

JVET-M0327

CE8-related: A new CPR syntax scheme

Hikvision

Shurui Ye, Fangdong Chen, Li Wang

Current CPR in VTM 3.0

- The current decoded picture is considered as a reference picture, which is put in the last position of reference picture list 0.
- If one frame using the current picture as the only reference picture, it is treated as a P frame (CPR-P frame).
- CPR-P frame: all the syntax of the picture are signaled as P frame instead of I frame.
- CPR blocks: The bitstream syntax follows the same syntax structure for inter coding.

Proposed scheme 1

- Using initial context values of I frame for CPR-P frame
 - Initial context values of I frame → the syntax elements which are already set for I frame
 - Initial context values of P frame → new syntax elements

Syntax elements	Initial context values of I frame	Initial context values of P frame
General slice data syntax	√	
Coding tree unit syntax	√	
Sample adaptive offset syntax	√	
Coding quadtree syntax	√	
Multi-type tree syntax	√	
Coding unit syntax	pcm_flag, pcm_alignment_zero_bit, intra_luma_ref_idx, intra_luma_mpm_flag, intra_luma_mpm_idx, intra_luma_mpm_remainder, intra_chroma_pred_mode	cu_skip_flag, pred_mode_flag, merge_flag, inter_affine_flag, mvp_l0_flag, amvr_4pel_flag, cu_cbf
PCM sample syntax	√	
Merge data syntax		√
Motion vector difference syntax		√
Transform tree syntax	√	
Transform unit syntax	√	

- Remain the frame type as I frame if the original frame type is I
 - Keep the frame type as I frame if the original frame type is I (treated as P frame in VTM3.0)
 - Besides that, the syntax structure is the same as VTM3.0

- Take CPR as an intra mode in IBP frame
 - Take CPR as intra prediction mode and keep the frame type
 - CU level CPR flag rather than with **inter_pred_idc** and **ref_idx_10**
 - When dual tree is enabled
 - CPR flag is only parsed for luma blocks
 - for Chroma block, enlarge the range of DM (direct mode) mode to include CPR mode.
- In P and B frame, the **ref_idx_10** binarization will not be influenced when CPR is enabled.

Experimental Results

- Scheme1: Using I initial context values of I frame for CPR-P frame
- Results for Proposed VS VTM 3.0 with CPR enabled

	All Intra Main10				
	Over VTM-3.0+CPRon				
	Y	U	V	EncT	DecT
Class A1	-0.01%	0.06%	-0.03%	99%	96%
Class A2	-0.01%	0.02%	0.02%	99%	94%
Class B	-0.03%	0.11%	0.02%	100%	99%
Class C	-0.08%	0.20%	0.01%	101%	101%
Class E	-0.12%	-0.07%	-0.09%	101%	97%
Overall	-0.05%	0.08%	-0.01%	100%	98%
Class D	-0.16%	-0.01%	-0.40%	101%	100%
Class F	-0.05%	0.03%	0.04%	100%	99%
Class SCC	-0.02%	0.02%	0.03%	100%	97%

	Random access Main10				
	Over VTM-3.0+CPRon				
	Y	U	V	EncT	DecT
Class A1	-0.01%	0.07%	-0.08%	99%	97%
Class A2	-0.01%	-0.04%	-0.04%	99%	98%
Class B	0.00%	-0.05%	-0.10%	99%	98%
Class C	-0.03%	0.05%	0.08%	100%	101%
Class E					
Overall	-0.01%	0.00%	-0.04%	99%	98%
Class D	-0.01%	0.25%	0.15%	100%	101%
Class F	0.02%	0.15%	0.13%	100%	99%
Class SCC	-0.05%	-0.07%	-0.08%	99%	101%

Thank Alibaba for crosschecking.

Experimental Results

- Scheme2: Remain the frame type as I frame if the original frame type is I
- Results for Proposed VS VTM 3.0 with CPR enabled

	All Intra Main10				
	Over VTM-3.0+CPRon				
	Y	U	V	EncT	DecT
Class A1	-0.01%	0.06%	0.01%	100%	99%
Class A2	-0.01%	-0.04%	-0.03%	100%	96%
Class B	-0.04%	0.09%	0.09%	101%	100%
Class C	-0.07%	0.05%	-0.11%	102%	102%
Class E	-0.12%	-0.10%	-0.17%	101%	103%
Overall	-0.05%	0.02%	-0.03%	101%	100%
Class D	-0.16%	-0.06%	-0.43%	102%	102%
Class F	-0.08%	0.03%	0.04%	102%	101%
Class SCC	-0.04%	-0.01%	0.02%	102%	97%

	Random access Main10				
	Over VTM-3.0+CPRon				
	Y	U	V	EncT	DecT
Class A1	-0.01%	0.08%	-0.05%	99%	98%
Class A2	0.01%	0.00%	-0.08%	99%	99%
Class B	0.00%	-0.03%	-0.08%	100%	99%
Class C	-0.02%	0.02%	0.11%	100%	100%
Class E					
Overall	0.00%	0.01%	-0.02%	100%	99%
Class D	0.04%	0.25%	0.15%	100%	101%
Class F	0.06%	0.10%	0.29%	100%	100%
Class SCC	0.01%	0.00%	-0.01%	100%	103%

Thank Alibaba for crosschecking.

Experimental Results

- Scheme3: Take CPR as an intra mode in IBP frame
- Results for Proposed VS VTM 3.0 with CPR enabled

	All Intra Main10				
	Over VTM-3.0+CPRon				
	Y	U	V	EncT	DecT
Class A1	-0.05%	0.01%	-0.04%	100%	97%
Class A2	-0.07%	-0.08%	-0.05%	100%	95%
Class B	-0.06%	0.01%	-0.08%	101%	101%
Class C	-0.12%	0.11%	-0.11%	102%	104%
Class E	-0.15%	-0.01%	-0.25%	101%	99%
Overall	-0.09%	0.01%	-0.10%	101%	100%
Class D	-0.20%	-0.19%	-0.66%	101%	103%
Class F	-0.17%	-0.20%	-0.05%	101%	101%
Class SCC	-0.39%	-0.35%	-0.38%	101%	99%

	Random access Main10				
	Over VTM-3.0+CPRon				
	Y	U	V	EncT	DecT
Class A1	0.00%	0.12%	-0.02%	99%	98%
Class A2	0.02%	-0.10%	-0.11%	99%	99%
Class B	0.03%	-0.05%	0.10%	100%	100%
Class C	0.00%	-0.07%	-0.24%	100%	100%
Class E					
Overall	0.01%	-0.03%	-0.06%	100%	99%
Class D	0.02%	-0.10%	-0.25%	100%	99%
Class F	-0.03%	0.02%	-0.04%	100%	100%
Class SCC	0.12%	0.11%	0.13%	100%	104%

Thank Alibaba for crosschecking.

- It is proposes a new syntax scheme of CPR.
 - It take CPR as intra prediction and keep the frame type.
 - Make the syntax and semantic more clear
 - Not affect the binarization operation of inter syntax element **ref_idx_l0**.

- It is proposed to adopt the proposed scheme3 into VVC

Thank you !

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