

JCTVC-R0076

Non-SCCE3: Run-copy coding method for double-color index map of palette CU

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Sapporo June 2014

Current palette mode

- On top of SCM-1.0 + JCTVC-Q0094 + bug-fixes of JCTVC-Q0047
- There are two copy-run modes for index map coding :
 - “Copy left run” mode
 - “Copy above run” mode

Double colors issue in current palette mode

- There are only two major colors in palette table:
 - Index number is either 0 or 1
- Redundancy in copy-left run mode
 - Need to signal color index after copy-left run mode flag
 - It is unnecessary to signal the color index for double colors palette table

An example for current palette mode:

- For the first row:
 - ‘Index (0)’ + ‘Run (1)’ + ‘Index (1)’ + ‘Run (1)’ +
‘Index (0)’ + ‘Run (1)’ + ‘Index (1)’ + ‘Run (1)’ +
...

0	0	1	1	0	0	1	1
0	0	1	0	0	0	1	0
0	0	1	0	0	0	1	0
0	0	0	1	0	0	0	1
⋮							

Our solution

- In copy-left run mode
 - Skip the coding color index when the palette has two colors

An example of our solution

- For the first row:
 - ‘Index (0)’ + ‘Run (1)’ + ~~‘Index (1)’~~ + ‘Run (1)’ +
~~‘Index (0)’~~ + ‘Run (1)’ + ~~‘Index (1)’~~ + ‘Run (1)’ +
...

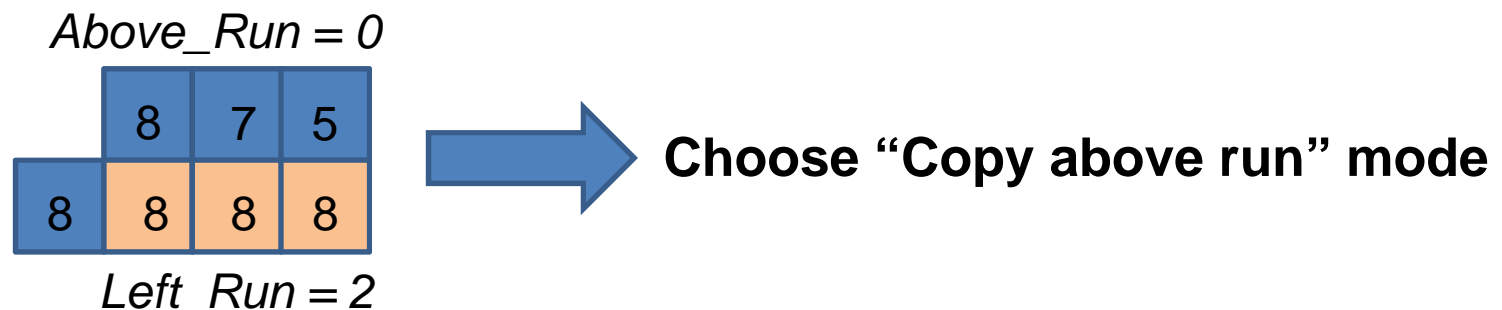
0	0	1	1	0	0	1	1
0	0	1	0	0	0	1	0
0	0	1	0	0	0	1	0
0	0	0	1	0	0	0	1
■							
■							
■							

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	-0.3%	-0.3%	-0.3%	-0.9%	-0.9%	-0.9%
RGB, text & graphics with motion,720p	-0.1%	-0.1%	0.0%	-0.1%	-0.1%	-0.1%
RGB, mixed content, 1440p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, mixed content, 1080p	-0.1%	0.0%	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	-0.6%	-0.4%	-0.4%	-1.3%	-1.0%	-1.0%
YUV, text & graphics with motion,720p	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.2%
YUV, mixed content, 1440p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, mixed content, 1080p	-0.1%	0.0%	0.0%	-0.1%	0.0%	0.0%
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[%]	100%			100%		
Dec Time[%]	100%			100%		

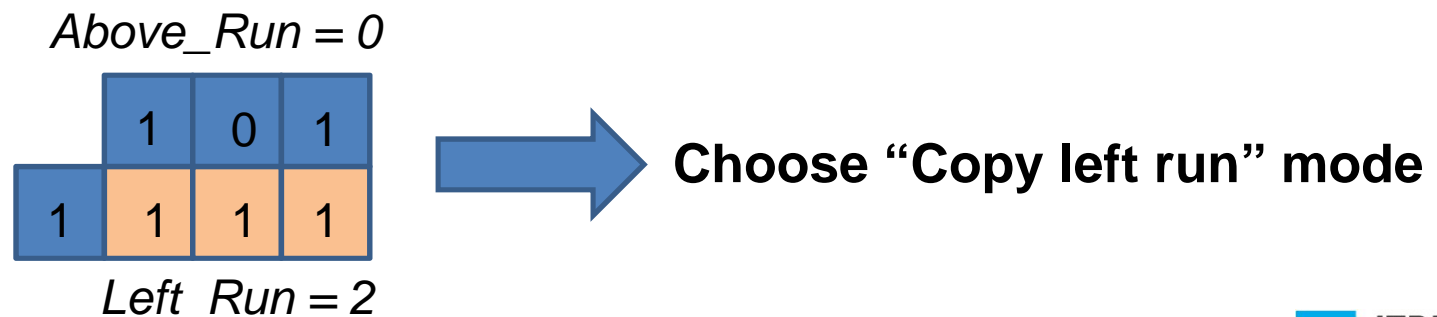
Current encoder in palette mode

- If “copy left run” and “copy above run” are coexisted, the best mode is decided based on :
 - Run values
 - The bit numbers of the color index
- An example:



Our proposed encoder

- The proposed “copy-left run” mode skips the coding of indices as palette size equals to two, the decision is modified accordingly:
 - Run values
 - No need for the bit numbers of the color index
- An example:



Encoder improvement 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	-0.4%	-0.4%	-0.4%	-1.2%	-1.2%	-1.2%
RGB, text & graphics with motion, 720p	-0.1%	-0.1%	0.0%	-0.2%	-0.1%	-0.1%
RGB, mixed content, 1440p	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%
RGB, mixed content, 1080p	-0.1%	-0.1%	-0.1%	-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	-0.8%	-0.5%	-0.5%	-1.7%	-1.3%	-1.3%
YUV, text & graphics with motion, 720p	-0.1%	-0.1%	-0.1%	-0.2%	-0.2%	-0.2%
YUV, mixed content, 1440p	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%
YUV, mixed content, 1080p	-0.2%	-0.1%	-0.1%	-0.2%	-0.1%	-0.1%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	-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%		

Conclusion

- Skip color index coding when there are only double colors in palette mode
- Complexity is almost unchanged but with 1.7% coding gain

Recommendations

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

Acknowledgement

- We would like to thank Qualcomm for cross check

Thank You

Appendix

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	-0.2%	-0.2%	-0.2%	-0.4%	-0.4%	-0.4%
RGB, text & graphics with motion, 720p	0.0%	-0.1%	0.0%	-0.1%	-0.1%	-0.1%
RGB, mixed content, 1440p	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%
RGB, mixed content, 1080p	-0.1%	0.0%	-0.1%	0.0%	-0.1%	-0.1%
RGB, Animation, 720p	0.0%	0.0%	-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%	-0.4%	-0.4%	-0.4%
YUV, text & graphics with motion, 720p	-0.1%	0.0%	-0.1%	-0.1%	0.1%	-0.1%
YUV, mixed content, 1440p	-0.1%	0.1%	-0.1%	0.0%	0.0%	0.0%
YUV, mixed content, 1080p	-0.1%	-0.1%	-0.1%	0.0%	-0.1%	-0.1%
YUV, Animation, 720p	0.1%	-0.1%	0.0%	0.0%	0.2%	-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%		

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%	-0.2%	-0.1%	-0.2%	-0.3%	-0.3%
RGB, text & graphics with motion, 720p	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
RGB, mixed content, 1440p	-0.2%	-0.1%	-0.1%	-0.1%	0.0%	-0.1%
RGB, mixed content, 1080p	-0.1%	-0.2%	-0.3%	0.1%	0.0%	0.1%
RGB, Animation, 720p	-0.1%	-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%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
YUV, text & graphics with motion, 720p	0.0%	0.1%	-0.3%	0.1%	-0.2%	0.2%
YUV, mixed content, 1440p	0.0%	0.0%	-0.1%	-0.1%	-0.1%	-0.5%
YUV, mixed content, 1080p	0.0%	-0.4%	0.1%	0.0%	-0.6%	-0.2%
YUV, Animation, 720p	-0.1%	0.1%	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%		

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%	0.2%	0.0%	0.3%	0.5%	0.6%	0.0%	1.3%
RGB, text & graphics with motion, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
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%	0.4%	0.6%	0.6%	0.0%	1.3%
YUV, text & graphics with motion, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
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, Lossy

	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%	0.2%	0.0%	0.4%	0.1%	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	0.0%	0.2%	0.0%	0.4%	0.1%	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[%]	100%				100%			
Dec Time[%]	100%				100%			

Results of LB, Lossy

	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%	0.2%	0.0%	0.5%	0.0%	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	0.0%	0.2%	0.0%	0.5%	0.0%	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[%]	100%				100%			
Dec Time[%]	100%				100%			