

JCTVC-J0221

Clean-up of semantics and decoding process on weighted prediction

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Summary

- Weighted prediction of current WD7
 - Some equations are described in semantics part
 - Range limits of signaling values of weighting factor and additive offset are explicitly undefined
- Proposal
 - These equations are moved to the decoding process on weighted prediction
 - Range limits are defined
 - Signaling value of weighting factor has a range of -128 to 127, inclusive (signed 8bit).
 - Signaling value of additive offset for Chroma has a range of -512 to 511, inclusive (signed 10bit) and the reconstructed value is clipped in the range of -128 to 127.
- Results
 - The coding results are almost unchanged

Weighted prediction (WP)

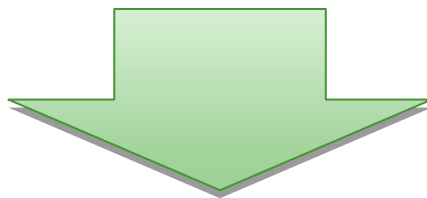
- Point 1: Clean-up of semantics on WP

7.4.3.7 Weighted prediction parameter semantics

...

delta_luma_weight_l0[i] is the difference of the weighting factor applied to the luma prediction value for list 0 prediction using RefPicList0[i]. **The variable LumaWeightL0[i] is specified by $(1 \ll \text{luma_log2_weight_denom}) + \text{delta_luma_weight_l0}[i]$.** When luma_weight_l0_flag is equal to 1, the value of LumaWeightL0[i] shall be in the range of -128 to 127 , inclusive. When luma_weight_l0_flag is equal to 0, LumaWeightL0[i] is inferred to be equal to $2^{\text{luma_log2_weight_denom}}$ for RefPicList0[i].

...



- These decoding processes are moved to the decoding process part in 8.3.6.
- This modification does not change anymore.

Weighted prediction (WP)

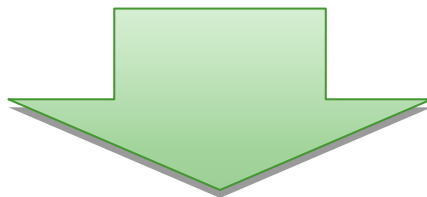
- **Point 2:** Range limit of signaling value of **weighting factor** is undefined explicitly

7.4.3.7 Weighted prediction parameter semantics

...

delta_luma_weight_l0[i] is the difference of the weighting factor applied to the luma prediction value for list 0 prediction using RefPicList0[i]. The variable LumaWeightL0[i] is specified by $(1 \ll \text{luma_log2_weight_denom}) + \text{delta_luma_weight_l0}[i]$. When luma_weight_l0_flag is equal to 1, **the value of LumaWeightL0[i] shall be in the range of -128 to 127, inclusive**. When luma_weight_l0_flag is equal to 0, LumaWeightL0[i] is inferred to be equal to $2^{\text{luma_log2_weight_denom}}$ for RefPicList0[i].

...



- Signaling value of weighting factor has a range of -128 to 127, inclusive (signed 8bit).

Weighted prediction (WP)

- **Point 2:** Range limit of signaling value of additive offset for chroma is undefined explicitly

7.4.3.7 Weighted prediction parameter semantics

...

delta_chroma_offset_l0[i][j] is the difference of the additive offset applied to the chroma prediction values for list 0 prediction using RefPicList0[i] with j equal to 0 for Cb and j equal to 1 for Cr.

The variable ChromaOffsetL0[i][j] is specified as follows:

... Equation (7-65)

The variable ChromaOffsetL0[i][j] shall be in the range of -127 to 128, inclusive. When chroma_weight_l0_flag is equal to 0, ChromaOffsetL0[i][j] is inferred to be equal to 0 for RefPicList0[i].

...



- Signaling value of additive offset for Chroma has a range of -512 to 511, inclusive and the reconstructed value is clipped in the range of -128 to 127.

Experimental results on Point 2

Black-fade sequences

	Random Access Main			Random Access HE10		
	Y	U	V	Y	U	V
Class A	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class B	0.1%	0.1%	0.2%	0.3%	-0.9%	0.0%
Class C	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%
Class D	-0.1%	0.1%	-0.3%	-0.1%	-0.4%	-0.4%
Class E						
Overall	0.0%	0.0%	0.0%	0.1%	-0.4%	-0.1%
Enc Time[%]	99%			100%		
Dec Time[%]	99%			99%		

	Low delay B Main			Low delay B HE10		
	Y	U	V	Y	U	V
Class A						
Class B	0.0%	-0.3%	-0.2%	0.0%	0.1%	-0.1%
Class C	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
Class D	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
Class E	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Overall	0.0%	-0.1%	0.0%	0.0%	0.1%	0.0%
Enc Time[%]	100%			99%		
Dec Time[%]	99%			100%		

	Low delay P Main			Low delay P HE10		
	Y	U	V	Y	U	V
Class A						
Class B	0.0%	0.0%	0.0%	0.0%	0.1%	-0.1%
Class C	0.0%	0.1%	-0.1%	0.0%	0.0%	0.0%
Class D	0.0%	0.1%	0.1%	0.0%	0.1%	-0.2%
Class E	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Overall	0.0%	0.0%	0.0%	0.0%	0.1%	-0.1%
Enc Time[%]	100%			100%		
Dec Time[%]	98%			100%		

White-fade sequences

	Random Access Main			Random Access HE10		
	Y	U	V	Y	U	V
Class A	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class B	0.2%	0.2%	0.3%	0.3%	-1.0%	0.0%
Class C	0.0%	0.0%	0.1%	0.0%	-0.1%	-0.1%
Class D	-0.1%	0.0%	-0.3%	0.0%	0.0%	-0.2%
Class E						
Overall	0.0%	0.0%	0.0%	0.1%	-0.3%	-0.1%
Enc Time[%]	100%			100%		
Dec Time[%]	97%			99%		

	Low delay B Main			Low delay B HE10		
	Y	U	V	Y	U	V
Class A						
Class B	0.0%	0.0%	-0.1%	0.0%	-0.1%	0.0%
Class C	0.0%	-0.1%	0.1%	0.0%	0.0%	0.0%
Class D	0.0%	0.1%	0.0%	0.0%	0.1%	0.1%
Class E	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Overall	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	99%			100%		
Dec Time[%]	98%			100%		

	Low delay P Main			Low delay P HE10		
	Y	U	V	Y	U	V
Class A						
Class B	0.0%	0.1%	-0.1%	-0.1%	-0.2%	-0.1%
Class C	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
Class D	0.0%	0.0%	0.0%	0.0%	-0.4%	0.0%
Class E	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Overall	0.0%	0.0%	0.0%	0.0%	-0.2%	0.0%
Enc Time[%]	100%			100%		
Dec Time[%]	98%			100%		

The coding results are almost unchanged.

Additional results for delta_chroma_offset

- We tested several signaling ranges from 8 to 12bit.

	Random Access Main			Random Access HE10		
	Y	U	V	Y	U	V
Signaling range 8bit	0.0%	0.0%	0.0%	2.0%	0.4%	0.6%
Signaling range 9bit	0.0%	0.0%	0.0%	0.3%	-0.2%	0.1%
Signaling range 10bit	0.0%	0.0%	0.0%	0.1%	-0.3%	-0.1%
Signaling range 11bit	0.0%	0.0%	0.0%	0.1%	-0.3%	-0.1%
Signaling range 12bit	0.0%	0.0%	0.0%	0.1%	-0.3%	-0.1%
	Low delay B Main			Low delay B HE10		
	Y	U	V	Y	U	V
Signaling range 8bit	0.0%	0.0%	0.0%	0.2%	0.7%	0.6%
Signaling range 9bit	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%
Signaling range 10bit	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Signaling range 11bit	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Signaling range 12bit	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Low delay P Main			Low delay P HE10		
	Y	U	V	Y	U	V
Signaling range 8bit	0.0%	0.0%	0.0%	0.5%	0.6%	1.0%
Signaling range 9bit	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Signaling range 10bit	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Signaling range 11bit	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Signaling range 12bit	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

- It is suggested that the range limit of delta_chroma_offset is signed 10bit.

Conclusion

- **Proposal**

- Clean-up text on weighted prediction is provided
 - The decoding process part on weighted prediction semantics is moved to the new decoding process.
 - Range limits of signaling WP parameters are defined
 - Signaling value of weighting factor has a range of -128 to 127, inclusive.
 - Signaling value of additive offset has a range of -512 to 511, inclusive and the reconstructed value is clipped in the range of -128 to 127.

- **Suggestion;**

- This clean-up is applied to the next version of HEVC WD and software.

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