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Title: **[MIV] On Delta QP for Additional View Atlases**

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1 Introduction

The main purpose of this document is to introduce the delta QP allocation method for additional view atlases to accomplish the BD-rate gain on the MIV. Optimizing the QPs can be a way to increase the performances of the MIV, while it does not affect the internal processes of the MIV. The current common test conditions (CTC) of the MIV allocates lower QPs to the geometry atlases than these of the texture atlases [1]. Further, this document reports experimental results on delta QPs for additional view atlases, to address the need of QP tuning in the future MIV. Experimental results showed that assigning lower QPs to additional view atlases showed IV-PSNR BD-rate gains compared to the anchor.

2 Proposal

Experimental results of [2] verified that delta QP -10 for geometry showed BD-rate gain, and the MIV experts had conducted experiments to allocate delta QPs to the geometry atlases for higher BD-rate performances. Because the geometry contains different characteristics with these of texture (e.g., nearly continuous values within objects and sharp edges), assigning delta QPs increased the BD-rate performances. Therefore, this document conducted experiments using delta QPs for additional view atlases to accomplish the BD-rate gains, where [3] presented preliminary experimental results on it and reported the BD-rate gains.

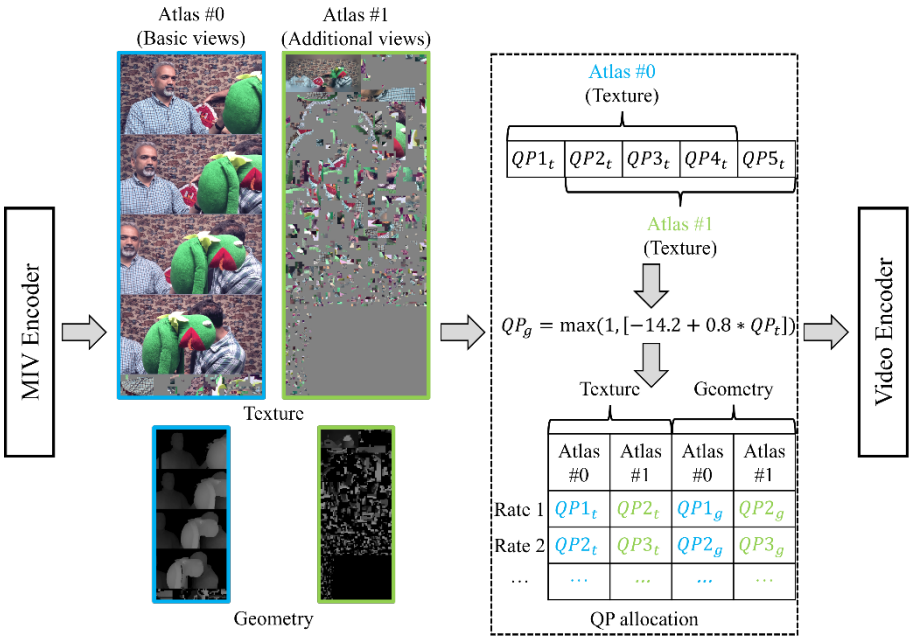


Figure 1. Delta QP allocation for additional view atlases

Figure 2 shows the delta QP allocation for additional view atlases. In the figure, atlas #0 contains basic views, while atlas #1 includes additional view patches. QP1 to QP4 are assigned to atlas #0, and QP2 to QP5 are given to atlas #1. Therefore, the additional view atlases contain higher QPs than these of basic view atlases. This document also provides experimental results for lower QPs on additional view atlases.

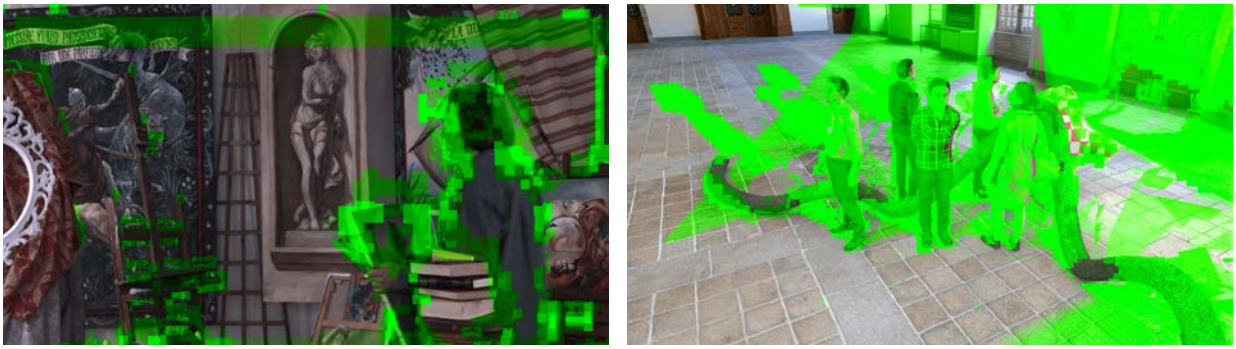
3 Experimental Results

The experiments followed the CTC for TMIV11 and VVenC 0.3.1.0[1], for nine mandatory test sequences. In this document, experiments using higher QPs for additional view atlases are denoted as 'deltaQP_high'. Otherwise, when using lower QPs for additional view atlases, it was called 'deltaQP_low'.

Table 1 shows the Y-PSNR and IV-PSNR BD-rate gains of deltaQP_high compared to the anchor. The proposed method outperformed the anchor in sequences A and D, accomplishing up to 9% of IV-PSNR BD-rate gains. Further, the proposed method showed gains on natural sequences D, E, and P. However, the BD-rate losses on J and R were observed. Although the basic views represent most of the scenes, some sequences needed more pixels of additional views than these of basic views in intermediate view synthesis. Figure 2 shows the synthesized intermediate views of sequence D and R. Note that the green pixels represent pixels from additional views, and TMIV v8.0 was used. Experiments proved that sequence R used more pixels from additional views than these of basic views, therefore the proposed method showed the highest BD-rate loss on sequence R. Nevertheless, it is worth investigating the impact of delta QP on additional view atlases because of its BD-rate gains on the IV-PSNR.

Table 1. Y-PSNR and IV-PSNR BD-rates of deltaQP_high compared to the anchor.

Sequence		**High-BR BD rate Y-PSNR**	**Low-BR BD rate Y-PSNR**	**High-BR BD rate IV-PSNR**	**Low-BR BD rate IV-PSNR**
ClassroomVideo	A	-5.3%	-	-9.47%	-
Museum	B	-1.0%	-	-0.25%	-
Fan	O	-2.3%	-	-1.72%	-
Kitchen	J	3.9%	-	2.63%	-
Painter	D	-10.4%	-	-9.69%	-
Frog	E	-1.7%	-	-1.83%	-
Carpark	P	-1.4%	-	-4.19%	-
Chess	N	2.7%	-	-1.87%	-
Group	R	16.2%	-	8.23%	-
MIV		**0.08%**	**-**	**-2.02%**	**-**



(a) (b)

Figure 2. Synthesized intermediate views, (a) sequence D, view *v2*, (b) sequence R, view *v02*.
Note: green pixels represent additional views.

Table 2 shows the Y-PSNR and IV-PSNR BD-rate gains of deltaQP_low compared to the anchor. Overall, the anchor outperformed the deltaQP_low. There might be gains of BD-rate on sequence J and R due to the higher portion of additional views, as shown in Figure 2. However, the proposed deltaQP_low had BD-rate loss on the mentioned sequences. One of the reasons of this is that in sequence J and R there were more additional view patches than the others, therefore the same or similar QP values for basic and additional view atlases might be needed.

Table 2. Y-PSNR and IV-PSNR BD-rates of deltaQP_low compared to the anchor.

Sequence		**High-BR BD rate Y-PSNR**	**Low-BR BD rate Y-PSNR**	**High-BR BD rate IV-PSNR**	**Low-BR BD rate IV-PSNR**
ClassroomVideo	A	-	29.2%	-	28.8%
Museum	B	-	22.2%	-	24.6%
Fan	O	-	10.0%	-	9.8%
Kitchen	J	-	14.8%	-	15.2%
Painter	D	-	35.5%	-	35.9%
Frog	E	-	15.5%	-	15.9%
Carpark	P	-	18.0%	-	19.7%
Chess	N	-	20.4%	-	24.1%
Group	R	-	8.9%	-	16.3%
MIV		**-**	**19.4%**	**-**	**21.1%**

4 Conclusion and Recommendation

This contribution proposed the delta QP for additional view atlases to increase the BD-rate performances of the MIV. Assigning higher QPs for additional view atlases than these of basic view atlases showed 2.00% of IV-PSNR BD-rate savings compared to the anchor in average. Especially, the proposed method outperformed the anchor in sequences which are realistic or captured natural scenes. Despite it showed the BD-rate loss on sequence R, it is worth investigating the reasons of this and finding an equation to allocate the optimized QPs for additional view atlases. Therefore, this document recommends:

- Open an EE to study on the QP tuning for additional view atlases. Extensive experiments need to be conducted to find a general equation for optimized QPs.

5 References

[1] "Common Test Conditions for MPEG Immersive Video", Joel Jung, Bart Kroon, ISO/IEC JTC1/SC29/WG4 output document n00169, January 2022, online meeting.

[2] "[MPEG-I Visual] Results on depth QPs in CTC of 3DoF+ Video", Bin Wang, Lu Yu, Bart Kroon, Joelb Jung, ISO/IEC JTC1/SC29/WG11 input document m44688, October 2018, Macau, China.

[3] "[MPEG-I Visual] Report on Asymmetric Quantization on MIV", Soonbin Lee, Jong-Beom Jeong, Eun-Seok Ryu, ISO/IEC JTC1/SC29/WG4 input document m55014, October 2020, online meeting.