

SHARP

Be Original.

Non-CE9: A bug fix of BDOF specification JVET-00207

SHARP CORPORATION

Takeshi Chujoh, Eiich Sasaki and Tomohiro Ikai

- A bug fix for the BDOF specification, when bitdepth is greater than 12-bit.
 - At the previous meeting, there was a discussion about the BDOF specifications when bitdepth is greater than 12-bit. However, the verification of specification was insufficient.
- Set only two variables o fixed values.
- The specification and experimental results of bitdepth from 8-bit to 12-bit including CTC are not changed.

Two problems

- Since the precision of variables tempH and tempV decreases as the variable bitDepth increases, the optical flow cannot be solved.
- The threshold variable mvRefineThres of the optical flow should be fixed value if the internal bit precision is constant.

		bitDepth								
		8	9	10	11	12	13	14	15	16
Value	shift1	6	6	6	6	6	7	8	9	10
	shift2	4	4	4	4	4	5	6	7	8
	shift3	1	1	1	1	1	2	3	4	5
	shift4	7	6	5	4	3	3	3	3	3
	mvRefineThres	32	32	32	32	32	64	128	256	512
Precision (dynamic range)	predSamplesL0	14	14	14	14	14	15	16	17	18
	predSamplesL1	(16)	(16)	(16)	(16)	(16)	(17)	(18)	(19)	(20)
	gradientHL0									
	gradientVL0	9	9	9	9	9	9	9	9	9
	gradientHL1	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
	gradientVL1									
	Diff	11 (13)	11 (13)	11 (13)	11 (13)	11 (13)	11 (13)	11 (13)	11 (13)	11 (13)
	tempH	9	9	9	9	9	8	7	6	5
	tempV	(11)	(11)	(11)	(11)	(11)	(10)	(9)	(8)	(7)
	bdofOffset	15 (17)	15 (17)	15 (17)	15 (17)	15 (17)				
	pbSamples	8	9	10	11	12				

- Change only 2 lines.
 - Set the variable shift1 to 6.
 - Set the variable mvRefineThres to 32.

8.5.6.4 Bidirectional optical flow prediction process

Inputs to this process are:

- two variables nCbW and nCbH specifying the width and the height of the current coding block,
- two $(nCbW + 2) \times (nCbH + 2)$ luma prediction sample arrays predSamplesL0 and predSamplesL1,
- the prediction list utilization flags predFlagL0 and predFlagL1,
- the reference indices refIdxL0 and refIdxL1,
- the bidirectional optical flow utilization flags bdofUtilizationFlag[xIdx][yIdx] with $xIdx = 0..(nCbW \gg 2) - 1$, $yIdx = 0..(nCbH \gg 2) - 1$.

Output of this process is the $(nCbW) \times (nCbH)$ array pbSamples of luma prediction sample values.

Variables bitDepth, shift1, shift2, shift3, shift4, offset4, and mvRefineThres are derived as follows:

- The variable bitDepth is set equal to $BitDepth_Y$.
- The variable shift1 is set to equal to ~~$\text{Max}(6, bitDepth - 6)$~~ 6.
- The variable shift2 is set to equal to $\text{Max}(4, bitDepth - 8)$.
- The variable shift3 is set to equal to $\text{Max}(1, bitDepth - 11)$.
- The variable shift4 is set equal to $\text{Max}(3, 15 - bitDepth)$ and the variable offset4 is set equal to $1 \ll (\text{shift4} - 1)$.
- The variable mvRefineThres is set equal to ~~$1 \ll \text{Max}(5, bitDepth - 7)$~~ 32.

- If the variable shift1 is set equal to 6, the precision of variables tempH and tempV become constant to derive the optical flow correctly.
- As the precision of gradients is proportional to that of predSamples, bdofOffset is derived correctly.

		bitDepth								
		8	9	10	11	12	13	14	15	16
Value	shift1	6	6	6	6	6	6	6	6	6
	shift2	4	4	4	4	4	5	6	7	8
	shift3	1	1	1	1	1	2	3	4	5
	shift4	7	6	5	4	3	3	3	3	3
	mvRefineThres	32	32	32	32	32	32	32	32	32
Precision (dynamic range)	predSamplesL0	14	14	14	14	14	15	16	17	18
	predSamplesL1	(16)	(16)	(16)	(16)	(16)	(17)	(18)	(19)	(20)
	gradientHL0									
	gradientVL0	9	9	9	9	9	10	11	12	13
	gradientHL1	(11)	(11)	(11)	(11)	(11)	(12)	(13)	(14)	(15)
	gradientVL1									
	Diff	11	11	11	11	11	11	11	11	11
		(13)	(13)	(13)	(13)	(13)	(13)	(13)	(13)	(13)
	tempH	9	9	9	9	9	9	9	9	9
	tempV	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
	bdofOffset	15	15	15	15	15	16	17	18	19
		(17)	(17)	(17)	(17)	(17)	(18)	(19)	(20)	(21)
	pbSamples	8	9	10	11	12	13	14	15	16

- In this contribution, we proposed a bug fix for the BDOF specification, when bitdepth is greater than 12-bit.
- Set only two variables to fixed values.
- Recommend to fix this change to WD and VTM software.

SHARP

Be Original.

