JVET-P0487
CE8-related : Binarization of palette escape value

Sunmi Yoo, Jie Zhao, Junghak Nam, Jungah Choi, Seung Hwan Kim, Jaehyun Lim

LG Electronics Inc.

Summary

- Proposal
  - Binarization for escape coding
    - QP dependent binarization (deriving cMax according to QP and bitdepth)
    - EG3 → TB
- Simulation results (Based on VTM-6.0, YUV 4:4:4 configuration)

	Standard QPs									
	DualTree = 1					DualTree = 0				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
AI overall	-0.06%	-0.04%	-0.04%	100%	100%	-0.10%	-0.23%	-0.24%	100%	100%
RA overall	0.00%	-0.08%	-0.11%	100%	99%	-0.08%	-0.10%	-0.13%	100%	99%
LDB overall	-0.04%	-0.08%	0.03%	100%	99%	0.09%	0.04%	0.05%	99%	99%
	Low QPs									
AI overall	-1.06%	-1.35%	-1.33%	100%	100%	-1.50%	-1.66%	-1.68%	100%	100%
RA overall	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
LDB overall	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	-0.68%	-0.62%	-0.63%	100%	100%

- Thank KDDI (JVET-P0943) for crosschecking ☺

Proposed method

- Escape value binarization using TB (Truncated binary coding)
  - QP dependent binarization
    - The input for TB, cMax (the maximum value for binarization) is calculated by :
      - Q((1 << $\text{BitDepth}_{\{\text{Luma, Chroma}\}}$) - 1), where Q(x) is quantization function

- Alternative QP derivation is used
  - Input bitdepth is condisdered for escape value coding
    - 8-bit sequence : remains the same as current VVC
    - 10-bit sequence : no bdoffset is applied

Experimental result (Standard QP)

	All Intra Main10									
	DualTree = 1					**DualTree = 0**				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
TGM	-0.13%	-0.07%	-0.12%	101%	99%	-0.40%	-0.52%	-0.57%	100%	100%
TGM	-0.09%	-0.08%	-0.03%	101%	100%	0.13%	-0.10%	-0.07%	101%	100%
A	-0.03%	0.02%	0.01%	100%	101%	0.02%	0.01%	0.02%	101%	100%
M	-0.01%	-0.07%	-0.02%	100%	100%	-0.21%	-0.39%	-0.43%	100%	99%
CC	0.00%	0.02%	-0.01%	100%	100%	0.00%	0.00%	0.00%	100%	101%
Overall	-0.06%	-0.04%	-0.04%	100%	100%	-0.10%	-0.23%	-0.24%	100%	100%
	Random access Main10									
	DualTree = 1					**DualTree = 0**				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
TGM	-0.18%	-0.16%	-0.18%	100%	99%	-0.24%	-0.25%	-0.25%	100%	97%
TGM	0.06%	-0.14%	-0.24%	100%	99%	-0.04%	-0.06%	-0.03%	100%	98%
A	0.11%	0.06%	0.02%	100%	100%	-0.01%	-0.02%	-0.02%	100%	100%
M	0.06%	-0.09%	-0.07%	100%	99%	-0.06%	-0.08%	-0.30%	100%	99%
CC	0.00%	0.00%	0.05%	100%	102%	0.00%	0.00%	0.00%	100%	102%
Overall	0.00%	-0.08%	-0.11%	100%	99%	-0.08%	-0.10%	-0.13%	100%	99%
	Low delay B Main10									
	DualTree = 1					**DualTree = 0**				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
TGM	-0.06%	-0.08%	-0.14%	100%	99%	-0.01%	0.06%	-0.10%	99%	99%
TGM	-0.07%	-0.17%	0.56%	100%	99%	0.30%	-0.02%	0.55%	99%	100%
A	0.02%	0.05%	0.04%	100%	99%	-0.06%	0.03%	0.08%	100%	101%
M	-0.09%	-0.08%	-0.44%	100%	98%	0.19%	0.11%	-0.41%	99%	99%
CC	0.01%	-0.07%	0.02%	100%	99%	0.00%	0.00%	0.01%	99%	99%
Overall	-0.04%	-0.08%	0.03%	100%	99%	0.09%	0.04%	0.05%	99%	99%

Experimental result (Low QP)

	All Intra Main10									
	DualTree = 1					DualTree = 0				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
TGM	-2.02%	-2.59%	-2.58%	100%	101%	-3.67%	-3.67%	-3.81%	100%	100%
TGM	-0.77%	-0.93%	-0.86%	100%	101%	-1.11%	-1.24%	-1.18%	99%	100%
A	-0.24%	-0.55%	-0.47%	100%	100%	-0.20%	-0.85%	-0.79%	100%	100%
M	-1.69%	-1.95%	-2.01%	100%	100%	-1.45%	-1.45%	-1.50%	100%	100%
CC	0.01%	-0.02%	0.00%	99%	100%	0.00%	0.01%	-0.01%	100%	100%
Overall	-1.06%	-1.35%	-1.33%	100%	100%	-1.50%	-1.66%	-1.68%	100%	100%
	Random access Main10									
	DualTree = 1					**DualTree = 0**				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
TGM	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
TGM	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
A	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
M	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
CC	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Overall	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
	Low delay B Main10									
	DualTree = 1					**DualTree = 0**				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
TGM	-1.30%	-1.41%	-1.42%	99%	100%	-1.78%	-1.77%	-1.79%	100%	100%
TGM	-0.17%	-0.40%	-0.38%	101%	103%	-0.32%	-0.31%	-0.30%	99%	101%
A	-0.05%	-0.16%	-0.12%	100%	100%	-0.54%	-0.12%	-0.08%	100%	100%
M	-0.54%	-0.09%	0.05%	100%	101%	-0.32%	-0.41%	-0.52%	100%	101%
CC	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	0.00%	0.01%	0.01%	100%	100%
Overall	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	-0.68%	-0.62%	-0.63%	100%	100%

Experimental result (Low QP, min Qp applied)

	All Intra Main10									
	DualTree = 1					DualTree = 0				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
TGM	-1.96%	-3.49%	-3.46%	100%	99%	-3.36%	-4.41%	-4.55%	100%	100%
TGM	-0.63%	-1.18%	-1.11%	100%	104%	-0.98%	-1.51%	-1.47%	100%	101%
A	-0.16%	-0.71%	-0.61%	99%	103%	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
M	-1.56%	-2.79%	-2.85%	99%	101%	-1.32%	-1.74%	-1.87%	100%	100%
CC	0.01%	-0.02%	0.00%	99%	101%	0.00%	0.01%	-0.01%	100%	100%
Overall	-0.97%	-1.83%	-1.79%	100%	102%	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
	Random access Main10									
	DualTree = 1					**DualTree = 0**				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
TGM	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
TGM	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
A	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
M	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
CC	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Overall	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
	Low delay B Main10									
	DualTree = 1					**DualTree = 0**				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
TGM	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
TGM	-0.10%	-0.62%	-0.60%	101%	102%	-0.17%	-0.51%	-0.52%	98%	101%
A	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
M	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
CC	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Overall	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!

Conclusion

- Alternative binarization for palette escape value is proposed
  - To change from 3rd order of EG to TB
  - QP dependent binarization, as the maximum value for TB differs depending on QP value
  - The difference between ChannelBitDepth and InputBitDepth is applied for quantization

- It is proposed to be studied in CE

Thank you