

JVET-P0547

Non-CE5: Deblocking filter at PROF sub-block boundary

Kyohei Unno, Kei Kawamura, Sei Naito
KDDI Corp. (KDDI Research, Inc.)

■ Problem statement

- PROF is a prediction refinement tool considering rotation.
- Motion vectors for each sub-blocks applied PROF don't indicate true motion for the boundary strength (bS) calculation of the deblocking filter.

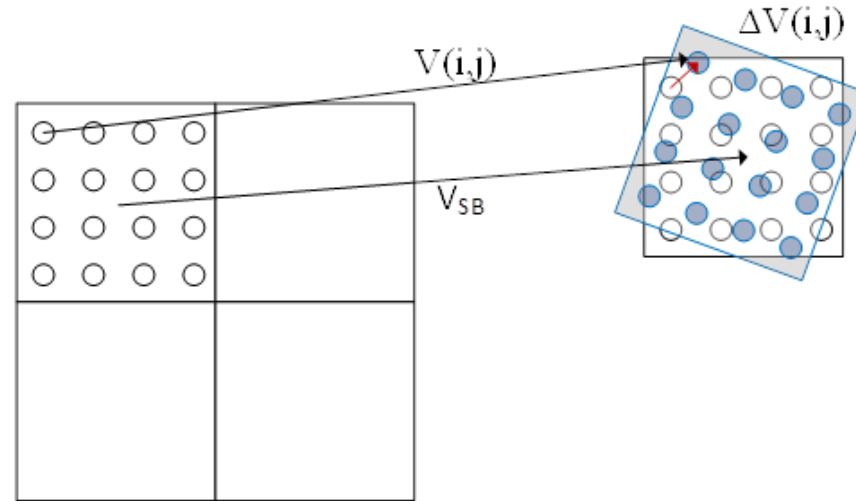
■ Proposal

- Motion vector differences between P-side and Q-side are treated as zero at PROF sub-block boundary.

■ Experimental results

- -0.02%/0.00%/0.04% (RA/LDB/LDP) in comparison with VTM-6.0 (ALF ON).
- -0.01%/-0.02%/0.00% (RA/LDB/LDP) in comparison with VTM-6.0 (ALF OFF).

- PROF is a prediction refinement tool considering rotation.



PROF process shown in JVET-O0070

- At PROF sub-block boundary, if motion vector difference is equal to or greater than 1/2 pixels, boundary strength (bS) is set to 1, otherwise, bS is set to 0.
- However, motion vectors for each sub-blocks applied PROF don't indicate true motion.
- PROF improves not only objective quality but also subjective quality.

■ Change bS calculation for PROF sub-block boundary as follows:

- If PROF is applied to list X ($\text{cbProfFlagLX} = 1$), difference between list X motion vector for P-side and list X motion vector for Q-side is set equal to 0 (bS will be 0).
- Otherwise, bS calculation is the same as that of VTM-6.0.
 - Difference between list X mv of P-side and list Y (not equal to X) mv of Q-side is calculated as same as VTM-6.0 regardless of PROF applied or not.

■ Details of the proposed motion vector difference calculation

- For uni-prediction
 - If $\text{cbProfFlagL0} = 1$, mv difference is set equal to 0.
- For bi-prediction && (P-side L0 == Q side L0) && (P-side L1 == Q side L1)
 - If $\text{cbProfFlagLX} = 1$, list X mv difference is set equal to 0.
- For bi-prediction && (P-side L0 != Q-side L0) && (P-side L1 != Q side L1)
 - Same as VTM-6.0

■ Anchor: VTM-6.0 (ALF ON)

- Coding performance changes are very minor (-0.02%/0.00%/0.04% (RA/LDB/LDP)).

	Random access				
	Over VTM-6.0			EncT	DecT
	Y	U	V		
Class A1	-0.02%	-0.01%	-0.01%	100%	100%
Class A2	-0.04%	0.08%	0.02%	100%	101%
Class B	-0.02%	0.06%	0.00%	100%	100%
Class C	0.00%	0.04%	-0.02%	100%	101%
Class E					
Overall	-0.02%	0.05%	0.00%	100%	100%
Class D	-0.03%	-0.08%	0.00%	100%	99%
Class F	0.01%	0.03%	0.00%	100%	100%

	Low delay B				
	Over VTM-6.0			EncT	DecT
	Y	U	V		
Class A1					
Class A2					
Class B	0.01%	0.02%	-0.13%	100%	101%
Class C	-0.03%	-0.13%	0.03%	100%	101%
Class E	0.01%	-0.08%	0.69%	100%	100%
Overall	0.00%	-0.05%	0.13%	100%	100%
Class D	0.05%	0.60%	0.24%	100%	102%
Class F	0.01%	-0.07%	0.95%	100%	100%

	Low delay P				
	Over VTM-6.0			EncT	DecT
	Y	U	V		
Class A1					
Class A2					
Class B	-0.01%	0.13%	0.37%	100%	100%
Class C	0.03%	-0.05%	0.13%	100%	99%
Class E	0.12%	0.02%	0.29%	100%	99%
Overall	0.04%	0.04%	0.27%	100%	100%
Class D	0.03%	-0.24%	-0.30%	100%	100%
Class F	-0.05%	0.12%	0.04%	100%	99%

■ Anchor: VTM-6.0 (ALF OFF)

- Coding performance changes are also very minor (-0.01%/-0.02%/0.00% (RA/LDB/LDP)).

	Random access				
	Over VTM-6.0			EncT	DecT
	Y	U	V		
Class A1	0.01%	0.15%	0.03%	100%	100%
Class A2	-0.07%	-0.07%	0.01%	100%	100%
Class B	0.00%	-0.06%	-0.05%	100%	100%
Class C	0.02%	0.01%	0.02%	100%	100%
Class E					
Overall	-0.01%	0.00%	-0.01%	100%	100%
Class D	-0.02%	0.04%	0.00%	100%	98%
Class F	0.01%	0.01%	0.04%	100%	100%

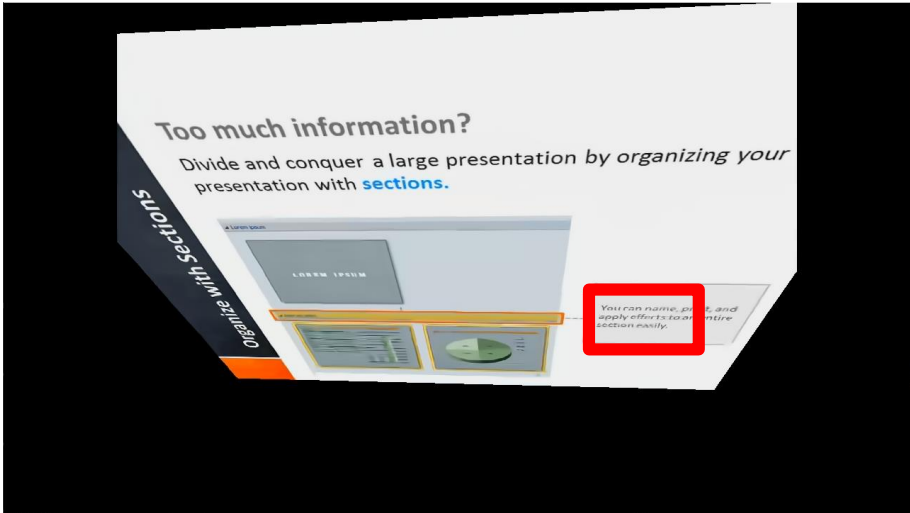
	Low delay B				
	Over VTM-6.0			EncT	DecT
	Y	U	V		
Class A1					
Class A2					
Class B	0.00%	-0.07%	-0.11%	100%	100%
Class C	0.02%	0.16%	-0.13%	100%	100%
Class E	-0.12%	-0.23%	-0.17%	100%	99%
Overall	-0.02%	-0.04%	-0.13%	100%	100%
Class D	0.01%	-0.11%	-0.22%	100%	100%
Class F	0.02%	0.02%	0.03%	100%	98%

	Low delay P				
	Over VTM-6.0			EncT	DecT
	Y	U	V		
Class A1					
Class A2					
Class B	0.00%	-0.01%	0.12%	100%	100%
Class C	-0.02%	-0.07%	-0.17%	100%	101%
Class E	0.01%	0.03%	-0.18%	100%	99%
Overall	0.00%	-0.02%	-0.05%	100%	100%
Class D	-0.02%	0.18%	-0.02%	100%	100%
Class F	0.08%	0.11%	0.06%	100%	100%

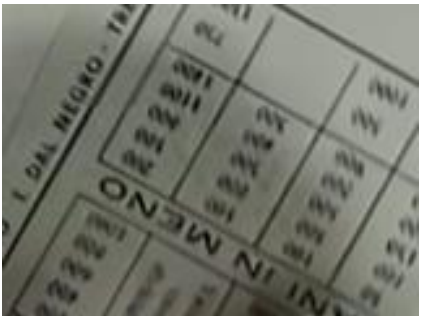
- Decoded images by the proposed method are more clear than images by anchor.
- The same figures are shown in the contribution document.



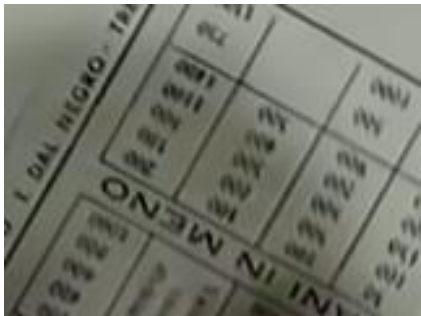
Cactus, QP37, RA, ALF ON, POC80



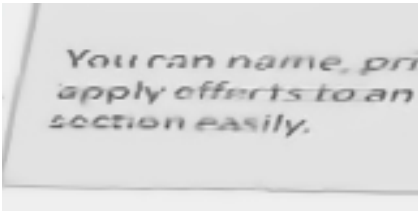
SlideShow, QP37, RA, ALF ON, POC171



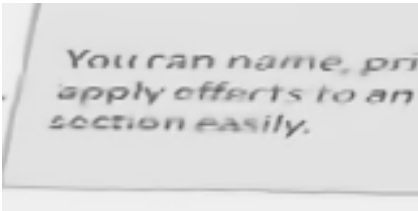
Anchor (VTM-6.0)



Proposed



Anchor (VTM-6.0)



Proposed

■ Proposal

- Motion vector differences between P-side and Q-side are treated as zero at PROF sub-block boundary.

■ Experimental results

- -0.02%/0.00%/0.04% (RA/LDB/LDP) in comparison with VTM-6.0 (ALF ON).
- -0.01%/-0.02%/0.00% (RA/LDB/LDP) in comparison with VTM-6.0 (ALF OFF).

■ Proposal is recommended to adopt to VVC D7 and VTM-7.

■ Thank Tencent for cross-checking.