

Non-RCE4: On Palette prediction modes coding

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Palette mode RCE4 Test2

- 2 prediction modes to code the block of indexes:
 - Run mode
 - Copy above mode
- The prediction mode flag, `palette_run_type_flag`, is always signaled.
- But it is not always needed.

Proposal

- 1st simplification: No Copy above mode for the first line:
 - It is not possible to use the copy above mode for the first line.
 - palette_run_type_flag is not coded for the first CU line
- 2d simplification: No Copy above mode after a Copy above mode
 - The Copy above mode is not needed after a Copy above mode because the simple way is to add +1 to the last Copy_run.
 - palette_run_type_flag is not coded when the last mode is a Copy above mode.

Experiments results: 1st modification

- Anchor: RCE4 Test 2
- Test: RCE4 Test 2 + 1st modification

■ Results AI/RA/LB:

- SC:
0.1%/ 0.1%/0.1%
- OSC:
0.2%/0.3%/0.4%

Anchor: RCE4 Test 2 Test: No copy first line				All Intra Main-tier			All Intra High-tier			All Intra Super-High-tier		
	Y	U	V	Y	U	V	Y	U	V	Y	U	V
Class F	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB 4:4:4 SC	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	-0.1%	-0.1%	0.0%	-0.1%	-0.1%	-0.1%
RGB 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YCbCr 4:4:4 SC	-0.1%	0.0%	0.0%	-0.1%	0.0%	0.0%	-0.1%	0.0%	0.0%	-0.1%	-0.1%	-0.1%
YCbCr 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RangeExt	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB 4:4:4 SC (Optional)	-0.1%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%
YCbCr 4:4:4 SC (Optional)	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%
Enc Time[%]	98.6%			98.5%			98.6%			98.6%		
Dec Time[%]	92.6%			92.2%			92.4%			92.4%		
	Random Access Main-tier			Random Access High-tier								
	Y	U	V	Y	U	V						
Class F	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%						
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%						
RGB 4:4:4 SC	0.0%	-0.1%	0.0%	-0.1%	-0.1%	-0.1%						
RGB 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%						
YCbCr 4:4:4 SC	-0.1%	-0.2%	-0.1%	-0.4%	-0.3%	-0.3%						
YCbCr 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%						
RangeExt	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%						
RGB 4:4:4 SC (Optional)	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%						
YCbCr 4:4:4 SC (Optional)	-0.4%	-0.5%	-0.4%	-0.4%	-0.5%	-0.5%						
Enc Time[%]	98.9%			99.1%								
Dec Time[%]	95.3%			95.7%								
	Low delay B Main-tier			Low delay B High-tier								
	Y	U	V	Y	U	V						
Class F	0.1%	-0.1%	0.0%	0.2%	0.0%	0.0%						
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%						
RGB 4:4:4 SC	-0.1%	-0.1%	-0.2%	-0.1%	-0.2%	-0.2%						
RGB 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%						
YCbCr 4:4:4 SC	-0.1%	-0.1%	-0.2%	-0.1%	-0.1%	-0.1%						
YCbCr 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%						
RangeExt	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%						
RGB 4:4:4 SC (Optional)	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%						
YCbCr 4:4:4 SC (Optional)	-0.9%	-0.9%	-0.8%	-0.6%	-0.6%	-0.5%						
Enc Time[%]	100.2%			100.2%								
Dec Time[%]	92.7%			93.3%								

Experiments results: 2d modification

- Anchor: RCE4 Test 2
- Test: RCE4 Test 2 + 2d modification

■ Results AI/RA/LB:

- SC:
0.4%/0.2%/0.2%
- OSC:
1.9%/1.7%/1.9%

	All Intra Main-tier			All Intra High-tier			All Intra Super-High-tier		
	Y	U	V	Y	U	V	Y	U	V
Class F	-0.1%	-0.2%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB 4:4:4 SC	-0.3%	-0.3%	-0.3%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%
RGB 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YCbCr 4:4:4 SC	-0.3%	-0.3%	-0.3%	-0.4%	-0.3%	-0.4%	-0.4%	-0.4%	-0.4%
YCbCr 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RangeExt	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB 4:4:4 SC (Optional)	-2.1%	-2.1%	-2.2%	-2.2%	-2.2%	-2.2%	-2.2%	-2.2%	-2.2%
YCbCr 4:4:4 SC (Optional)	-1.5%	-1.6%	-1.6%	-1.6%	-1.6%	-1.6%	-1.7%	-1.7%	-1.7%
Enc Time[%]	100.5%			100.4%			100.3%		
Dec Time[%]	91.6%			91.0%			91.2%		

	Random Access Main-tier			Random Access High-tier		
	Y	U	V	Y	U	V
Class F	0.0%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB 4:4:4 SC	-0.4%	-0.4%	-0.4%	-0.5%	-0.5%	-0.5%
RGB 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YCbCr 4:4:4 SC	-0.4%	-0.4%	-0.4%	-0.4%	-0.5%	-0.4%
YCbCr 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RangeExt	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB 4:4:4 SC (Optional)	-2.0%	-2.0%	-2.0%	-2.3%	-2.3%	-2.3%
YCbCr 4:4:4 SC (Optional)	-1.3%	-1.5%	-1.4%	-1.3%	-1.3%	-1.3%
Enc Time[%]	99.8%			99.8%		
Dec Time[%]	93.9%			94.6%		

	Low delay B Main-tier			Low delay B High-tier		
	Y	U	V	Y	U	V
Class F	0.0%	0.1%	0.5%	0.1%	0.2%	0.3%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB 4:4:4 SC	-0.2%	-0.1%	-0.2%	-0.2%	-0.2%	-0.2%
RGB 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YCbCr 4:4:4 SC	-0.3%	-0.1%	-0.2%	-0.3%	-0.2%	-0.2%
YCbCr 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RangeExt	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB 4:4:4 SC (Optional)	-1.7%	-1.7%	-1.7%	-2.3%	-2.3%	-2.4%
YCbCr 4:4:4 SC (Optional)	-1.7%	-1.5%	-1.6%	-1.8%	-1.9%	-1.9%
Enc Time[%]	100.0%			100.1%		
Dec Time[%]	93.3%			93.8%		

Experiments results: 1 + 2

- Anchor: RCE4 Test 2
- Test: RCE4 Test 2 + modifications 1+2

■ Results AI/RA/LB:

- SC:
0.4%/0.4%/0.4%
- OSC:
2.0%/2.0%/2.0%

	All Intra Main-tier			All Intra High-tier			All Intra Super-High-tier		
	Y	U	V	Y	U	V	Y	U	V
Class F	-0.1%	-0.2%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB 4:4:4 SC	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%
RGB 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YCbCr 4:4:4 SC	-0.4%	-0.4%	-0.3%	-0.4%	-0.4%	-0.4%	-0.5%	-0.5%	-0.5%
YCbCr 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RangeExt	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB 4:4:4 SC (Optional)	-2.4%	-2.3%	-2.4%	-2.4%	-2.4%	-2.4%	-2.4%	-2.4%	-2.4%
YCbCr 4:4:4 SC (Optional)	-1.7%	-1.8%	-1.7%	-1.8%	-1.8%	-1.8%	-1.9%	-1.9%	-1.9%
Enc Time[%]	98.5%			98.6%			98.8%		
Dec Time[%]	91.4%			91.0%			91.3%		

	Random Access Main-tier			Random Access High-tier		
	Y	U	V	Y	U	V
Class F	0.0%	-0.2%	-0.1%	-0.1%	-0.1%	-0.1%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB 4:4:4 SC	-0.4%	-0.4%	-0.3%	-0.5%	-0.5%	-0.4%
RGB 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YCbCr 4:4:4 SC	-0.5%	-0.5%	-0.3%	-0.4%	-0.5%	-0.4%
YCbCr 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RangeExt	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB 4:4:4 SC (Optional)	-2.3%	-2.2%	-2.3%	-2.5%	-2.5%	-2.5%
YCbCr 4:4:4 SC (Optional)	-1.4%	-1.6%	-1.6%	-1.4%	-1.5%	-1.4%
Enc Time[%]	99.0%			99.2%		
Dec Time[%]	94.7%			95.7%		

	Low delay B Main-tier			Low delay B High-tier		
	Y	U	V	Y	U	V
Class F	0.0%	-0.5%	0.5%	0.1%	-0.2%	0.2%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB 4:4:4 SC	-0.3%	-0.2%	-0.3%	-0.3%	-0.3%	-0.4%
RGB 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YCbCr 4:4:4 SC	-0.4%	-0.4%	-0.3%	-0.3%	-0.3%	-0.2%
YCbCr 4:4:4 Animation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RangeExt	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB 4:4:4 SC (Optional)	-1.8%	-1.8%	-1.8%	-2.5%	-2.6%	-2.6%
YCbCr 4:4:4 SC (Optional)	-2.2%	-2.0%	-2.1%	-1.7%	-1.6%	-1.7%
Enc Time[%]	99.9%			99.9%		
Dec Time[%]	92.0%			92.8%		

Conclusion

■ Proposal:

- 2 simplifications for the coding mode of RCE4 Test 2

- Recommend to use these palette prediction method if the Palette Mode coding RCE4 Test 2 is adopted for the Range Extensions.