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Title: Results of EE1 on ‘Pantomime’ Sequence

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1. Introduction

This document reports experimental results of the depth estimation on 'Pantomime' sequence in response to EE1 of 3D video coding [1]. We checked the performance of newly integrated techniques in DERS 5.0: depth reference mode and soft-segmentation matching method. The comparison was done by original views and synthesized views.

2. Results of Depth Estimation

We performed the depth estimation experiment following the description of EE in the document N10720 [1]. In order to check the optimized configurations, we tested newly added parameters in DERS 5.0 and compare with the depth video obtained by the best combinations of parameters in the last EE. Table 1 shows the best combinations of parameters in the last EE.

Table 1. Best combinations of parameters in the last EE

Precision	Half-pel
Smoothing coefficient	1.0
Matching block	3x3
Depth estimation mode	Semi-automatic (Nagoya)
Temporal weight	0.6
View number	37, 39, 41

2.1. Depth Reference Mode

Figure 1 shows the synthesis results for depth reference mode. As shown in Figure 1(b), visible artifacts exist near the bag at the background.



(a) conventional (b) depth reference mode
Figure 1. synthesis results for depth reference mode

Table 2 shows the average PSNR for the depth reference mode. From the results, we notice that the depth reference mode improves the average PSNR, while it reduces the subjective quality.

Table 2. Average PSNR for the depth reference mode

Method	Synthesized view PSNR (dB)		Average PSNR (dB)
	View 38	View 40	
Conventional	34.2135	35.7348	34.9741
Depth reference mode	34.3079	36.2386	35.2732

2.2. Soft-segmentation Matching Method

The soft-segmentation matching method includes four parameters: SoftDistanceCoeff, SoftColorCoeff, SoftBlockWidth, and SoftBlockHeight. Figure 2 shows the synthesis results for soft-segmentation matching method with default parameters [2].

- SoftDistanceCoeff = 10
- SoftColorCoeff = 20
- SoftBlockWidth = SoftBlockHeight = 11 .



(a) conventional (b) soft-segmentation matching method
Figure 2. synthesis results for soft-segmentation matching method

As shown in Figure 2(a) and Figure 2(b), the synthesis results were almost the same in terms of subjective quality. However, as shown in Table 3, the average PSNR for soft-segmentation matching method was decreased compared with the conventional method.

Table 3. Average PSNR for soft-segmentation matching method

Method	Synthesized view PSNR (dB)		Average PSNR (dB)
	View 38	View 40	
Conventional	34.2135	35.7348	34.9741
Soft-segmentation (default)	34.1317	35.4859	34.8088

In order to find the optimal parameter set, we first tested the performance of each parameter with fixating other parameters as default. Notice that we assume that the width and the height of the block is the same.

Table 4 through Table 6 and Figure 3 through Figure 5 shows average PSNRs for each parameter. From those results, we determine the best combination of parameters expecting the best performance. Therefore, the best parameter setting is as follows.

- SoftDistanceCoeff = 35
- SoftColorCoeff = 40
- SoftBlockWidth = SoftBlockHeight = 3

Table 4. Average PSNR for soft-segmentation matching method (SoftDistanceCoeff)

SoftDistanceCoeff	Synthesized view PSNR (dB)		Average PSNR (dB)
	View 38	View 40	
5	34.1277	35.4799	34.8038
10 (Default)	34.1317	35.4859	34.8088
15	34.1429	35.5195	34.8312
20	34.2592	35.5198	34.8895
25	34.2630	35.6292	34.9461
30	34.3191	35.6283	34.9737
35	34.3311	35.6429	34.9870
40	34.3147	35.6425	34.9786
Conventional	34.2135	35.7348	34.9741

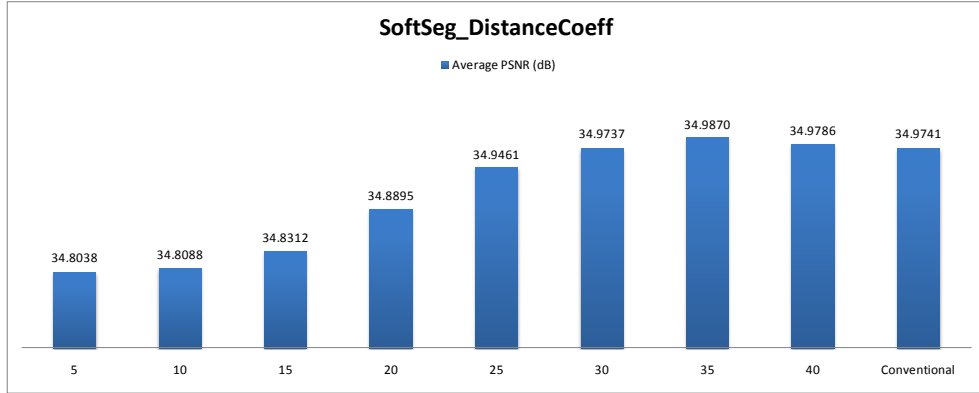


Figure 3. Average PSNR for soft-segmentation matching method (SoftDistanceCoeff)

Table 5. Average PSNR for soft-segmentation matching method (SoftColorCoeff)

SoftColorCoeff	Synthesized view PSNR (dB)		Average PSNR (dB)
	View 38	View 40	
10	34.0559	35.4273	34.7416
15	34.0437	35.4713	34.7575
20 (Default)	34.1317	35.4859	34.8088
25	34.1574	35.4860	34.8217
30	34.1897	35.5097	34.8497
35	34.1938	35.5534	34.8736
40	34.2697	35.6199	34.9448
45	34.2327	35.3411	34.7869
Conventional	34.2135	35.7348	34.9741

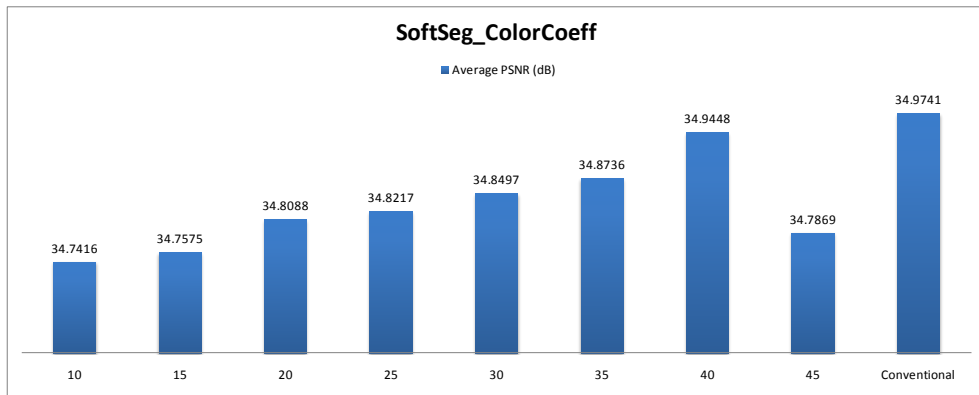


Figure 4. Average PSNR for soft-segmentation matching method (SoftColorCoeff)

Table 6. Average PSNR for soft-segmentation matching method (SoftBlock)

SoftBlock	Synthesized view PSNR (dB)		Average PSNR (dB)
	View 38	View 40	
3	34.3849	35.7291	35.0570
5	34.3776	35.6549	35.0163
7	34.3583	35.5916	34.9749
9	34.2421	35.5696	34.9058
11 (Default)	34.1317	35.4859	34.8088
13	34.0825	35.5130	34.7978
15	33.7758	35.5317	34.6537
Conventional	34.2135	35.7348	34.9741

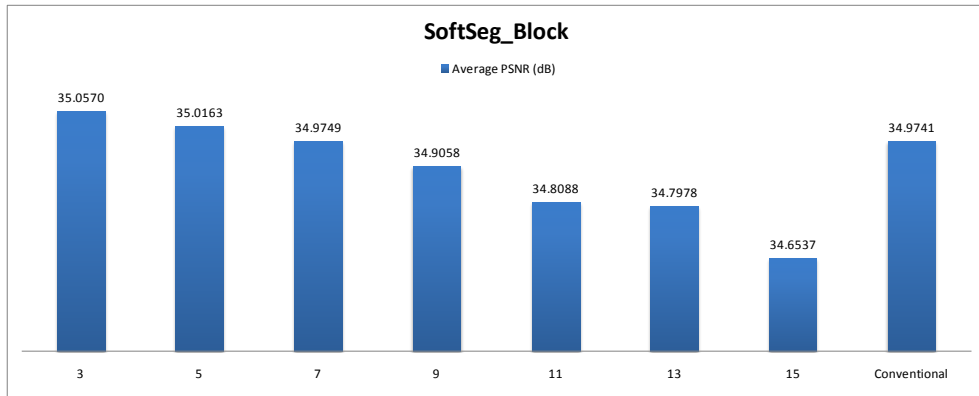


Figure 5. Average PSNR for soft-segmentation matching method (SoftBlock)

2.3. Overall Evaluation

We compare three pairs of synthesized views obtained by three methods for overall evaluation: conventional mode, only depth reference mode, and depth reference mode with Soft-segmentation. As shown in Table 7 and Figure 6, the average PSNR was the highest when exploiting only depth reference mode.

Table 7. Average PSNR for each method

Method	Synthesized view PSNR (dB)		Average PSNR (dB)
	View 38	View 40	
Conventional	34.2135	35.7348	34.9741
Only depth reference mode	34.3079	36.2386	35.2732
Depth reference mode with Soft-segmentation (optimal)	34.3454	36.1656	35.2555

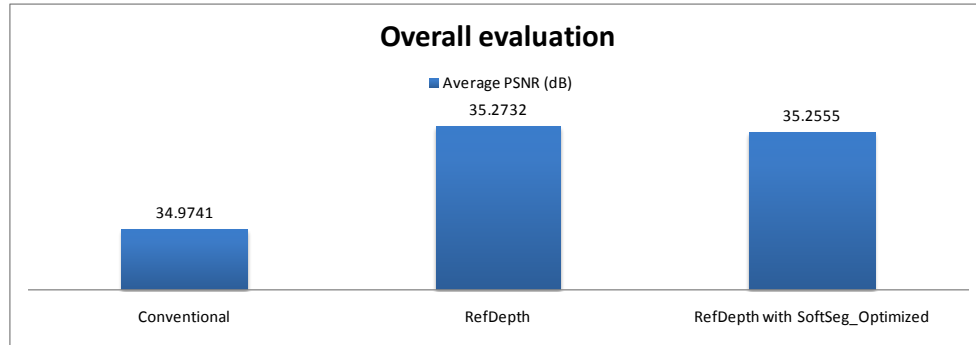


Figure 6. Average PSNR for overall evaluation

2.4. Observations of EE1

- Depth reference mode improved the average PSNR of synthesized views. However, the subjective quality was rather worse than before.
- Soft-segmentation matching method reduced the average PSNR of synthesized views and the subjective quality was almost the same.

3. Conclusion

In this document, we reported that the performance of the depth reference mode and the soft-segmentation matching method. In conclusion on EE1, the depth reference mode is acceptable if it shows further improvement of subjective quality.

4. Acknowledgements

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5. References

- [1] ISO/IEC JTC1/SC29/WG11 "Description of Exploration Experiments in 3D Video Coding," N10720, July 2009.
- [2] ISO/IEC JTC1/SC29/WG11 "An enhancement of Depth Estimation Reference Software with use of soft-segmentation," M16757, July 2009.