

JVET-Q0319

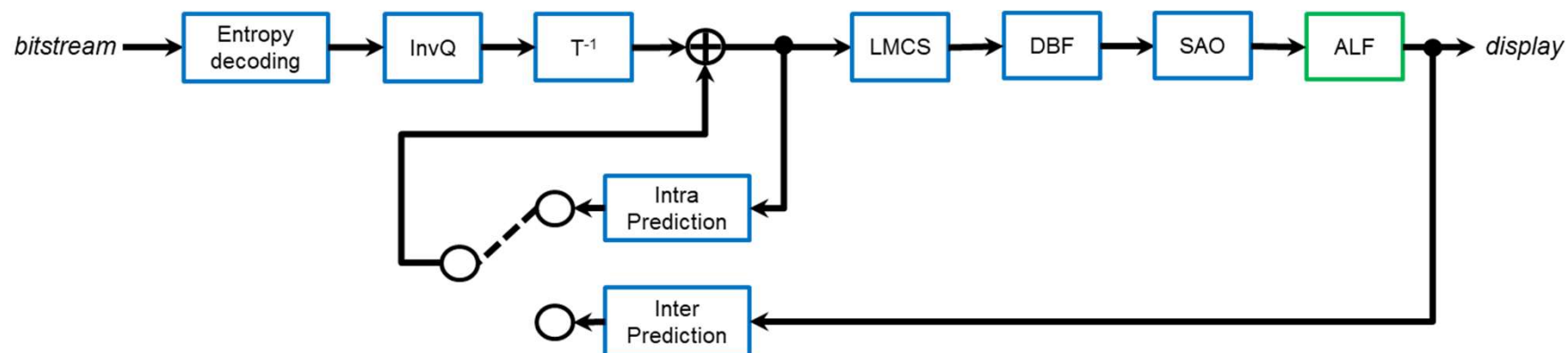
Non-CE5: On SEI for ALF

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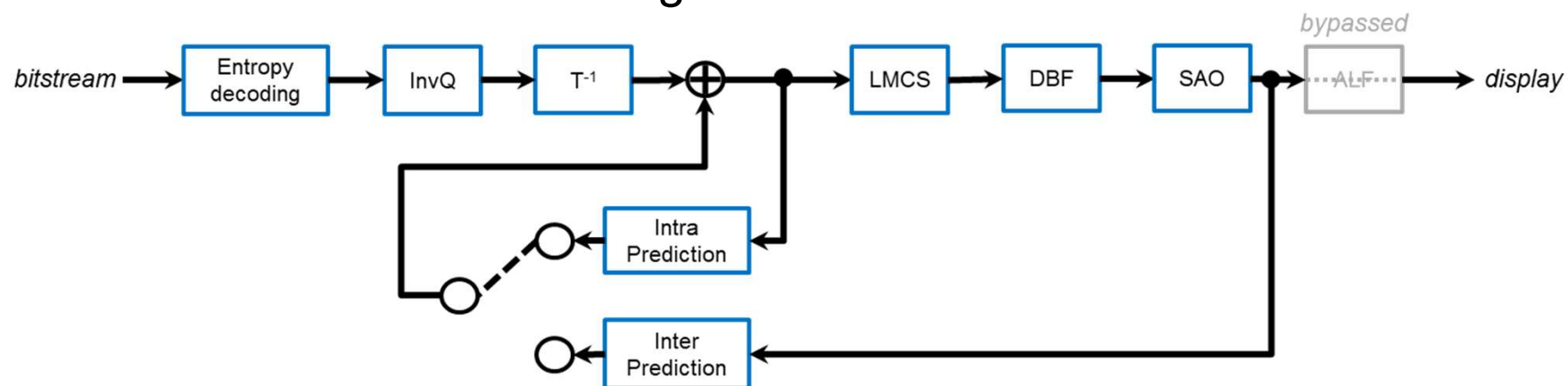
Previous related contribution: JVET-P0179 “Non-CE5: ALF as a post-filter”

Introduction

VTM7 Decoder Block Diagram with **ALF enabled** in bitstream

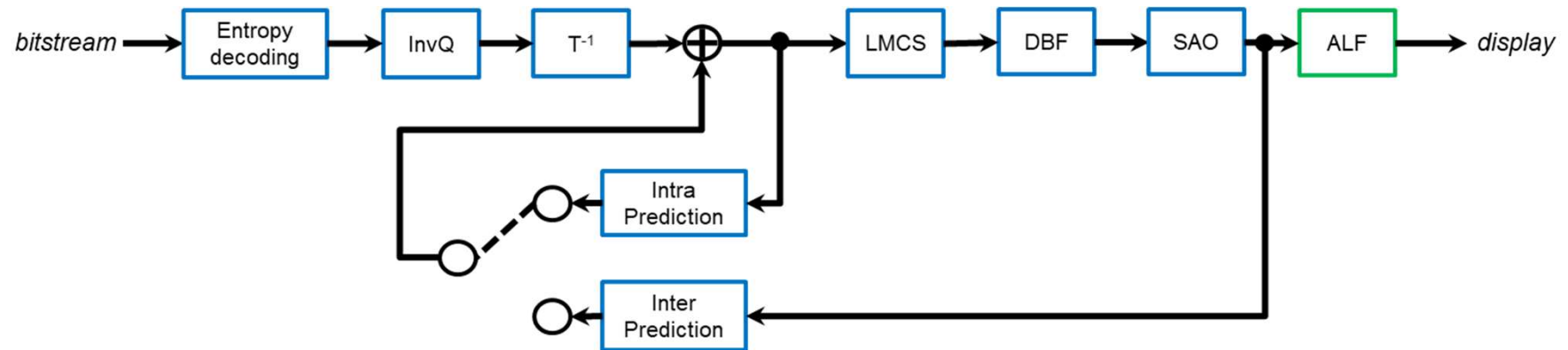


VTM7 Decoder Block Diagram with **ALF disabled** in bitstream

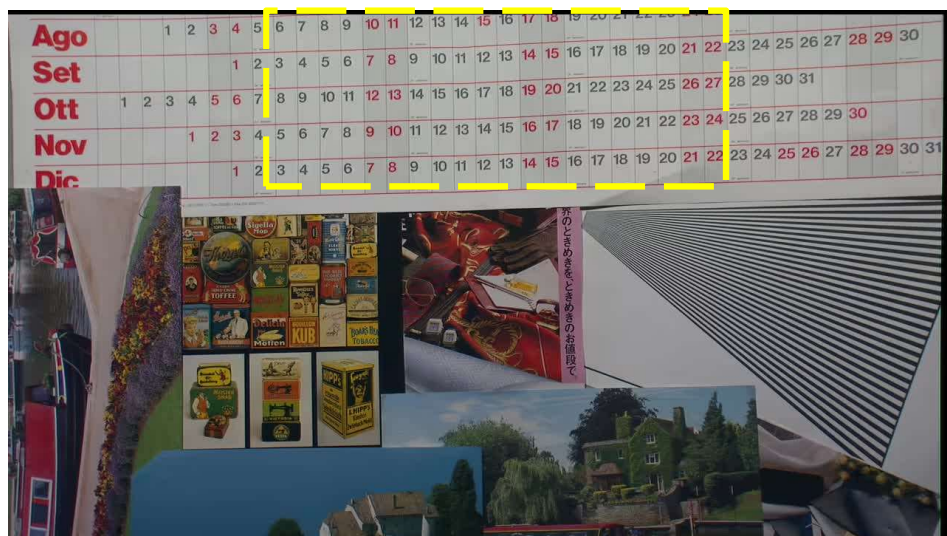


Introduction

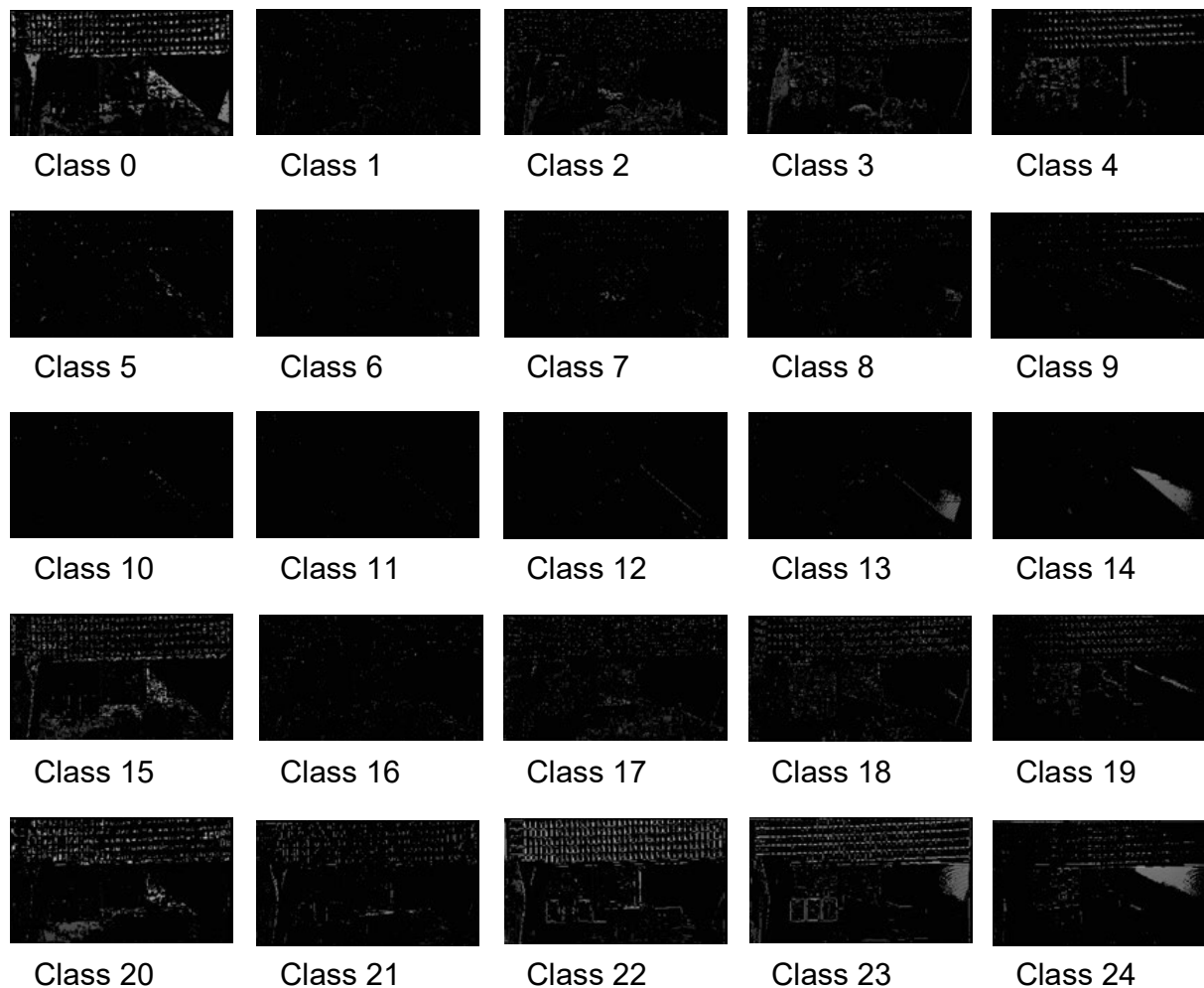
VTM7 Decoder Block Diagram with ALF disabled in bitstream + proposal SEI



Classification of ALF Luma



Spincalendar
1280x720@50p
RA QP32 (ALF off)

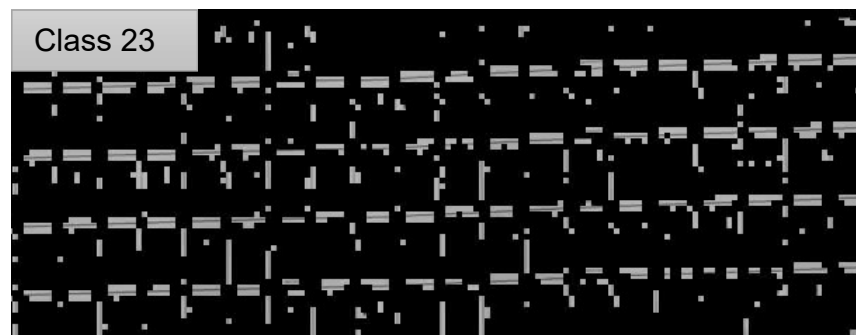
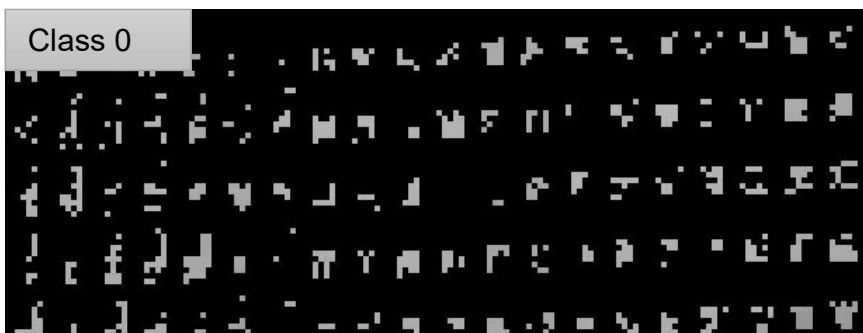


Classification of ALF Luma

Spincalendar
1280x720@50p
RA QP32
(ALF off)

only luminance pixels are
shown for the classes

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22



Class 4
contains most
of the numbers
and characters
of the calendar

Proposed specification changes

Aspect 1: adaptive loop filter control SEI

adaptive loop filter control(payloadSize) {	Descriptor
alf_enabled_flag	u(1)
if(alf_enabled_flag) {	
alf_luma_flag	u(1)
if(ChromaArrayType != 0)	
alf_chroma_idc	u(2)
alf_data()	
}	
}	

The adaptive loop filter control SEI message provides information to use the adaptive loop filter to modify the pictures for output. **When `sps_alf_enabled_flag` of the bitstream is equal to 1, there shall be no adaptive loop filter control SEI messages present in the CLVS.**

Use of this SEI message requires the definition of the following function:

– A function `alf_data()` that parses the adaptive loop filter data syntax.

alf_enabled_flag equal to 1 indicates that the adaptive loop filter is enabled.

alf_luma_flag equal to 1 specifies that adaptive loop filter is applied to the luminance component for all slices associated with the PH. **alf_luma_flag** equal to 0 specifies that adaptive loop filter is not applied to the luminance component for all slices associated with the PH.

When **alf_luma_flag** is not present, it is inferred to be equal to 0.

alf_chroma_idc equal to 0 specifies that the adaptive loop filter is not applied to Cb and Cr colour components.

alf_chroma_idc equal to 1 indicates that the adaptive loop filter is applied to the Cb colour component. **alf_chroma_idc** equal to 2 indicates that the adaptive loop filter is applied to the Cr colour component. **alf_chroma_idc** equal to 3 indicates that the adaptive loop filter is applied to Cb and Cr colour components.

When **alf_chroma_idc** is not present, it is inferred to be equal to 0.

Proposed specification changes

Aspect 2: adaptive loop filter control SEI with CTB level mask

- CTB on/off flags are sent to control each CTB filtering.

Aspect 3: adaptive loop filter control SEI with CC-ALF separate Cb/Cr enabled flag

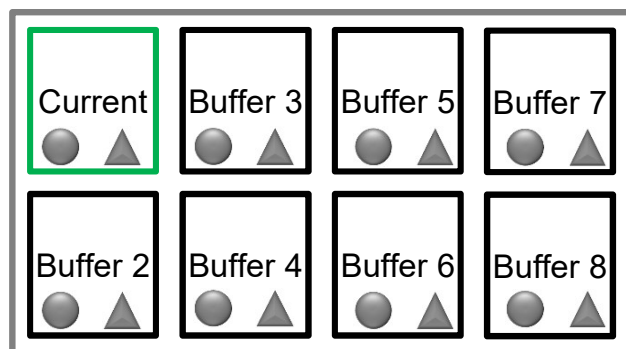
- Cross component ALF Cb and Cr flags are controlled separately.

Aspect 4: adaptive loop filter control SEI with CC-ALF combined Cb/Cr enabled flag

- Cross component ALF Cb/Cr flags are controlled at the same time.

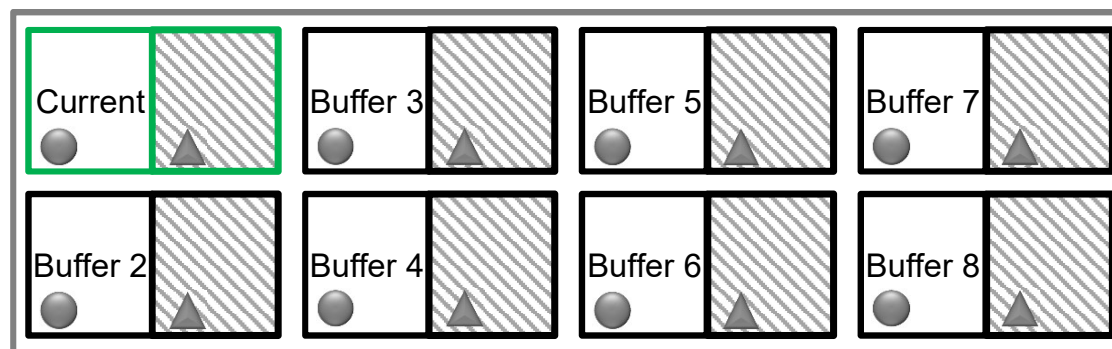
Suggested implementation of DPB buffer

VTM7 DPB buffer



- Used/unused for short/long-term reference
- ▲ Needed/not needed for output
- For storing reconstructed image for reference & output/display

Suggested DPB buffer implementation



- Used/unused for short/long-term reference
- ▲ Needed/not needed for output
- For storing reconstructed image before ALF
- ▨ For storing images for output/display (e.g. ALF filtered reconstructed image)

Use case applications

In the use-case of production studio, the content provider can customize the desired subjective quality and deliver to the consumer the same subjective quality by using VVC. Consumer can easily get the same subjective quality by just using VVC without the need of additional filtering modules.

In another use-case, an individual can use a production tool to customize the filters and classifications that he/she want to apply to and add the proposed SEI to the bitstream. The desired subjective quality can be embedded into the bitstream easily and uploaded for media sharing.



Example of
production tool
interface on
tablet/mobile
device

Conclusion

- New application use cases of VVC was suggested together with a new SEI.
- There are no changes to existing ALF engine or its coefficient signalling.
- No additional hardware/software modules needed.

We propose to adopt at least one of the aspects of Adaptive Loop Filter Control SEI.

Supplementary

Comparison of different methods	Pre-filter method	HEVC post-filter hint SEI method	Proposed SEI for VVC
Additional h/w or s/w modules needed?	Yes, before codec.	Yes, after code.	No, built-in VVC
Customization level	Determined by content provider, but typically: Picture level on/off No classification 1 set of filter	Picture level on/off	Picture/CTU level on/off
		No classification	4x4 level luma block classification
		1 set of filter for luma, 1 set of filter for Cb, 1 set of filter for Cr.	Up to 25 sets of luma filters, 1 set of filter for Cb, 1 set of filter for Cr.
DPB buffer changes?	No	No	Yes
Effect of using of sharpening filters	Higher bitrate needed.	At same bitrate, smaller QP used compared to pre-filter.	At same bitrate, smaller QP used compared to pre-filter.