, respectively.

Table 2. Y-PSNR BD-rate (Anchor v.s. Proposed)

QP1-4 v.s. AQMV1-4 (A97)			
Sequence name	WS-PSNR	VMAF	IV-PSNR
ClassroomVideo (CG1-A)	-9.76%	-4.76%	-9.99%
Museum (CG1-B)	-17.97%	-11.53%	-6.88%
Hijack (CG1-C)	-27.62%	-20.44%	-21.75%

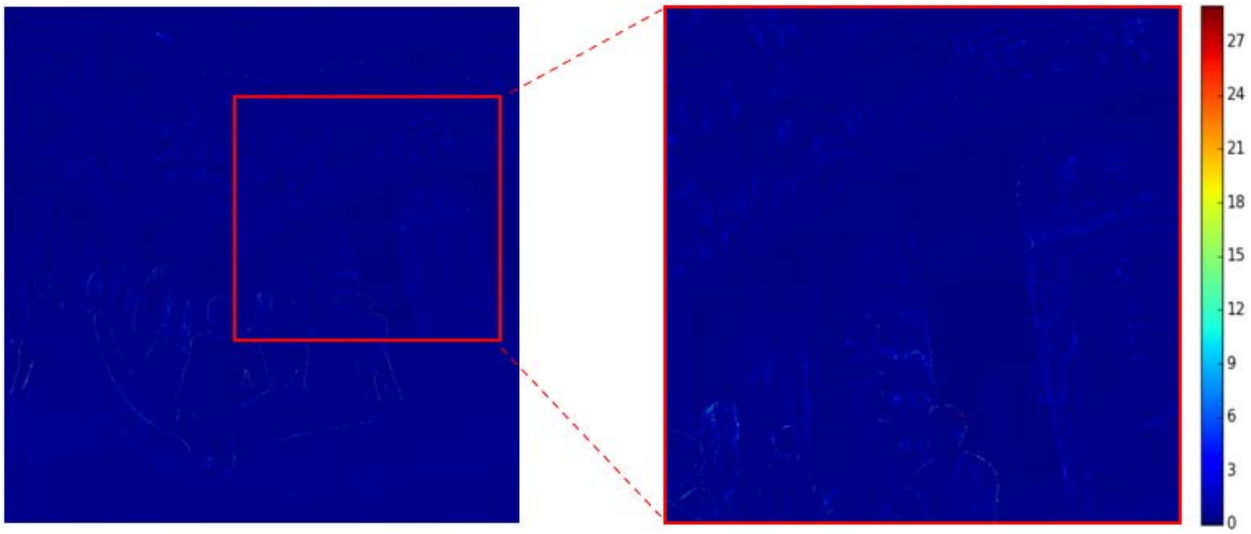

Fig. 3. Reconstructed ‘Museum v11’ pixel loss (QP1 v.s. QP2)

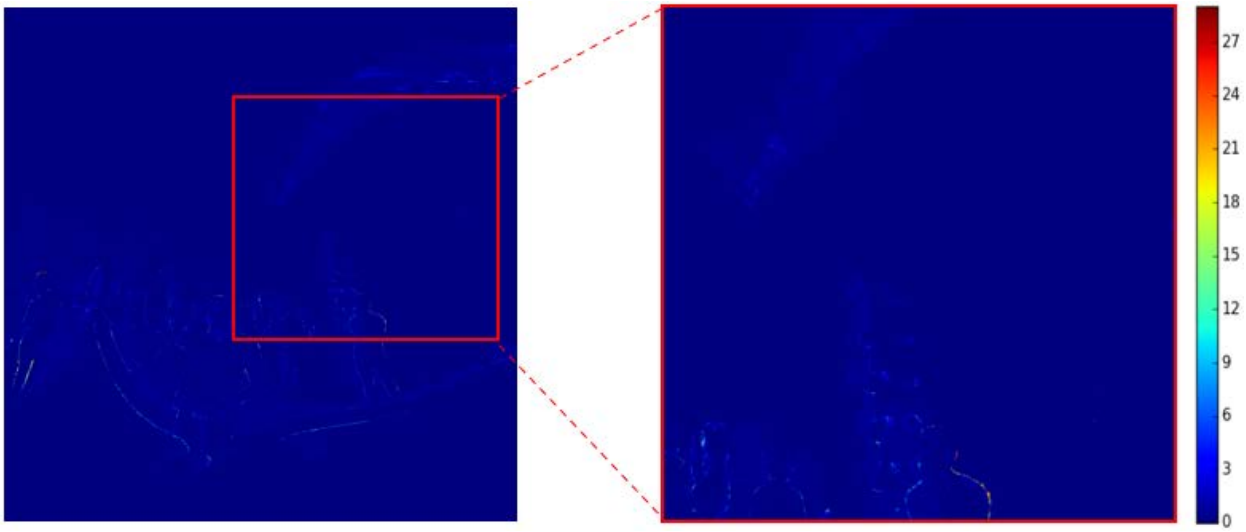

Fig. 4. Reconstructed ‘Museum v11’ pixel loss (QP1 v.s. AQMV1)

Because there were no noticeable artifacts in the human perception, we measured the pixel loss of QP1, QP2 and AQMV1. Figure 3 shows the pixel loss to the QP1 v.s. QP2 and figure 4 shows the pixel loss to the QP1 v.s. AQMV1. Figure 4 illustrates pixel loss is only observed at that additional views’ part but not at other parts (basic views). This kind of artifact is difficult to measure with a traditional metric, e.g. PSNR, because the losses are not uniform.

4 Conclusion

In this contribution, asymmetric quantization shows BD-rate gain over the QPs in CTC. Because of view synthesis processing in MIV, it is difficult to predict the visual quality of reconstrued view. To facilitate sub-bitstream access in MIV, further study is needed to investigate impact on different quality of each sub-bitstream.

5 References

[1] “Frame Packing and Extended MIV Profile”, ISO/IEC JTC1/SC29/WG11 MPEG2020/ m54491, Online.

[2] “Common Test Conditions for Immersive Video”, ISO/IEC JTC1/SC29/WG11 MPEG2020/ w18789, Geneva.