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Non-CE9: BDOP for chroma components

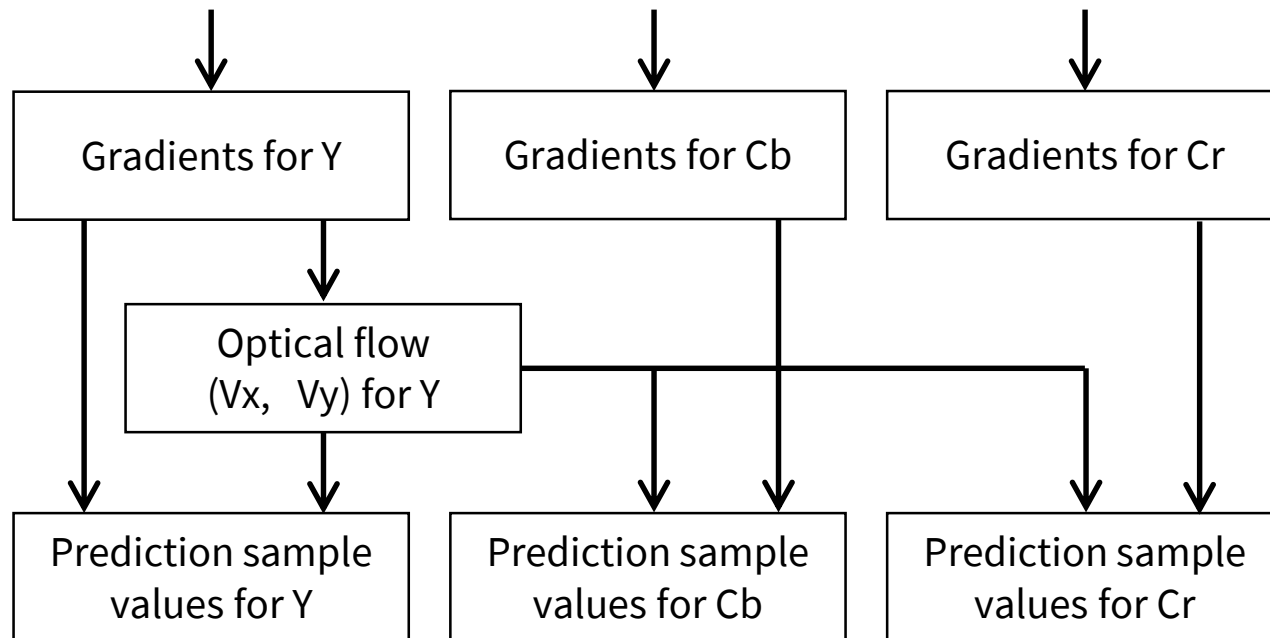
JVET-00210

SHARP CORPORATION

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- WD and VTM software have already supported 4:2:2, 4:4:4 and RGB formats.
- Currently, BDOP applies luma samples.
- In this contribution, a method of BDOP for chroma components, which is not only 4:2:0, but also 4:2:2, 4:4:4 and RGB, is proposed.
- As experimental results, average gain of 0.52%, 0.49%, 0.75% and 1.23% for 4:2:0, 4:2:2, 4:4:4 and RGB, respectively.

- A method to apply BDOF to chroma components efficiently by using optical flow vector obtained by luma component.



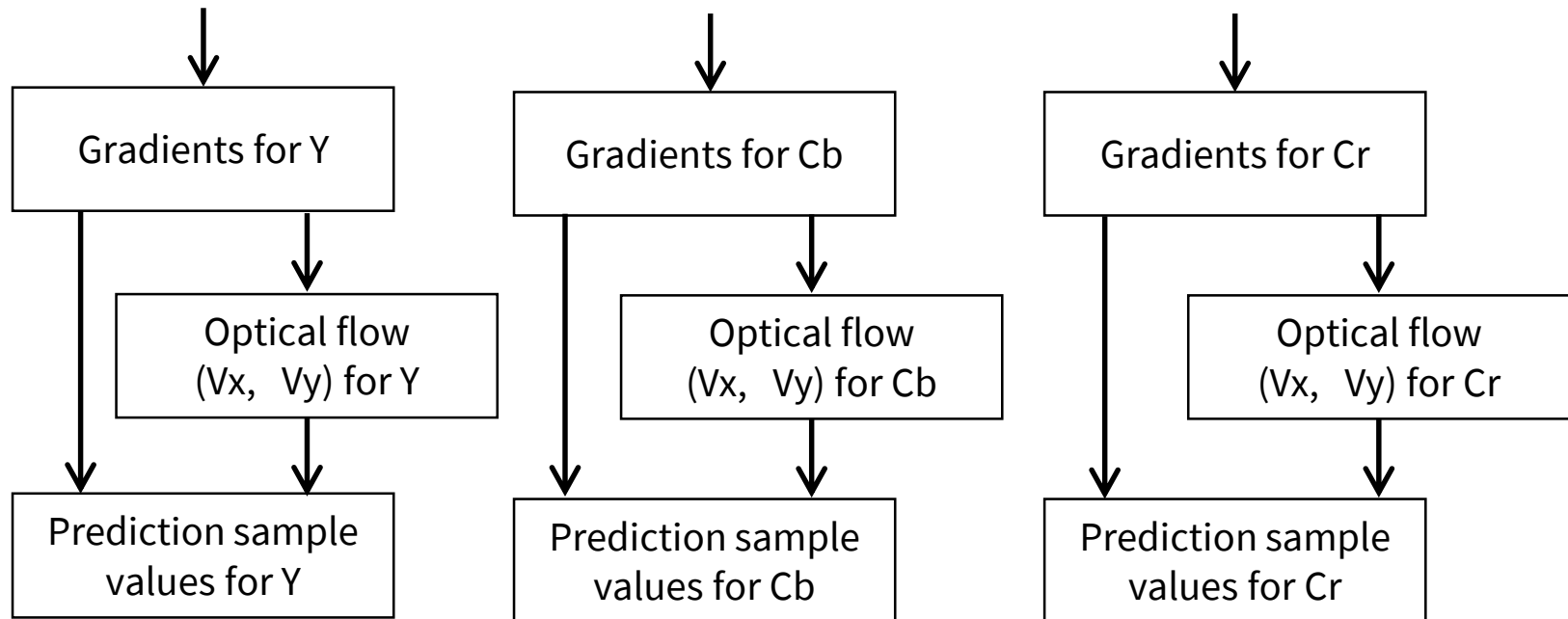
4x4 luma block

2x2 chroma block for 4:2:0
2x4 chroma block for 4:2:2
4x4 chroma block for 4:4:4

- There were gains of 0.43% for Cb and 0.61% for Cr.
- Enc.T 1% and Dec. T 5% were increased.

	Random Access Main 10				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1	-0.01%	-0.34%	-0.54%	101%	105%
Class A2	-0.04%	-0.71%	-1.00%	101%	106%
Class B	0.02%	-0.38%	-0.45%	101%	105%
Class C	-0.01%	-0.34%	-0.57%	101%	105%
Class E					
Overall	-0.01%	-0.43%	-0.61%	101%	105%
Class D	-0.02%	-0.56%	-0.56%	101%	105%
Class F	0.00%	-0.21%	-0.25%	101%	104%

- Two fast techniques are introduced.
 - JVET-O0208: Non-CE9: An improvement of early termination for BDOF
 - JVET-O0211: Non-CE9: A speed up method of BDOF
- Compared to a method to apply BDOF to each component.



- As Two fast techniques has been introduced, the decoding time was improved 2%.
- The coding efficiency is the same or better compared to a method to apply BDOF to each component.
- The 2% encoding time and the 3 % decoding time were decreased.

	Random Access Main 10 (4:2:0)				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Proposed method	-0.01%	-0.43%	-0.61%	101%	105%
Proposed method with speed up techniques	-0.01%	-0.46%	-0.61%	101%	103%
BDOF applied to each component	-0.02%	-0.35%	-0.58%	103%	110%

Experimental results (Range extensions)

	Random Access YUV 4:2:2				
	Y	U	V	EncT	DecT
Proposed method	-0.01%	-0.46%	-0.52%	101%	105%
Proposed method with speed up techniques	0.01%	-0.47%	-0.51%	101%	103%
BDOF applied to each component	-0.02%	-0.38%	-0.50%	104%	111%

	Random Access YUV 4:4:4				
	Y	U	V	EncT	DecT
Proposed method	0.00%	-0.56%	-0.95%	102%	106%
Proposed method with speed up techniques	-0.01%	-0.56%	-0.90%	102%	104%
BDOF applied to each component	0.01%	-0.50%	-0.81%	106%	113%

	Random Access RGB 4:4:4				
	Y	U	V	EncT	DecT
Proposed method	-0.15%	-0.94%	-1.51%	101%	106%
Proposed method with speed up techniques	-0.15%	-0.95%	-1.51%	101%	104%
BDOF applied to each component	-0.11%	-0.89%	-1.39%	104%	112%

- In this contribution, we proposed a method to apply BDOF to chroma components efficiently.
 - Our method support not only 4:2:0, but also 4:2:2, 4:4:4 and RGB.
- As experimental results, average chroma gains of 0.52%, 0.49%, 0.75% and 1.23% for 4:2:0, 4:2:2, 4:4:4 and RGB, respectively.
- Recommend to fix this change to WD and VTM software.
- Thank Naeri (LEG, JVET-O0702) and Iwamura-san (NHK, JVET-O0679) for cross-checking.

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