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Title: Results of EE4 on ‘Pantomime’ Sequence

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1. Introduction

This document reports experimental results of depth coding on 'Pantomime' sequence in response to EE4 of 3D video coding [1]. The objective of these experiments is to determine appropriate combinations of QPs for the test material in 2-view and 3-view configurations based on total target bit rates. Therefore, we first generated the depth video with the best performance in terms of PSNR of synthesized views by DERS 5.0. Then, we carried out the coding experiments with various QPs using JMVC 6.0.3 as guided in N10925. Using the decoded depth and color videos, we synthesized the intermediate views, and evaluated the quality of the synthesized images.

2. Results of Depth Video Coding

We performed the coding experiments following the description of EE in the document N10925 [1]. In order to determine appropriate range of rate points, we checked all possible combinations of the color and depth sequences with various QPs. Table 1 represents coding conditions.

Table 1. Coding conditions

Reference software		JMVC 6.0.3
GOP size		15
Number of frames		200
Search range		96
View number	2-view	39, 41
	3-view	37, 39, 41
ViewScalInfoSEI		Off

2.1. 2-view Configuration

We selected the best combinations of QPs for color and depth sequences based on the target bit rates; 2, 1.25, 0.75, 0.375 Mbps for 'Pantomime'. In the case of 2-view configuration, the total bit rate is calculated by

$$\text{Total bit rate} = \text{Rate(L_color)} + \text{Rate(R_color)} + \text{Rate(L_depth)} + \text{Rate(R_depth)}$$

Table 2 shows the total bit rates and PSNR of synthesized images for 2-view configuration. The synthesis results for view 40 are obtained by the decoded pairs of sequences. We have changed the lowest target bitrates from 0.375 Mbps to 0.66 Mbps since the lowest one is unapproachable bit rate in 'Pantomime' sequence. We have discussed this problem with NTT members and agreed with this through the reflector. Figure 1 shows the synthesis results for the best combinations of QPs.

Table 2. Total bit rates and PSNR of synthesized images for 2-view configuration

Target Bit rates (Mbps)	Color			Depth			Total bit rate (kbps)	PSNR of syn. for view40 (dB)
	QP	Bit rate (kbps)		QP	Bit rate (kbps)			
		View 39	View 41		View 39	View 41		
2	34	1019.5	609.6	37	213.0	172.2	2014.3	34.9
1.25	39	655.0	345.8	41	129.4	104.2	1234.4	33.3
0.75	45	407.2	215.0	46	72.3	55.2	749.8	30.4
0.375 → 0.66	50	347.2	204.8	50	61.0	48.6	661.6	27.9



(a) TB2: color QP 34, depth QP 25



(b) TB1.25: color QP 39, depth QP 41



(c) TB0.75: color QP 45, depth QP 46



(d) TB0.66: color QP 50, depth QP 44

Fig. 1. Synthesis results in the 100th frame at view_40 (2-view)

2.2. 3-view Configuration

In the case of 3-view configuration, coding experiments are performed based on the target bit rates; 3, 2, 1, 0.5 Mbps for 'Pantomime'. The total bit rate is calculated by

$$\text{Total bit rate} = \text{Rate}(L_color) + \text{Rate}(C_color) + \text{Rate}(R_color) + \\ \text{Rate}(L_depth) + \text{Rate}(C_depth) + \text{Rate}(R_depth)$$

Table 3 shows the total bit rates and PSNR of synthesized images for 3-view configuration. The synthesis results for view 38 and view 40 are also obtained by the decoded pairs of sequences. Similarly with the 2-view case, the lowest target bit rate is also unapproachable even though we use the highest QP value. Therefore, we selected alternate target bit rate from 0.5 Mbps to 0.95 Mbps. The modified bit rate is the reachable lowest bitrates in "Pantomime" sequence. Figure 2 shows the synthesis results for the best combinations of QPs.

Table 3. Total bit rates and PSNR of synthesized images

Target Bit rates (Mbps)	Color				Depth				Total bit rate (kbps)	PSNR of syn. (dB)	
	QP	Bit rate (kbps)			QP	Bit rate (kbps)				View 38	View 40
		View 37	View 39	View 41		View 37	View 39	View 41			
3	33	1135.8	572.9	762.1	37	203.7	179.9	189.3	3043.7	36.1	34.9
2	37	796.0	397.3	493.6	42	111.4	104.8	99.9	2003.1	34.8	33.8
1	46	387.0	219.5	223.0	47	67.3	65.9	55.6	1018.2	30.2	29.5
0.5 → 0.95	50	351.8	215.1	216.7	51	60.4	60.3	50.5	954.8	26.2	25.7



(a) TB3: color QP 33, depth QP 37



(b) TB2: color QP 37, depth QP 42



(c) TB1: color QP 46, depth QP 47



(d) TB0.95: color QP 50, depth QP 51

Fig. 2. Synthesis results in the 100th frame at view_40 (3-view)

3. Conclusion

We have reported the experimental results on 3D video coding. The best combinations of QPs were determined based on the assigned target bit rates. Each lowest target bit rates are modified and selected arbitrary. We also reported the synthesis results for the best combinations of QPs. We have confirmed that the quality drop of the synthesized image is clear in visual. We are ready to demonstrate the synthesized video for each target bit rates during 91th Kyoto meeting.

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5. References

- [1] ISO/IEC JTC1/SC29/WG11 “Description of Exploration Experiments in 3D Video Coding,” N10925, October 2009.