

JVET-Q0190

CE5-related: On CC-ALF modifications related to coefficients and signalling

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Introduction

Current VVC Specification draft description:

- Chroma ALF is enabled only when luma ALF is enabled:
if (pic_alf_enabled_flag == 1)

Current CE5 common base specification description:

- Sum of 8 unique filter coefficients values may be not equal to 0
 - I.e. sometimes the CC-ALF filter is not DC-neutral
 - This may cause changes in the average values for Cb and Cr components and result in some noticeable color changes/artifacts
- CC-ALF can be enabled for chroma in a slice/picture, even when luma and chroma ALF are not enabled for this slice/picture

Proposal – Aspect 1

- Constrain filter coefficients of each CC-ALF filter such that sum of filter coefficients in each chroma component's filter is equal to 0
 - $$\begin{aligned} \text{CcAlfApsCoeffCb}[\text{adaptation_parameter_set_id}][k][j] \\ = \text{alf_cross_component_cb_coeff_plus32}[k][j] - 32 \end{aligned}$$
 - $$\begin{aligned} \text{CcAlfApsCoeffCb}[\text{adaptation_parameter_set_id}][k][7] \\ = - (\text{CcAlfApsCoeffCb}[\text{adaptation_parameter_set_id}][k][0] \\ + \text{CcAlfApsCoeffCb}[\text{adaptation_parameter_set_id}][k][1] \\ + \text{CcAlfApsCoeffCb}[\text{adaptation_parameter_set_id}][k][2] \\ + \text{CcAlfApsCoeffCb}[\text{adaptation_parameter_set_id}][k][3] \\ + \text{CcAlfApsCoeffCb}[\text{adaptation_parameter_set_id}][k][4] \\ + \text{CcAlfApsCoeffCb}[\text{adaptation_parameter_set_id}][k][5] \\ + \text{CcAlfApsCoeffCb}[\text{adaptation_parameter_set_id}][k][6]) \end{aligned}$$
 - It is a requirement of bitstream conformance that $\text{CcAlfApsCoeffCb}[\text{adaptation_parameter_set_id}][k][7]$ shall be in the range between -32 and 31 inclusive.

Results over VTM7.0

	Y	U	V	YUV	EncT	DecT
AI	-0.01%	-0.06%	-0.11%	-0.02%	99%	97%
RA	0.00%	-0.10%	-0.07%	-0.02%	100%	100%
LDB	-0.01%	-0.23%	-0.05%	-0.04%	100%	99%

Proposal – Aspect 2

- Disable CC-ALF when luma ALF is not enabled, same way as it is done for chroma ALF
 - Signal CC-ALF syntax in picture header (PH)/slice header (SH) only when `pic_alf_enabled_flag/slice_alf_enabled_flag` is equal to 1
 - Align design of CC-ALF to ALF, as CC-ALF is claimed as part of ALF process

Results over VTM7.0

	Y	U	V	YUV	EncT	DecT
AI	0.00%	0.00%	0.00%	0.00%	99%	98%
RA	0.00%	0.00%	0.00%	0.00%	100%	102%
LDB	0.00%	-0.01%	0.00%	0.00%	101%	99%

Detailed Results

- Results of the proposed **aspect 1** under CTC

All Intra Main10						
Over VTM-7.0 with CE5 common base						
	Y	U	V	YUV*	EncT	DecT
Class A1	0.00%	-0.01%	0.00%	0.00%	98%	94%
Class A2	0.00%	-0.28%	-0.23%	-0.05%	100%	99%
Class B	-0.01%	-0.01%	-0.05%	-0.01%	100%	99%
Class C	-0.01%	-0.04%	-0.07%	-0.02%	101%	98%
Class E	-0.01%	-0.01%	-0.24%	-0.03%	99%	96%
Overall	-0.01%	-0.06%	-0.11%	-0.02%	99%	97%
Class D	0.00%	-0.05%	-0.09%	-0.02%	98%	96%
Class F	-0.01%	-0.02%	-0.02%	-0.01%	99%	101%

Random access Main10						
Over VTM-7.0 with CE5 common base						
	Y	U	V	YUV*	EncT	DecT
Class A1	-0.01%	-0.15%	-0.02%	-0.02%	100%	101%
Class A2	0.01%	-0.09%	-0.02%	0.00%	101%	99%
Class B	0.00%	-0.09%	-0.15%	-0.02%	101%	100%
Class C	0.00%	-0.08%	-0.03%	-0.01%	100%	99%
Overall	0.00%	-0.10%	-0.07%	-0.02%	100%	100%
Class D	-0.01%	-0.13%	-0.02%	-0.03%	100%	98%
Class F	0.00%	-0.02%	-0.04%	0.00%	101%	99%

Low delay B Main10						
Over VTM-7.0 with CE5 common base						
	Y	U	V	YUV*	EncT	DecT
Class B	0.00%	-0.24%	0.04%	-0.02%	100%	99%
Class C	0.04%	-0.10%	-0.26%	-0.01%	100%	99%
Class E	-0.11%	-0.37%	0.09%	-0.11%	101%	97%
Overall	-0.01%	-0.23%	-0.05%	-0.04%	100%	99%
Class D	-0.05%	-0.32%	-0.55%	-0.13%	100%	99%
Class F	0.02%	-0.17%	0.33%	0.03%	99%	103%

Detailed Results

- Results of the proposed aspect 2 under CTC

All Intra Main10						
Over VTM-7.0 with CE5 common base						
	Y	U	V	YUV*	EncT	DecT
Class A1	0.00%	0.00%	0.00%	0.00%	99%	93%
Class A2	0.00%	0.00%	0.00%	0.00%	100%	100%
Class B	0.00%	0.00%	0.00%	0.00%	99%	98%
Class C	0.00%	0.00%	0.00%	0.00%	100%	101%
Class E	0.00%	0.00%	0.00%	0.00%	98%	96%
Overall	0.00%	0.00%	0.00%	0.00%	99%	98%
Class D	0.00%	0.00%	0.00%	0.00%	97%	97%
Class F	0.00%	0.00%	0.00%	0.00%	97%	96%

Random access Main10						
Over VTM-7.0 with CE5 common base						
	Y	U	V	YUV*	EncT	DecT
Class A1	0.00%	0.00%	0.00%	0.00%	99%	103%
Class A2	0.00%	0.00%	0.00%	0.00%	100%	99%
Class B	0.00%	0.01%	0.00%	0.00%	100%	101%
Class C	0.00%	0.00%	0.01%	0.00%	99%	103%
Overall	0.00%	0.00%	0.00%	0.00%	100%	102%
Class D	0.00%	-0.01%	-0.01%	0.00%	100%	102%
Class F	0.00%	0.00%	0.02%	0.00%	101%	102%

Low delay B Main10						
Over VTM-7.0 with CE5 common base						
	Y	U	V	YUV*	EncT	DecT
Class B	-0.01%	-0.02%	0.00%	-0.01%	100%	98%
Class C	0.00%	0.00%	0.00%	0.00%	100%	99%
Class E	0.00%	0.00%	0.00%	0.00%	102%	98%
Overall	0.00%	-0.01%	0.00%	0.00%	101%	99%
Class D	0.00%	0.00%	0.00%	0.00%	100%	98%
Class F	0.01%	0.00%	0.16%	0.03%	99%	99%

Detailed Results

- Results of the combined **aspect 1** and **aspect 2** under CTC

All Intra Main10						
Over VTM-7.0 with CE5 common base						
	Y	U	V	YUV*	EncT	DecT
Class A1	0.00%	-0.01%	0.00%	0.00%	98%	95%
Class A2	0.00%	-0.28%	-0.23%	-0.05%	99%	100%
Class B	-0.01%	-0.01%	-0.05%	-0.01%	99%	97%
Class C	-0.01%	-0.04%	-0.07%	-0.02%	99%	98%
Class E	-0.01%	-0.01%	-0.24%	-0.03%	97%	96%
Overall	-0.01%	-0.06%	-0.11%	-0.02%	98%	97%
Class D	0.00%	-0.05%	-0.09%	-0.02%	97%	96%
Class F	-0.01%	-0.02%	-0.02%	-0.01%	98%	96%

Random access Main10						
Over VTM-7.0 with CE5 common base						
	Y	U	V	YUV*	EncT	DecT
Class A1	-0.01%	-0.15%	-0.02%	-0.02%	99%	100%
Class A2	0.01%	-0.09%	-0.02%	-0.01%	99%	99%
Class B	0.00%	-0.08%	-0.15%	-0.02%	99%	101%
Class C	0.00%	-0.08%	-0.02%	-0.01%	99%	102%
Overall	0.00%	-0.10%	-0.06%	-0.02%	99%	101%
Class D	-0.01%	-0.13%	-0.03%	-0.03%	99%	100%
Class F	0.00%	-0.02%	-0.03%	0.00%	100%	102%

Low delay B Main10						
Over VTM-7.0 with CE5 common base						
	Y	U	V	YUV*	EncT	DecT
Class B	0.00%	-0.23%	0.02%	-0.02%	99%	98%
Class C	0.04%	-0.10%	-0.26%	-0.01%	99%	99%
Class E	-0.11%	-0.37%	0.09%	-0.11%	99%	95%
Overall	-0.01%	-0.22%	-0.05%	-0.04%	99%	97%
Class D	-0.05%	-0.32%	-0.55%	-0.13%	99%	97%
Class F	0.00%	-0.22%	0.35%	0.01%	97%	101%

Summary

Proposed two aspects for CC-ALF design:

- Constrain filter coefficients of each CC-ALF filter such that sum of filter coefficients in each chroma component's filter is equal to 0
- Disable CC-ALF when luma ALF is not enabled, same way as it is for chroma ALF