JCT3V-H0068
Simplification of DBBP in 3D-HEVC

Min Woo Park

Multimedia Platform Lab.
DMC R&D Center
Samsung Electronics

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Segmentation Threshold in DBBP

❖ Currently, the threshold derivation process need to access all depth pixels in the corresponding depth block

❖ To simplify the derivation process, we propose to use only 4 corner depth pixels to derive the threshold for making a segmentation mask
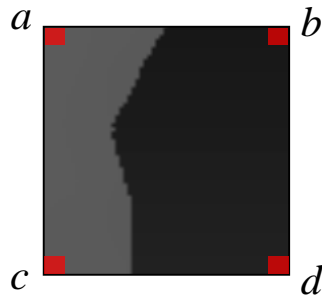
Current

$$Th_{curr} = \frac{1}{N^2} \sum_{x=0}^{N-1} \sum_{y=0}^{N-1} d(x, y)$$
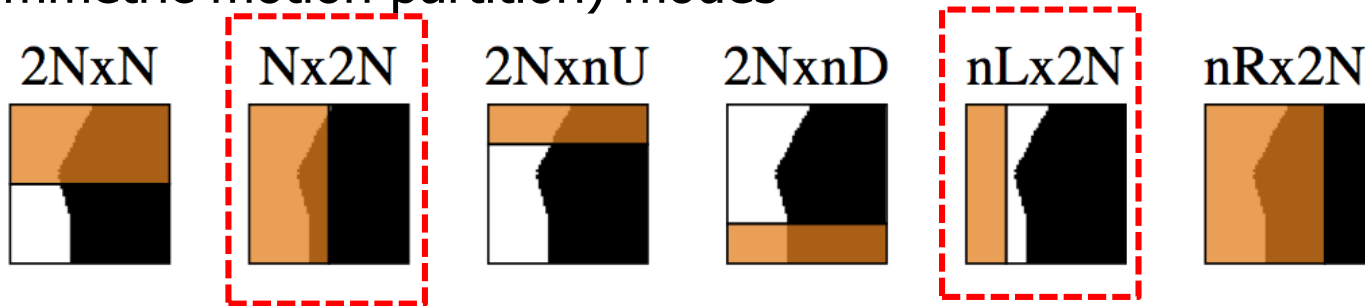
Proposed

$$Th_{prop} = (a + b + c + d) >> 2$$

Simulation Results (Test 1)

❖ Based on CTC with HTM 10.0r1 reference software

❖ Test 1: Simplification of the segmentation threshold derivation

- No coding loss
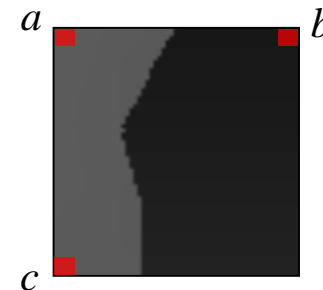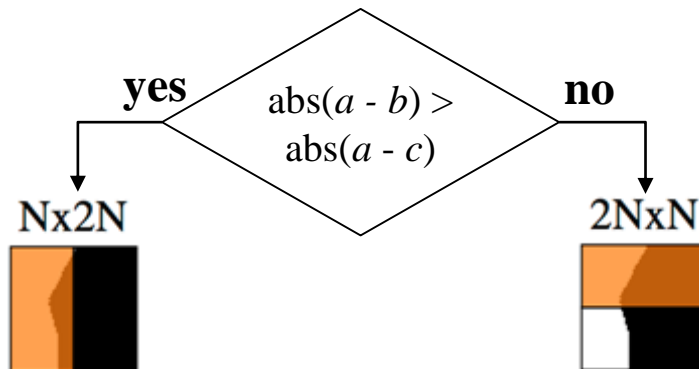 - 0.02% bit-saving for synthesized views
- 97.2% encoding time

	video 0	video 1	video 2	video PSNR / video bitrate	video PSNR / total bitrate	synth PSNR / total bitrate	enc time	dec time	ren time
Balloons	0.00%	0.06%	-0.01%	0.01%	0.01%	-0.02%	96.4%	106.0%	101.5%
Kendo	0.00%	0.00%	-0.08%	-0.01%	0.01%	0.05%	96.6%	100.7%	104.6%
Newspaper_CC	0.00%	-0.01%	-0.02%	-0.01%	-0.03%	-0.07%	95.4%	107.7%	101.4%
GT_Fly	0.00%	0.12%	-0.22%	-0.01%	-0.01%	0.04%	98.4%	91.6%	100.6%
Poznan_Hall2	0.00%	0.13%	-0.23%	0.00%	-0.01%	-0.08%	98.3%	105.4%	93.6%
Poznan_Street	0.00%	-0.06%	-0.01%	-0.01%	0.00%	0.00%	97.0%	94.3%	95.5%
Undo_Dancer	0.00%	-0.05%	-0.04%	0.00%	0.00%	-0.03%	97.4%	89.6%	95.3%
Shark	0.00%	0.12%	0.00%	0.01%	0.01%	-0.01%	97.7%	104.8%	104.6%
1024x768	0.00%	0.02%	-0.04%	0.00%	0.00%	-0.01%	96.2%	104.8%	102.5%
1920x1088	0.00%	0.05%	-0.10%	0.00%	0.00%	-0.02%	97.8%	97.2%	97.9%
average	**0.00%**	**0.04%**	**-0.08%**	**0.00%**	**0.00%**	**-0.02%**	**97.2%**	**100.0%**	**99.6%**

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PU Partition Derivation in DBBP

❖ Currently, DBBP can have 6 PU partition modes including 4 AMP (asymmetric motion partition) modes

2NxN   Nx2N   2NxnU   2NxnD   nLx2N   nRx2N

▪ But, 4 AMP modes can be covered 2 symmetric partition modes

• For example, either Nx2N or nLx2N can be the best mode in the above Fig.

❖ Therefore, we propose to use only 2 symmetric partition modes and to modify the partition derivation process as below

$$\text{abs}(a - b) > \text{abs}(a - c)$$

yes → Nx2N

no → 2NxN

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Simulation Results (Test 2)

❖ Based on CTC with HTM 10.0r1 reference software

❖ Test 2: Simplification of the partition mode derivation

■ No coding loss

• 0.04% bit-saving for synthesized views

■ 96.1% decoding time

	video 0	video 1	video 2	video PSNR / video bitrate	video PSNR / total bitrate	synth PSNR / total bitrate	enc time	dec time	ren time
Balloons	0.00%	-0.12%	0.02%	0.00%	0.00%	-0.04%	100.0%	102.1%	99.7%
Kendo	0.00%	-0.08%	-0.10%	-0.03%	-0.03%	0.04%	99.7%	97.3%	102.4%
Newspaper_CC	0.00%	0.00%	-0.24%	-0.04%	-0.04%	-0.06%	99.5%	101.2%	100.5%
GT_Fly	0.00%	-0.09%	-0.22%	-0.03%	-0.03%	-0.02%	100.5%	89.3%	101.5%
Poznan_Hall2	0.00%	-0.36%	-0.32%	-0.11%	-0.12%	-0.20%	99.6%	96.3%	94.1%
Poznan_Street	0.00%	-0.11%	-0.03%	-0.01%	0.00%	-0.01%	99.8%	88.0%	95.0%
Undo_Dancer	0.00%	-0.15%	-0.11%	-0.03%	-0.04%	-0.03%	100.1%	91.4%	96.1%
Shark	0.00%	-0.14%	-0.11%	-0.01%	-0.01%	-0.01%	98.7%	102.9%	104.3%
1024x768	0.00%	-0.07%	-0.11%	-0.02%	-0.02%	-0.02%	99.7%	100.2%	100.9%
1920x1088	0.00%	-0.17%	-0.16%	-0.04%	-0.04%	-0.05%	99.7%	93.6%	98.2%
average	**0.00%**	**-0.13%**	**-0.14%**	**-0.03%**	**-0.03%**	**-0.04%**	**99.7%**	**96.1%**	**99.2%**

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Simulation Results (Test 3)

- ❖ Based on CTC with HTM 10.0r1 reference software
- ❖ Test 3: Combining Test 1 and Test 2
  - ■ No coding loss
    - • 0.04% bit-saving for synthesized views
  - ■ 96.9% encoding time and 97.2% decoding time

	video 0	video 1	video 2	video PSNR / video bitrate	video PSNR / total bitrate	synth PSNR / total bitrate	enc time	dec time	ren time
Balloons	0.00%	0.06%	0.00%	0.01%	-0.01%	-0.01%	96.1%	101.1%	100.2%
Kendo	0.00%	-0.17%	-0.06%	-0.04%	-0.02%	-0.02%	95.8%	100.5%	102.2%
Newspaper_CC	0.00%	-0.04%	-0.16%	-0.04%	-0.04%	-0.05%	94.8%	101.3%	101.3%
GT_Fly	0.00%	-0.02%	-0.25%	-0.03%	-0.02%	0.00%	99.2%	92.8%	103.4%
Poznan_Hall2	0.00%	-0.08%	-0.07%	0.01%	0.00%	-0.11%	96.8%	93.6%	93.5%
Poznan_Street	0.00%	-0.08%	-0.05%	-0.02%	-0.03%	-0.04%	97.0%	98.9%	94.6%
Undo_Dancer	0.00%	-0.18%	-0.12%	-0.02%	-0.02%	-0.04%	98.5%	91.3%	95.1%
Shark	0.00%	-0.05%	-0.15%	-0.01%	-0.01%	-0.01%	96.9%	98.1%	105.4%
1024x768	0.00%	-0.05%	-0.07%	-0.02%	-0.02%	-0.03%	95.5%	101.0%	101.2%
1920x1088	0.00%	-0.08%	-0.13%	-0.01%	-0.02%	-0.04%	97.7%	94.9%	98.4%
average	**0.00%**	**-0.07%**	**-0.11%**	**-0.02%**	**-0.02%**	**-0.04%**	**96.9%**	**97.2%**	**99.5%**

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Conclusion

❖ We proposed to simply the derivation processes of the segmentation threshold and the PU partition

- Only using 4 corner depth pixels in derivation processes
- No coding loss (0.04% bit-saving for synthesized views)
- About 97% encoding/decoding time

❖ We recommend to adopt the proposed methods into next 3D-HEVC WD

Thanks RWTH Aachen University for the cross checking (JCT3V-H0071).

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