

# **JCT3V-I0076: Simplification of Threshold Derivation for DBBP and DMM4**

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# Segmentation Threshold Derivation

- ❖ This proposal is the follow-up of JCT3V-H0068
- ❖ Currently, the threshold derivation process in DBBP and DMM4 needs to access all the samples in the corresponding depth or texture block
  - In WD, DBBP and DMM4 use the same threshold derivation process
- ❖ To simplify the derivation process, we propose to only use 4 corner samples to derive the threshold for generating a binary segmentation mask

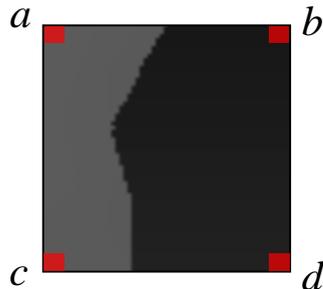
**Current**



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



**Proposed**



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

# Simulation Results – Test 1

## ❖ Test 1: Applying the proposed method to DBBP

- Based on CTC with HTM 11 reference software
- No coding loss with 96.9% 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%	0.00%	0.07%	0.00%	0.02%	0.03%	96.2%	96.0%	101.6%
Kendo	0.00%	0.09%	0.04%	0.01%	-0.02%	0.03%	95.7%	99.6%	98.9%
Newspaper_CC	0.00%	-0.05%	0.10%	0.00%	0.02%	0.04%	94.2%	95.5%	98.9%
GT_Fly	0.00%	0.02%	0.02%	0.01%	0.00%	-0.08%	98.3%	105.6%	102.1%
Poznan_Hall2	0.00%	0.07%	-0.18%	0.00%	0.00%	0.01%	97.7%	100.9%	100.7%
Poznan_Street	0.00%	0.16%	0.07%	0.03%	0.03%	0.02%	97.0%	105.0%	101.8%
Undo_Dancer	0.00%	0.00%	0.02%	0.01%	0.02%	0.07%	97.8%	99.1%	100.7%
Shark	0.00%	-0.02%	0.04%	0.00%	0.00%	0.01%	98.1%	99.2%	102.4%
1024x768	0.00%	0.01%	0.07%	0.00%	0.01%	0.03%	95.3%	97.1%	99.8%
1920x1088	0.00%	0.04%	-0.01%	0.01%	0.01%	0.01%	97.8%	102.0%	101.5%
<b>average</b>	<b>0.00%</b>	<b>0.03%</b>	<b>0.02%</b>	<b>0.01%</b>	<b>0.01%</b>	<b>0.02%</b>	<b>96.9%</b>	<b>100.1%</b>	<b>100.9%</b>

# Simulation Results – Test 2

## ❖ Test 2: Applying the proposed method to DMM4

- Based on CTC with HTM 11 reference software
- No coding loss

	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%	0.04%	0.06%	0.02%	0.00%	0.04%	99.9%	95.9%	101.2%
Kendo	0.00%	-0.12%	-0.10%	-0.04%	-0.07%	-0.13%	100.1%	99.8%	100.0%
Newspaper_CC	0.00%	-0.11%	-0.07%	-0.02%	0.01%	-0.04%	99.2%	100.7%	99.5%
GT_Fly	0.00%	-0.11%	-0.02%	-0.01%	0.04%	0.11%	99.9%	102.2%	101.5%
Poznan_Hall2	0.00%	-0.09%	0.17%	0.01%	0.02%	0.14%	99.1%	95.7%	101.2%
Poznan_Street	0.00%	0.20%	-0.08%	0.01%	0.02%	0.03%	99.9%	99.0%	100.8%
Undo_Dancer	0.00%	-0.14%	-0.15%	-0.03%	-0.03%	-0.01%	99.6%	100.7%	101.7%
Shark	0.00%	-0.07%	-0.04%	-0.02%	-0.03%	0.01%	99.7%	97.8%	103.3%
1024x768	0.00%	-0.06%	-0.04%	-0.01%	-0.02%	-0.05%	99.7%	98.8%	100.2%
1920x1088	0.00%	-0.04%	-0.02%	-0.01%	0.01%	0.06%	99.6%	99.1%	101.7%
<b>average</b>	<b>0.00%</b>	<b>-0.05%</b>	<b>-0.03%</b>	<b>-0.01%</b>	<b>0.00%</b>	<b>0.02%</b>	<b>99.7%</b>	<b>99.0%</b>	<b>101.2%</b>

# Simulation Results – Test 2 AI

- ❖ **Test 2 AI:** Applying the proposed method to DMM4
  - Based on AI test condition with HTM 11 reference software
  - 0.1% bit-saving on synthesized views

	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%	0.00%	0.00%	0.00%	0.00%	-0.02%	99.4%	91.1%	95.9%
Kendo	0.00%	0.00%	0.00%	0.00%	0.01%	-0.04%	98.9%	98.1%	96.4%
Newspaper_CC	0.00%	0.00%	0.00%	0.00%	0.02%	-0.06%	98.8%	90.3%	97.0%
GT_Fly	0.00%	0.00%	0.00%	0.00%	0.03%	-0.07%	98.6%	109.3%	99.0%
Poznan_Hall2	0.00%	0.00%	0.00%	0.00%	0.01%	-0.06%	98.7%	102.0%	105.8%
Poznan_Street	0.00%	0.00%	0.00%	0.00%	0.01%	-0.03%	99.3%	104.6%	100.5%
Undo_Dancer	0.00%	0.00%	0.00%	0.00%	0.01%	-0.02%	99.5%	99.7%	99.7%
Shark	0.00%	0.00%	0.00%	0.00%	-0.10%	-0.28%	97.8%	103.8%	101.1%
1024x768	0.00%	0.00%	0.00%	0.00%	0.01%	-0.04%	99.0%	93.2%	96.4%
1920x1088	0.00%	0.00%	0.00%	0.00%	-0.01%	-0.09%	98.8%	103.9%	101.2%
<b>average</b>	<b>0.00%</b>	<b>0.00%</b>	<b>0.00%</b>	<b>0.00%</b>	<b>0.00%</b>	<b>-0.07%</b>	<b>98.9%</b>	<b>99.9%</b>	<b>99.4%</b>

# Simulation Results – Test 3

## ❖ Test 3: Applying the proposed method to both DBBP & DMM4

- Based on CTC with HTM 11 reference software
- No coding loss with 96.7% 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%	0.09%	0.11%	0.03%	0.03%	0.03%	96.1%	95.6%	100.5%
Kendo	0.00%	-0.12%	0.00%	-0.03%	-0.08%	-0.08%	96.1%	96.5%	100.6%
Newspaper_CC	0.00%	-0.17%	0.10%	0.01%	0.04%	0.00%	94.1%	93.0%	98.9%
GT_Fly	0.00%	-0.07%	-0.06%	0.00%	0.05%	0.09%	98.1%	106.7%	103.2%
Poznan_Hall2	0.00%	-0.01%	0.05%	0.01%	0.01%	0.09%	97.4%	93.5%	101.3%
Poznan_Street	0.00%	0.22%	0.04%	0.03%	0.03%	0.04%	97.0%	97.2%	100.8%
Undo_Dancer	0.00%	-0.07%	-0.15%	-0.01%	-0.01%	-0.02%	97.1%	98.7%	101.9%
Shark	0.00%	-0.02%	0.10%	-0.01%	-0.01%	0.01%	97.6%	101.3%	102.6%
1024x768	0.00%	-0.07%	0.07%	0.00%	0.00%	-0.02%	95.4%	95.0%	100.0%
1920x1088	0.00%	0.01%	0.00%	0.00%	0.01%	0.04%	97.4%	99.5%	102.0%
<b>average</b>	<b>0.00%</b>	<b>-0.02%</b>	<b>0.02%</b>	<b>0.00%</b>	<b>0.01%</b>	<b>0.02%</b>	<b>96.7%</b>	<b>97.8%</b>	<b>101.2%</b>

# Simulation Results – Test 4

- ❖ **Test 4:** Additionally applying to the partition derivation in DBBP
  - The partition derivation in DBBP also has the threshold derivation
  - So, the proposed method can be applied to the partition derivation
  - Based on CTC with HTM 11 reference software
  - No coding loss

	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%	0.08%	0.14%	0.03%	0.04%	0.03%	93.8%	93.5%	96.7%
Kendo	0.00%	-0.08%	0.01%	-0.01%	-0.03%	-0.05%	93.3%	91.8%	95.1%
Newspaper_CC	0.00%	-0.12%	0.14%	0.01%	0.03%	0.00%	92.3%	97.1%	95.4%
GT_Fly	0.00%	-0.07%	-0.01%	0.00%	0.05%	0.12%	95.1%	103.3%	97.6%
Poznan_Hall2	0.00%	0.11%	0.00%	0.02%	0.00%	0.10%	94.6%	96.9%	97.6%
Poznan_Street	0.00%	0.09%	0.00%	0.01%	0.01%	0.00%	94.5%	91.8%	96.3%
Undo_Dancer	0.00%	-0.07%	-0.13%	-0.01%	-0.01%	0.02%	95.0%	99.0%	95.9%
Shark	0.00%	-0.03%	0.09%	-0.01%	-0.01%	0.02%	94.9%	96.4%	98.2%
1024x768	0.00%	-0.04%	0.10%	0.01%	0.01%	-0.01%	93.2%	94.1%	95.7%
1920x1088	0.00%	0.01%	-0.01%	0.00%	0.01%	0.05%	94.8%	97.5%	97.1%
<b>average</b>	<b>0.00%</b>	<b>-0.01%</b>	<b>0.03%</b>	<b>0.01%</b>	<b>0.01%</b>	<b>0.03%</b>	<b>94.2%</b>	<b>96.2%</b>	<b>96.6%</b>

# Conclusion

- ❖ We proposed to simplify the threshold derivation process for DBBP and DMM4
  - Only using 4 corner samples in derivation processes
  - No coding loss with about 97% encoding time
  - For DMM4, 0.1% bit-saving on synthesized view under AI test condition
- ❖ We recommend to adopt the proposed method into next 3D-HEVC WD

**Thanks [MediaTek](#) for the cross check (JCT3V-I0138).**

