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Title: Results of EE4 on ‘Cafe’ Sequence

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1. Introduction

This document reports experimental results of EE4 on 'Cafe' sequence in response to N11095 [1]. Since we generated the depth video using DERS 5.1 and manual operation described in M17488 [2], we conducted EE4 experiments voluntarily. We selected four recommending rate points and QP combinations of ‘Cafe’ sequence. We prepared the viewing materials for each rate point.

2. Results of Color and Depth Video Coding

We conducted the coding experiments conforming to the description of EE in the document N11095. In order to set appropriate target rates for each configuration, we compared all possible QP combinations of the color and depth sequences. The coding results showed that the highest quality was about 30.7 dB and the lowest quality was about 35.5 dB. Hence we selected four rendering qualities and their corresponding rate points as described in Table 1. These rate points are adjustable by necessity. Table 2 shows the coding condition.

Table 1. Target Bit Rates

Rate Point		R1	R2	R3	R4
Rendering Quality (dB)		30.7	32.3	33.9	35.5
Target Rates (Mbps)	2-view	0.50	0.60	0.90	1.90
	3-view	0.75	0.90	1.25	2.50

Table 2. Coding Conditions

Reference software	JMVC 7.0
GOP size	15
Number of frames	200

Search range		96
View number	2-view	2, 4
	3-view	2, 3, 4
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; 0.5, 0.6, 0.9, 1.9 Mbps for 'Cafe'. 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 3 shows the total bit rates and PSNR of synthesized images for the 2-view configuration. The synthesis results for view 3 are obtained by the decoded pairs of sequences. Figure 1 shows the synthesis results of each QP combinations.

Table 3. Total bit rates and PSNR of synthesized images for 2-view configuration

Target Bit rates (Mbps)	Color			Depth			Total bit rate (kbps)	Rendering quality for View 3 (dB)
	QP	Bit rate (kbps)		QP	Bit rate (kbps)			
		View 2	View 4		View 2	View 4		
0.5	49	199.22	165.92	50	78.18	71.34	514.66	30.7
0.6	44	276.06	176.94	48	83.07	75.90	611.97	32.3
0.9	40	381.46	252.66	43	127.53	119.58	881.23	33.9
1.9	32	839.72	611.56	38	206.88	203.64	1861.8	35.5



(a) R1: 0.5 Mbps, color QP 49, depth QP 50



(b) R2: 0.6 Mbps, color QP 44, depth QP 48



(c) R3: 1.0 Mbps, color QP 40, depth QP 43



(c) R4: 1.85 Mbps, color QP 32, depth QP 38

Fig. 1. Synthesis results in the 100th frame at view3 (2-view)

3-view Configuration

In the case of 3-view configuration, coding experiments are performed based on the target bit rates; 2.50, 1.25, 0.90, 0.75 Mbps for 'Cafe'. 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 4 shows the total bit rates and PSNR of synthesized images for 3-view configuration. The synthesis results for view 2.75 and 3.25 are also obtained by the decoded pairs of sequences. Figure 2, 3 show the synthesis results for the best combinations of QPs.

Table 4. Total bit rates

Target Bit rates (Mbps)	Color				Depth				Total bit rate (kbps)
	QP	Bit rate (kbps)			QP	Bit rate (kbps)			
		View 2	View 3	View 4		View 2	View 3	View 4	
0.75	49	199.22	149.79	165.92	50	78.18	84.35	71.34	748.8
0.90	44	276.06	183.63	176.94	48	83.07	88.97	75.90	884.55
1.25	40	381.46	227.22	252.66	43	127.53	134.03	119.58	1242.49
2.50	32	839.72	446.79	611.56	38	206.88	231.51	203.64	2560.09



(a) R1: 0.75 Mbps, color QP 49, depth QP 50 (b) R2: 0.90 Mbps, color QP 44, depth QP 48



(c) R3: 1.25 Mbps, color QP 40, depth QP 43 (d) R4: 2.5 Mbps, color QP 32, depth QP 38
Fig. 2. Synthesis results in the 100th frame at view 2.75 (3-view)



(a) R1: 0.75 Mbps, color QP 49, depth QP 50 (b) R2: 0.90 Mbps, color QP 44, depth QP 48



(c) R3: 1.25 Mbps, color QP 40, depth QP 43 (d) R4: 2.5 Mbps, color QP 32, depth QP 38
Fig. 3. Synthesis results in the 100th frame at view3.25 (3-view)

3. Conclusion

We have reported the experimental results of EE4 on ‘Cafe’ sequence. We selected four recommending rate points and their corresponding QP combinations. From the results of synthesis views, we have confirmed that the quality drops of the synthesized images are noticeable in visual. We are ready to demonstrate the resultant video for each target bit rate during 92nd Dresden meeting.

4. Acknowledgements

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5. References

- [1] ISO/IEC JTC1/SC29/WG11 “Description of Exploration Experiments in 3D Video Coding,” N11095, January 2010.
- [2] ISO/IEC JTC1/SC29/WG11 “Results of EE1 on ‘Cafe’ Sequence,” M17488, April 2010.