JCTVC-T0072
CE1-related: Palette coding for non-444 format content

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Overview

- Proposed to extend the use of current palette coding as in SCM3.0 to non-444 format content
  - YUV420 CU is treated as YUV444 for deriving palette table and indices
  - Current palette coding design as in SCM is directly applied
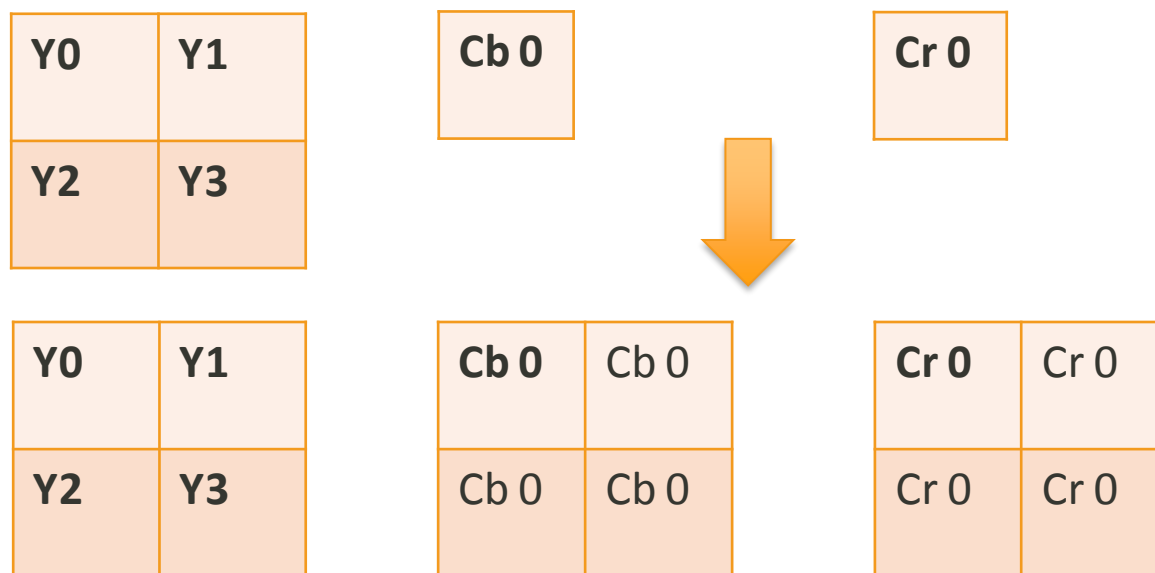 - Minimum changes to software and spec

- Results (lossy, CTC)

	All Intra			Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V	G/Y	B/U	R/V
Text & graphics with motion, 720p	-3.5%	-3.7%	-4.3%	-3.1%	-3.6%	-4.7%	-2.2%	-3.7%	-4.9%
Mixed content, 480p	-0.5%	-2.7%	-2.8%	-0.2%	-1.3%	-1.5%	0.1%	-0.1%	-0.6%
Animation, 768p	-5.3%	-15.1%	-10.6%	-2.9%	-16.7%	-10.0%	-1.6%	-12.7%	-6.0%
Average of all sequences	-3.2%	-6.3%	-5.5%	-2.3%	-6.3%	-5.2%	-1.5%	-5.1%	-4.1%
Enc Time[%]	111%			102%			100%		
Dec Time[%]	98%			101%			97%		

Introduction

- In the current SCM software, the palette coding mode is only used for RGB and YUV444 contents.

  - Each entry in the palette table represents 3 components.
  - One palette share flag, one transpose flag, and one index map are signalled.

- We provide a straightforward extension to apply the current palette coding method as in SCM3.0 to non-444 (YUV420) contents.

Proposed Method (1/2)

- In the proposed implementation, YUV420 Chroma values in position 1, 2, 3 are padded with the Chroma value in position 0.

- Then the palette derivation and coding processes as in SCM3.0 are applied.

Y0	Y1
Y2	Y3

Cb 0

Cr 0

Y0	Y1
Y2	Y3

Cb 0	Cb 0
Cb 0	Cb 0

Cr 0	Cr 0
Cr 0	Cr 0

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Proposed Method (2/2)

- Escape coding
  - Method 1
    - No change in syntax.
    - When Escape, both Luma and Chroma values are signalled (as in JCTVC-S1005).
    - The Chroma values for positions 1, 2 and 3 are discard in the reconstruction process.
  - Method 2
    - One line change to syntax.
    - When Escape, Chroma values for positions 1, 2 and 3 are not signalled.

Changes to Syntax

palette_coding(x0, y0, nCbS) {	Descriptor
palette_share_flag[x0][y0]	ae(v)
…	
while(scanPos < nCbS * nCbS) {	
…	
xC = x0 + travScan[scanPos][0]	
yC = y0 + travScan[scanPos][1]	
…	
if(palette_run_type_flag[xC][yC] = = COPY_INDEX_MODE &&	
paletteIndex = = indexMax) {	
PaletteSampleMode[xR][yR] = ESCAPE_MODE	
PaletteIndexMap[xR][yR] = paletteIndex	
for(cIdx = 0; cIdx < 3; cIdx++) {	
==if(ChromaArrayType ==3 || cIdx ==0 || (xC%2 == 0 && yC%2 ==0 && ChromaArrayType ==1)) {==	
palette_escape_val	ae(v)
PaletteEscapeVal[cIdx][xR][yR] = palette_escape_val	
==}==	
}	
}	
…	
runPos++	
scanPos++	
}	
}	
}	

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Simulation Results (1/3)

- ## SCM3.0 anchor, CTC420, lossy

  - ### Method 1 (no syntax change)

	All Intra			Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V	G/Y	B/U	R/V
Text & graphics with motion, 720p	-3.4%	-3.8%	-4.4%	-3.0%	-3.5%	-4.6%	-2.1%	-2.7%	-4.3%
Mixed content, 480p	-0.5%	-2.6%	-2.6%	-0.2%	-1.1%	-1.4%	0.1%	-0.2%	-0.6%
Animation, 768p	-5.3%	-15.0%	-10.5%	-2.9%	-16.7%	-9.8%	-1.5%	-12.7%	-6.5%
Average of all sequences	-3.2%	-6.3%	-5.5%	-2.3%	-6.2%	-5.1%	-1.4%	-4.6%	-3.9%
Enc Time[%]	111%			101%			100%		
Dec Time[%]	97%			99%			100%		

  - ### Method 2 (one line syntax change)

	All Intra			Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V	G/Y	B/U	R/V
Text & graphics with motion, 720p	-3.5%	-3.7%	-4.3%	-3.1%	-3.6%	-4.7%	-2.2%	-3.7%	-4.9%
Mixed content, 480p	-0.5%	-2.7%	-2.8%	-0.2%	-1.3%	-1.5%	0.1%	-0.1%	-0.6%
Animation, 768p	-5.3%	-15.1%	-10.6%	-2.9%	-16.7%	-10.0%	-1.6%	-12.7%	-6.0%
Average of all sequences	-3.2%	-6.3%	-5.5%	-2.3%	-6.3%	-5.2%	-1.5%	-5.1%	-4.1%
Enc Time[%]	111%			102%			100%		
Dec Time[%]	98%			101%			97%		

Simulation Results (2/3)

- Method 1 – lossless

All Intra			
Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)
Text & graphics with motion, 720p			
-0.1%	-0.1%	-0.2%	0.0%
Mixed content, 480p -- 0.0%	0.0%	0.0%	0.0%
Animation, 768p -- -0.3%	-0.3%	-0.3%	-0.3%
Average of all sequences -- -0.1%	-0.1%	-0.3%	0.0%
Enc Time[%] 117%			
Dec Time[%] 99%			

Random Access			
Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)
Text & graphics with motion, 720p			
-0.1%	-0.2%	-0.3%	-0.1%
Mixed content, 480p -- 0.0%	0.0%	0.0%	0.0%
Animation, 768p -- 0.0%	0.0%	0.0%	0.0%
Average of all sequences -- 0.0%	-0.1%	-0.3%	0.0%
Enc Time[%] 100%			
Dec Time[%] 97%			

Low Delay B			
Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)
Text & graphics with motion, 720p			
0.0%	0.0%	0.0%	0.0%
Mixed content, 480p -- 0.0%	0.0%	0.0%	0.0%
Animation, 768p -- 0.0%	0.0%	0.0%	0.0%
Average of all sequences -- 0.0%	0.0%	0.0%	0.0%
Enc Time[%] 100%			
Dec Time[%] 101%			

- Method 2 – lossless

All Intra			
Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)
Text & graphics with motion, 720p			
-0.1%	-0.1%	-0.3%	0.0%
Mixed content, 480p -- -0.1%	-0.1%	-0.1%	-0.1%
Animation, 768p -- -0.5%	-0.5%	-0.5%	-0.5%
Average of all sequences -- -0.2%	-0.2%	-0.5%	0.0%
Enc Time[%] 119%			
Dec Time[%] 100%			

Random Access			
Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)
Text & graphics with motion, 720p			
-0.1%	-0.2%	-0.3%	-0.1%
Mixed content, 480p -- 0.0%	0.0%	0.0%	0.0%
Animation, 768p -- 0.0%	0.0%	0.0%	0.0%
Average of all sequences -- 0.0%	-0.1%	-0.3%	0.0%
Enc Time[%] 103%			
Dec Time[%] 99%			

Low Delay B			
Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)
Text & graphics with motion, 720p			
-0.1%	0.0%	-0.1%	0.0%
Mixed content, 480p -- 0.0%	0.0%	0.0%	0.0%
Animation, 768p -- 0.0%	0.0%	0.0%	0.0%
Average of all sequences -- 0.0%	0.0%	-0.1%	0.0%
Enc Time[%] 98%			
Dec Time[%] 103%			

Simulation Results (3/3)

- Down-sampled 420, Text and graphics with motion, 1080p, lossy
  - Method 1 (no syntax change)

	All Intra			Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V	G/Y	B/U	R/V
sc_flyingGraphics_1920x1080_60_8bit_420	-5.3%	-8.7%	-9.2%	-2.4%	-5.5%	-5.9%	-5.4%	-8.8%	-9.3%
sc_desktop_1920x1080_60_8bit_420	-6.6%	-6.0%	-6.3%	-4.8%	-3.9%	-3.9%	-6.6%	-6.0%	-6.3%
sc_console_1920x1080_60_8bit_420	-13.1%	-11.3%	-10.2%	-6.2%	-5.3%	-4.3%	-13.2%	-11.4%	-10.2%
Average of all sequences	-8.3%	-8.7%	-8.5%	-4.5%	-4.9%	-4.7%	-8.4%	-8.7%	-8.6%
Enc Time[%]	n/a			n/a			n/a		
Dec Time[%]	n/a			n/a			n/a		

  - Method 2 (one line syntax change)

	All Intra			Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V	G/Y	B/U	R/V
sc_flyingGraphics_1920x1080_60_8bit_420	-5.4%	-8.8%	-9.3%	-2.4%	-5.4%	-5.7%	-1.5%	-6.1%	-7.2%
sc_desktop_1920x1080_60_8bit_420	-6.6%	-6.0%	-6.3%	-4.9%	-3.8%	-3.7%	-2.5%	-1.4%	-1.1%
sc_console_1920x1080_60_8bit_420	-13.2%	-11.4%	-10.2%	-6.3%	-5.4%	-4.5%	-2.9%	-2.8%	-2.6%
Average of all sequences	-8.4%	-8.7%	-8.6%	-4.5%	-4.9%	-4.6%	-2.3%	-3.5%	-3.6%
Enc Time[%]	n/a			n/a			n/a		
Dec Time[%]	n/a			n/a			n/a		

Conclusion

- This document proposes to extend the use of the current palette coding method as in SCM3.0 to non-444 contents.

- Coding gains are reported with minimum changes to software and text.

- Thanks to Intel for crosscheck (JCTVC-T0145).

- Recommend to include this extension to SCM4.0 and WD.