JCTVC-R0051
Non-SCCE3:Adaptive escape scheme for palette mode

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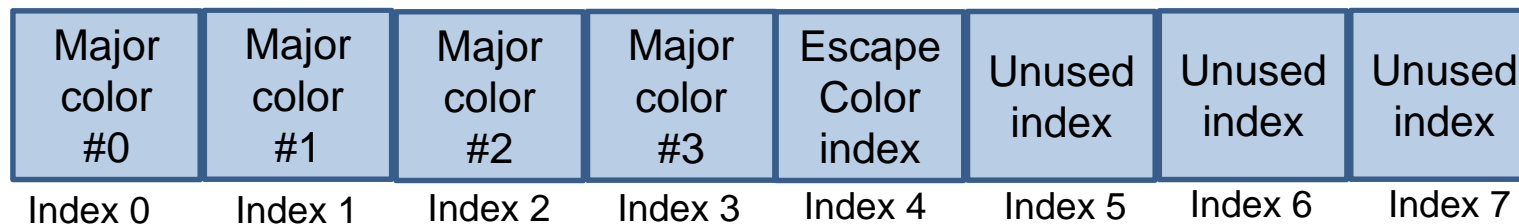Sapporo June 2014

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Current palette mode

- On top of SCM-1.0 + JCTVC-Q0094 + bug-fixes of JCTVC-Q0047

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Escape value signaling in current palette mode

- The last color index is always reserved to signal escape color for each palette CU.
  - EX: If there are four colors in palette, it needs three bits to code color indices.

Major color #0	Major color #1	Major color #2	Major color #3	Escape Color index	Unused index	Unused index	Unused index
Index 0	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6	Index 7

- Not all the palette CUs contain escape color
  - Current software only transmits escape color when the palette size is 31

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Our scheme

- At CU level, an adaptive escape flag is proposed.

- Adaptive escape flag is on:
  - Keep the last index for escape color
  - Identical to current SCCE3 software
- Adaptive escape flag is off:
  - Remove the last index for escape color

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Example of our scheme

- ## Let N be the palette size :

  - **If the flag is on**: the number of bits for color index is: **Floor(log2N) + 1**

  - **If the flag off:** the number of bits for color index is: **Ceil(log2N)**

N	# of Bits for color index	
	flag on	flag off
1	1	0
2	2	1
3	2	2
4	3	2
5-7	3	3
8	4	3
9-15	4	4
16	5	4
17-31	5	5

Results of AI, Lossy

	All Intra (Full Frame)			All Intra (2CTU)		
	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p	-0.2%	-0.2%	-0.2%	-0.5%	-0.5%	-0.5%
RGB, text & graphics with motion,720p	-0.1%	-0.1%	-0.1%	-0.2%	-0.1%	-0.2%
RGB, mixed content, 1440p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, mixed content, 1080p	-0.1%	-0.1%	0.0%	-0.1%	-0.1%	-0.1%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p	-0.4%	-0.3%	-0.3%	-0.7%	-0.6%	-0.6%
YUV, text & graphics with motion,720p	-0.1%	-0.2%	-0.2%	-0.2%	-0.2%	-0.2%
YUV, mixed content, 1440p	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%
YUV, mixed content, 1080p	-0.1%	0.0%	0.0%	-0.1%	-0.1%	-0.1%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	101%			101%		
Dec Time[%]	100%			100%		

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Conclusion

- An adaptive escape flag is proposed at CU level.

- Escape index can be adaptively removed
  - 0.7% BD-rate saving

- Compatible for encoder without using escape pixel
  - Ex: current SCCE3 software

- Compatible for encoder with using escape pixel
  - Ex: refer to ITRI's contribution JCTVC-R0075

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Recommendations

- Recommend further study with Palette-related CEs in the scope of Screen Content Coding study.

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Acknowledgement

- Thanks Qualcomm for cross check

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Thank You

Recommendations

- Recommend further study with Palette-related CEs in the scope of Screen Content Coding study.

Appendix

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Results of RA, Lossy

	Random Access (Full Frame)			Random Access (2CTU)		
	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p	-0.1%	-0.1%	-0.1%	-0.2%	-0.2%	-0.2%
RGB, text & graphics with motion,720p	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
RGB, mixed content, 1440p	0.0%	0.1%	0.0%	0.1%	0.1%	0.1%
RGB, mixed content, 1080p	-0.1%	-0.1%	-0.1%	-0.1%	0.0%	-0.1%
RGB, Animation, 720p	-0.1%	-0.1%	-0.1%	0.0%	-0.1%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p	-0.2%	-0.2%	-0.2%	-0.2%	-0.3%	-0.3%
YUV, text & graphics with motion,720p	-0.1%	0.0%	-0.2%	-0.1%	-0.2%	-0.2%
YUV, mixed content, 1440p	-0.1%	-0.1%	-0.2%	0.0%	0.0%	-0.1%
YUV, mixed content, 1080p	-0.1%	-0.1%	0.0%	0.0%	-0.1%	-0.1%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	100%			100%		
Dec Time[%]	100%			100%		

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Results of LB, Lossy

	Low delay B (Full Frame)			Low delay B (2CTU)		
	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.2%
RGB, text & graphics with motion,720p	-0.2%	-0.3%	-0.2%	-0.3%	-0.2%	-0.2%
RGB, mixed content, 1440p	-0.1%	0.0%	0.1%	-0.1%	-0.1%	-0.1%
RGB, mixed content, 1080p	0.0%	0.0%	-0.1%	0.0%	-0.1%	-0.1%
RGB, Animation, 720p	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p	-0.1%	-0.2%	-0.1%	-0.1%	-0.1%	-0.1%
YUV, text & graphics with motion,720p	0.1%	-0.2%	-0.1%	0.1%	-0.1%	0.4%
YUV, mixed content, 1440p	-0.1%	-0.1%	-0.1%	-0.1%	-0.4%	-0.3%
YUV, mixed content, 1080p	-0.2%	-1.6%	-0.3%	-0.1%	-1.0%	-0.3%
YUV, Animation, 720p	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	100%			100%		
Dec Time[%]	100%			100%		

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Results of AI, Lossless

	All Intra(Full Frame)				All Intra(2CTU)			
	Bit-rate saving (Total)	Bit-rate saving (Average)	Bit-rate saving (Min)	Bit-rate saving (Max)	Bit-rate saving (Total)	Bit-rate saving (Average)	Bit-rate saving (Min)	Bit-rate saving (Max)
RGB, text & graphics with motion, 1080p	0.1%	0.1%	0.0%	0.2%	0.3%	0.3%	0.0%	0.7%
RGB, text & graphics with motion,720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, mixed content, 1440p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, mixed content, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p	0.2%	0.2%	0.0%	0.3%	0.3%	0.3%	0.0%	0.7%
YUV, text & graphics with motion,720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, mixed content, 1440p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, mixed content, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	101%				101%			
Dec Time[%]	100%				100%			

Results of RA, Lossless

	Random Access(Full Frame)				Random Access(2CTU)			
	Bit-rate saving (Total)	Bit-rate saving (Average)	Bit-rate saving (Min)	Bit-rate saving (Max)	Bit-rate saving (Total)	Bit-rate saving (Average)	Bit-rate saving (Min)	Bit-rate saving (Max)
RGB, text & graphics with motion, 1080p	0.0%	0.1%	0.0%	0.2%	0.0%	0.2%	0.0%	0.4%
RGB, text & graphics with motion,720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, mixed content, 1440p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, mixed content, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p	0.0%	0.1%	0.0%	0.3%	0.0%	0.2%	0.0%	0.4%
YUV, text & graphics with motion,720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, mixed content, 1440p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, mixed content, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	101%				101%			
Dec Time[%]	100%				100%			

Results of LB, Lossless

	Low Delay B(Full Frame)				Low Delay B(2CTU)			
	Bit-rate saving (Total)	Bit-rate saving (Average)	Bit-rate saving (Min)	Bit-rate saving (Max)	Bit-rate saving (Total)	Bit-rate saving (Average)	Bit-rate saving (Min)	Bit-rate saving (Max)
RGB, text & graphics with motion, 1080p	0.0%	0.1%	0.0%	0.3%	0.0%	0.2%	0.0%	0.4%
RGB, text & graphics with motion,720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, mixed content, 1440p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, mixed content, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p	0.0%	0.1%	0.0%	0.3%	0.0%	0.1%	0.0%	0.4%
YUV, text & graphics with motion,720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, mixed content, 1440p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, mixed content, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	101%				101%			
Dec Time[%]	100%				100%			