

Simplification on default quantization matrix signaling

Hui Yong Kim

Summary

□ Proposal

- ❖ Default matrix signaling using “scaling_list_pred_matrix_id_delta” syntax

□ Benefits

- ❖ Simplified parsing process of QM coefficients
 - Text simplification
 - Complexity reduction

□ Results

- ❖ Negligible BDR impact

Background

❑ Current design: the default matrix signaling via DC coefficient

- ❖ When the first matrix coefficient (i.e., DC) is equal to 0, the scaling list is inferred from the default scaling list

→ *Complicated Text and Parsing process*

For large QMs
(16x16, 32x32)

For small QMs
(4x4, 8x8)

scaling_list(scalingList, sizeID , matrixID) {	Descriptor
nextCoef = 8	u(1)
coefNum = Min(64, (1 << (4 + (sizeID << 1))))	
UseDefaultScalingMatrix = 0	
if(sizeID > 1) {	
scaling_list_dc_coef_minus8[sizeID - 2][matrixID]	se(v)
if(scaling_list_dc_coef_minus8[sizeID - 2][matrixID] == -8)	
UseDefaultScalingMatrixFlag = 1	
}	
if(UseDefaultScalingMatrixFlag == 0) {	
stopNow = 0	
for(i=0; i < coefNum && !stopNow; i++) {	
scaling_list_delta_coef	se(v)
nextCoef = (nextCoef + scaling_list_delta_coef + 256) % 256	
if(sizeID < 2) {	
useDefaultScalingMatrixFlag = (i == 0 && nextCoef == 0)	
if(useDefaultScalingMatrixFlag)	
stopNow = 1	
}	
if(!stopNow)	
scalingList[i] = nextCoef	
}	
}	
}	

Proposal

❑ Default matrix signaling using “scaling_list_pred_matrix_id_delta”

- ❖ When “scaling_list_pred_matrix_id_delta == 0”, the scaling list for MatrixID is inferred from the default scaling list

→ *Simplified Text and Parsing process*

scaling_list_param() {	Descriptor
scaling_list_present_flag	u(1)
if(scaling_list_present_flag)	
for(sizeID = 0; sizeID < 4; sizeID++)	
for(matrixID = 0; matrixID < (sizeID == 3) ? 2 : 6; matrixID++) {	
scaling_list_pred_mode_flag	u(1)
if(!scaling_list_pred_mode_flag)	
scaling_list_pred_matrix_id_delta	ue(v)
else	
scaling_list(ScalingList[sizeID][matrixID], sizeID , matrixID)	
}	
}	

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scaling_list_pred_matrix_id_delta specifies the target reference matrix to copy the value of scaling list.

RefMatrixID = MatrixID –
(1 + scaling_list_pred_matrix_id_delta)

Proposal

scaling_list_pred_matrix_id_delta specifies the target reference matrix to copy the value of scaling list.

RefMatrixID = MatrixID – scaling_list_pred_matrix_id_delta

The variable RefMatrixID equal to MatrixID specifies that scaling list for MatrixID is set equal to the default scaling list.

Text Modifications

scaling list param() {	Descriptor
scaling list present flag	u(1)
if(scaling list present flag)	
for(sizeID = 0; sizeID < 4; sizeID++)	
for(matrixID = 0; matrixID < (sizeID == 3) ? 2 : 6; matrixID++) {	
scaling list pred mode flag	u(1)
if(!scaling list pred mode flag)	
scaling list pred matrix id delta	ue(v)
else	
scaling_list(ScalingList[sizeID][matrixID], sizeID , matrixID)	
}	
}	

Needs semantics modification

scaling_list_pred_matrix_id_delta specifies the target reference matrix to copy the value of scaling list. When **scaling_list_pred_mode_flag** is equal to 0, **scaling_list_pred_matrix_id_delta** specifies which matrix should be used in the current matrix by the following:

$\text{RefMatrixID} = \text{MatrixID} - \text{scaling_list_pred_matrix_id_delta} \quad (7-25)$

where MatrixID is specified in Table 7-3.

The variable RefMatrixID equal to MatrixID specifies that scaling list for MatrixID is set equal to the default scaling list as specified from Table 7-4 to Table 7-5.

scaling_list(scalingList, sizeID , matrixID) {	Descriptor
nextCoef = 8	u(1)
coefNum = Min(64, (1 << (4 + (sizeID << 1))))	
UseDefaultScalingMatrix == 0	
if(sizeID > 1) {	
scaling list dc coef minus8 [sizeID - 2][matrixID]	se(v)
if(scaling_list_dc_coef_minus8[sizeID - 2][matrixID] == -8)	
UseDefaultScalingMatrixFlag == 1	
}	
if(UseDefaultScalingMatrixFlag == 0) {	
stopNow = 0	
for(i=0; i < coefNum && !stopNow; i++) {	
scaling list delta coef	se(v)
nextCoef = (nextCoef + scaling_list_delta_coef + 256) % 256	
if(sizeID < 2) {	
useDefaultScalingMatrixFlag = (i == 0 && nextCoef == 0)	
if(useDefaultScalingMatrixFlag)	
stopNow = 1	
}	
if(!stopNow)	
scalingList[i] = nextCoef	
}	
}	
}	

Experimental Results

❑ QM setting for test

- ❖ 4 out of 20 QMs are set to default
 - 16x16 luma intra/inter
 - 32x32 luma intra/inter
- ❖ Other matrices are from “scaling_list_symmetry1.txt” in CE4
 - Downsampled
 - DC matrix coefficient = The first matrix coefficient

❑ Results

- ❖ Negligible impact on coding gain
- ❖ Confirmed by Canon (JCTVC-I0450)

	All Intra Main			All Intra HE10		
	Y	U	V	Y	U	V
Class A	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
Class B	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
Class C	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
Class D	-0.0001%	-0.0001%	-0.0001%	-0.0001%	-0.0001%	-0.0001%
Class E	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
Overall	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
	0.0000%	0.0000%	0.0001%	0.0000%	0.0000%	0.0000%
Class F	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
Enc Time[%]	100%			100%		
Dec Time[%]	101%			100%		

	Random Access Main			Random Access HE10		
	Y	U	V	Y	U	V
Class A	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
Class B	-0.0001%	-0.0001%	0.0000%	0.0000%	0.0000%	0.0000%
Class C	-0.0001%	-0.0001%	-0.0001%	-0.0001%	-0.0001%	-0.0001%
Class D	-0.0003%	-0.0003%	-0.0003%	-0.0003%	-0.0003%	-0.0003%
Class E						
Overall	-0.0001%	-0.0001%	-0.0001%	-0.0001%	-0.0001%	-0.0001%
	-0.0001%	0.0000%	0.0007%	-0.0001%	-0.0001%	-0.0005%
Class F	-0.0001%	-0.0001%	-0.0001%	-0.0001%	-0.0001%	-0.0001%
Enc Time[%]	100%			100%		
Dec Time[%]	100%			100%		

	Low delay B Main			Low delay B HE10		
	Y	U	V	Y	U	V
Class A						
Class B	-0.0001%	-0.0001%	-0.0001%	-0.0001%	-0.0001%	-0.0001%
Class C	-0.0001%	-0.0001%	-0.0001%	-0.0001%	-0.0001%	-0.0001%
Class D	-0.0004%	-0.0004%	-0.0004%	-0.0004%	-0.0004%	-0.0004%
Class E	-0.0005%	-0.0004%	-0.0004%	-0.0005%	-0.0004%	-0.0004%
Overall	-0.0003%	-0.0002%	-0.0002%	-0.0003%	-0.0002%	-0.0002%
	-0.0003%	-0.0002%	-0.0002%	-0.0003%	-0.0002%	-0.0002%
Class F	-0.0003%	-0.0003%	-0.0003%	-0.0003%	-0.0003%	-0.0003%
Enc Time[%]	100%			100%		
Dec Time[%]	101%			100%		

Conclusions

❑ Proposal

- ❖ Default matrix signaling using “**scaling_list_pred_matrix_id_delta**” syntax

❑ Benefits

- ❖ Simplified parsing process of quantization matrix coefficients
 - Text simplification
 - Complexity reduction

❑ Simulation Results

- ❖ Negligible impact on coding performance

❑ Identical to the first proposal in JCTVC-I0059 (Sony)

❑ We suggest the proposal to be included in the next HM.



Thank You Very Much !

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