JCTVC-R0348

Suggested combined software and text for run-based palette mode

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Overall Summary

- The palette BoG provided a combination of useful palette techniques reported in the SCCE3 summary report.

- BD-rates under FF-IBC and All Intra compared with palette-off:
  -21.5% / -21.4% for RGB / YUV, text & graphics, 1080p
  -15.8% / -11.1% for RGB / YUV, text & graphics, 720p

- In comparison with SCCE3 category C, 1-4% BD-rate savings are observed, while overall complexity is reduced.

- Further simplification was conducted to remove two scans.

- **It is proposed to adopt the simplified combined palette into SCM-2.0.**

Combined Palette Mode

- **Category A, palette table coding techniques:**
    - Palette sharing, Test A2/A4/A5 (JCTVC-R0119/R0142/R0166)
    - Palette stuffing, Test A3/A4/A5/A8 (JCTVC-R0082/R0142/R0166/R0063)
    - Grouping reuse flags, Test A8 (JCTVC-R0063)
    - Encoder-only palette generation, Test C2/C4 sup. (JCTVC-R0086/R0175)
- **Category B, color index map coding techniques:**
    - Vertical scan, Test B4/B8/B9/B15 (JCTVC-R0057/R0143/R0168/R0048)
    - Redundant index removal, Test B5/B10/B12 (JCTVC-R0083/R0169/R0065)
    - Truncated binary codes for color indices, Test B5/B12 (JCTVC-R0083/R0065)
    - Escape color values coded as bypass, Test C4 (JCTVC-R0067)
    - Traverse scans, Test B9 (JCTVC-R0168)
- **Other techniques:**
    - Palette reset per CTU row for WPP-on only, Test C4 (JCTVC-R0067)
    - Bugfixes of RDO (JCTVC-R0306)
    - Bugfix of palette_num_signalled_entries (JCTVC-R0215)
    - Software memory reduction (JCTVC-R0307) **=> To be integrated after the Sapporo meeting**

Q0094BF Palette versus Palette-off

- FF-IBC condition

	All Intra		
	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p	-10.4%	-10.4%	-10.3%
RGB, text & graphics with motion,720p	-5.6%	-5.0%	-5.3%
RGB, mixed content, 1440p	-1.2%	-1.1%	-1.0%
RGB, mixed content, 1080p	-2.2%	-2.3%	-2.1%
RGB, Animation, 720p	0.0%	-0.1%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p	-10.6%	-12.1%	-11.2%
YUV, text & graphics with motion,720p	-4.7%	-6.8%	-8.8%
YUV, mixed content, 1440p	-0.9%	-2.4%	-2.3%
YUV, mixed content, 1080p	-2.3%	-3.4%	-3.2%
YUV, Animation, 720p	0.1%	-0.1%	0.0%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%
Enc Time[%]	102%		
Dec Time[%]	99%		

Combined Palette versus Palette-off

- FF-IBC condition

	All Intra		
	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p	-21.5%	-21.1%	-20.9%
RGB, text & graphics with motion,720p	-15.8%	-13.7%	-14.2%
RGB, mixed content, 1440p	-6.9%	-5.6%	-5.7%
RGB, mixed content, 1080p	-7.7%	-7.4%	-7.2%
RGB, Animation, 720p	-0.4%	-0.8%	-0.9%
RGB, camera captured, 1080p	0.1%	0.1%	0.0%
YUV, text & graphics with motion, 1080p	-21.4%	-24.3%	-23.5%
YUV, text & graphics with motion,720p	-11.1%	-16.1%	-20.0%
YUV, mixed content, 1440p	-5.4%	-11.5%	-11.8%
YUV, mixed content, 1080p	-7.3%	-12.8%	-12.9%
YUV, Animation, 720p	0.2%	-1.6%	-1.5%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%
Enc Time[%]	117%		
Dec Time[%]	100%		

Combined Palette versus Q0094BF

- FF-IBC condition

	All Intra		
	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p	-12.1%	-11.8%	-11.6%
RGB, text & graphics with motion,720p	-10.7%	-9.2%	-9.4%
RGB, mixed content, 1440p	-5.8%	-4.6%	-4.8%
RGB, mixed content, 1080p	-5.7%	-5.2%	-5.2%
RGB, Animation, 720p	-0.4%	-0.7%	-0.9%
RGB, camera captured, 1080p	0.0%	0.1%	0.0%
YUV, text & graphics with motion, 1080p	-12.3%	-13.9%	-13.7%
YUV, text & graphics with motion,720p	-6.9%	-10.1%	-12.5%
YUV, mixed content, 1440p	-4.5%	-9.2%	-9.7%
YUV, mixed content, 1080p	-5.1%	-9.7%	-9.8%
YUV, Animation, 720p	0.1%	-1.6%	-1.5%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%
Enc Time[%]	109%		
Dec Time[%]	96%		

Complexity Comparison

	Q0094BF R0033 (run)	C.1 R0122 (line)	C.2 R0086 (run)	C.3 R0144 (string)	C.4 R0067 (run)	**Combined Palette** C.5 R0348 (run)
Off-chip memory BW per sample	0	0	0	8B	0	0
Additional on-chip memory size	0	38.75B	19.375B	36KB	0	0
Worst case ctx bins per 3-com. Pixel	3.88	5.28	3.88	16.06	2.88	1.89
Parsing dependency	No	No	Yes	No	Yes	No

Note: Worst case context bins per 3-component pixel for HEVC RExt is 6.19.

Coding Efficiency Comparison, RGB-AI

- FF-IBC condition; BD-rates of the first 4 classes are averaged; anchor: Q0094BF palette
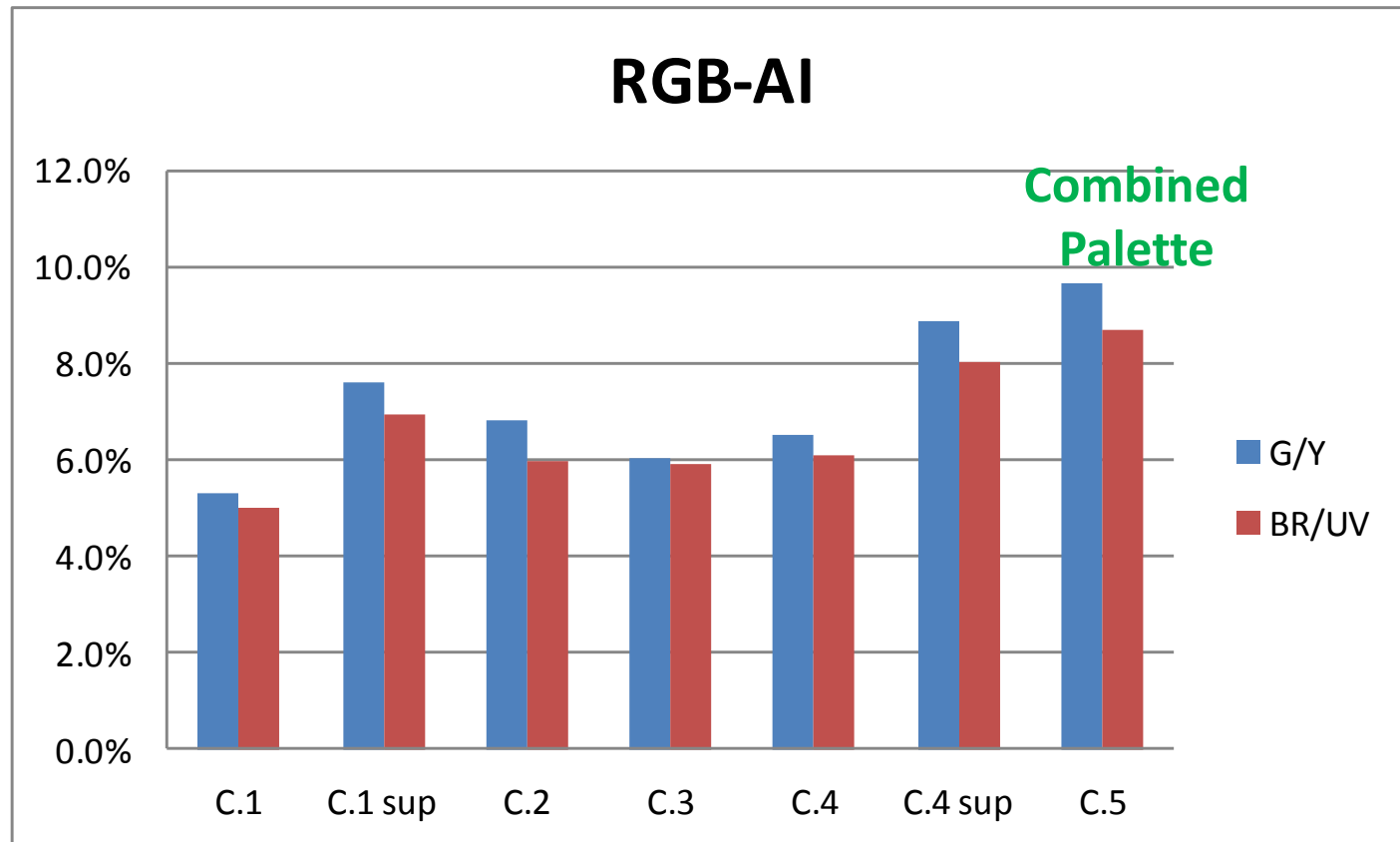
RGB-AI

Combined Palette

Legend: G/Y (blue), BR/UV (red)

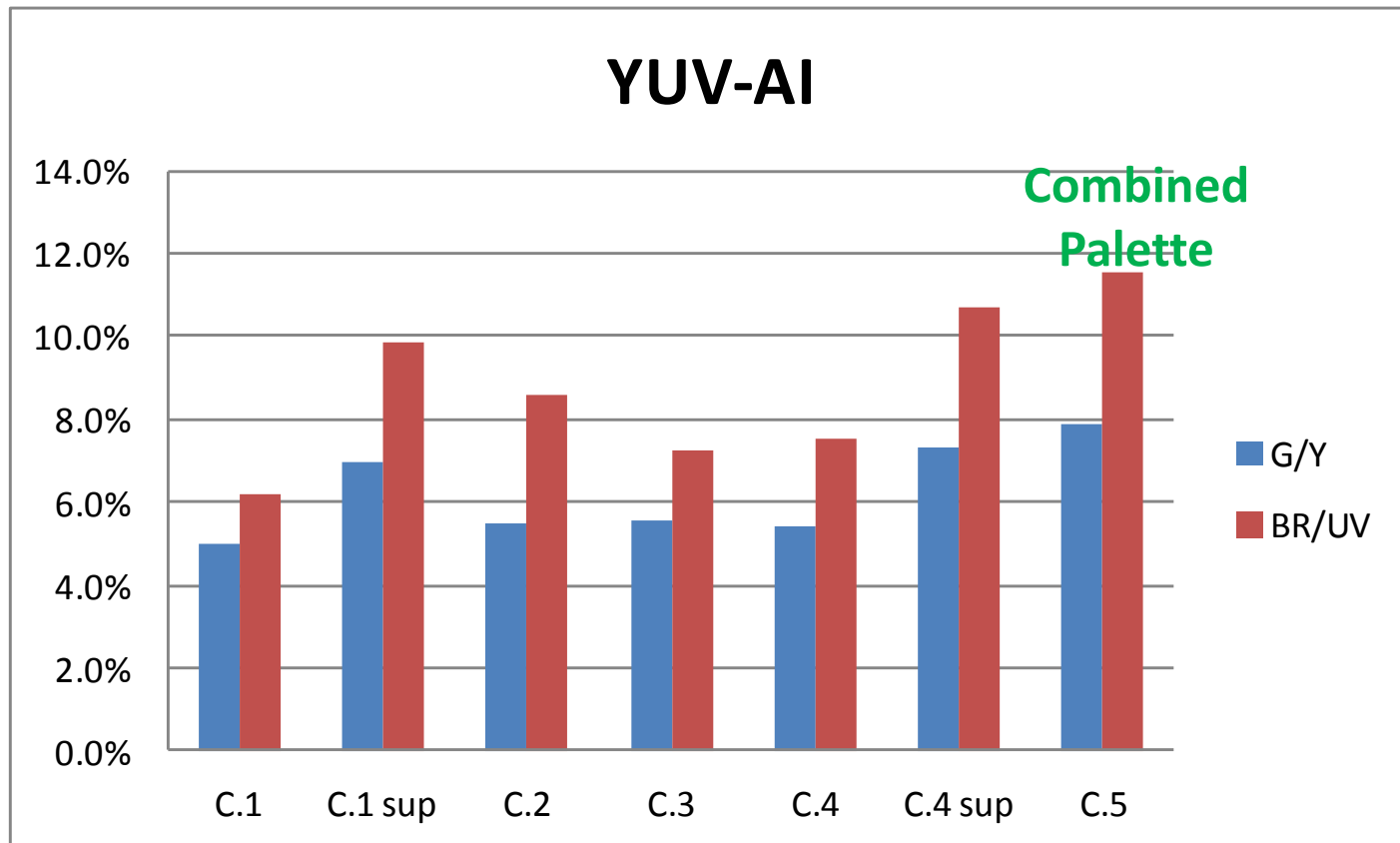Categories: C.1, C.1 sup, C.2, C.3, C.4, C.4 sup, C.5

C.1 supplemental and C.4 supplemental are non-CE variants of C.1 and C.4, respectively, with encoder-only changes.

Coding Efficiency Comparison, YUV-AI

- FF-IBC condition; BD-rates of the first 4 classes are averaged; anchor: Q0094BF palette

C.1 supplemental and C.4 supplemental are non-CE variants of C.1 and C.4, respectively, with encoder-only changes.

Simplified Combined Palette versus Combined Palette

- FF-IBC condition

- Removing horizontal and vertical scans and keeping only horizontal traverse and vertical traverse scans

	All Intra		
	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p	0.1%	0.1%	0.1%
RGB, text & graphics with motion,720p	0.0%	0.0%	0.0%
RGB, mixed content, 1440p	0.0%	0.0%	0.0%
RGB, mixed content, 1080p	0.0%	0.0%	0.0%
RGB, Animation, 720p	0.0%	0.0%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p	0.1%	0.1%	0.1%
YUV, text & graphics with motion,720p	0.0%	0.1%	0.1%
YUV, mixed content, 1440p	0.0%	0.0%	0.0%
YUV, mixed content, 1080p	0.0%	0.1%	0.1%
YUV, Animation, 720p	0.0%	0.0%	0.0%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%

Conclusion

- **It is proposed to adopt the simplified combined palette into SCM-2.0.**
  - It is a reasonable combination of useful palette techniques reported in the SCCE3 summary report.
  - In comparison with SCCE3 category C, 1-4% BD-rate savings are observed, while overall complexity is reduced.

THANK YOU