

JCTVC-T0119

Non-CE1: Improved palette run-length coding with palette flipping

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# Proposal (1)

- Modified run-length coding in CE1

## Test B.1

- One “run-to-the-end” flag is signaled to indicate the last run of one palette CU.
- It can only be applied to code the last run.

- The proposed palette flipping

- One CU-level flag *palette\_flipping\_flag* is proposed to indicate whether or not to flip CU vertically.
- This allows “run-to-the-end” flag to also be applied the first run.

0	0	0	0	0	0	0	0	▶	0
0	▶	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	▶	1
0	▶	0	0	0	0	0	1	0	1
0	0	0	0	0	0	0	0	▶	1
1	▶	1	0	0	0	0	2	0	0
2	0	2	0	0	0	0	0	▶	0
1	▶	1	1	1	0	0	0	0	0

(a) Original palette index map

1	1	1	1	0	0	0	0	▶	0
2	▶	2	0	0	0	0	0	0	0
1	0	1	0	0	0	0	2	▶	0
0	▶	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	1	▶	1
0	▶	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	▶	0
0	▶	0	0	0	0	0	0	0	0

(b) Flipped palette index map

# Proposal (2)

- Encoder method in SCM-3.0
  - Derives the possible largest runs for both index mode and copy-above mode, and compares the average bit costs.
  - Sub-optimal when one index mode is followed by one copy-above mode, as the index run does not consider future copy-above run.
- The proposed encoder improvement
  - When index mode is followed by copy-above mode, it is proposed to determine the optimal combination of index run and copy-above run.

# Lossy coding performance

- Gain for *text & graphics with motion*
  - AI: {0.7%, 0.7%, 0.8%},
  - RA: {0.4%, 0.5%, 0.6%}
  - LD: {0.3%, 0.5%, 0.4%}

	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
RGB, text & graphics with motion, 1080p & 720p	-0.6%	-0.7%	-0.6%	-0.4%	-0.5%	-0.4%	-0.3%	-0.4%	-0.4%
RGB, mixed content, 1440p & 1080p	-0.2%	-0.2%	-0.2%	-0.1%	-0.1%	-0.2%	-0.3%	-0.2%	-0.3%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p & 720p	-0.7%	-0.8%	-0.9%	-0.4%	-0.6%	-0.7%	-0.4%	-0.5%	-0.5%
YUV, mixed content, 1440p & 1080p	-0.3%	-0.6%	-0.6%	-0.2%	-0.3%	-0.5%	-0.1%	-0.3%	-0.3%
YUV, Animation, 720p	0.0%	-0.2%	-0.1%	-0.1%	-0.1%	0.1%	0.0%	-0.1%	0.0%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	-0.2%
Enc Time[%]		102%			102%			101%	
Dec Time[%]		100%			99%			101%	

# Lossless coding performance

- *text & graphics with motion*
  - 0.3%, 0.2% and 0.1% for AI, RA and LB, respectively

	All Intra				Random Access				Low Delay B			
	Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)	Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)	Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)
	RGB, text & graphics with motion, 1080p & 720p	-0.2%	-0.3%	-0.6%	-0.1%	-0.1%	-0.2%	-0.5%	0.0%	-0.1%	-0.1%	-0.3%
RGB, mixed content, 1440p & 1080p	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, Animation, 720p	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, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p & 720p	-0.3%	-0.3%	-0.7%	-0.1%	-0.1%	-0.2%	-0.5%	0.0%	-0.1%	-0.1%	-0.3%	0.0%
YUV, mixed content, 1440p & 1080p	0.0%	0.0%	0.0%	0.0%	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%	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%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	98%				95%				96%			
Dec Time[%]	94%				99%				100%			

Thanks to MediaTek for the cross-check!

# Closing remarks

- The proposed methods
  - One CU-level flag is proposed to indicate whether or not flip the CU vertically
  - Encoder improvement by determining optimal combination of index run followed by copy-above run.
- Coding performance
  - Average BD-rate savings for AI, RA and LB are 0.7%, -0.4% and 0.3%, respectively, for lossy coding.
  - Average bit-rate savings for AI, RA and LB are 0.3%, 0.2% and 0.1%, respectively, for lossless coding.
  - Little complexity impact.