



CE13: Results of Tests 1, 3d, and 3e in Section 3.1 on Replacing Redundant MVPs

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Overall Summary

- To compensate the coding efficiency loss caused by the fixed MVP list size:
- Test 1 adds two additional MVP candidates to fill empty positions in the MVP list for Merge mode by
 1. Truncating the first available MVP to integer precision
 2. Adding a constant value to the first available MVP
- Results: 0.1-0.5% BD-rate gain with an average of 101% encoding time and 99% decoding time
- Also report the results of Test 3d and 3e which combine Test 1 with adaptive MVP list size by neighboring merge indices (Test 2d) or by CU size (Test 2e).

Basic Approach

- Adding two additional MVP candidates to fill empty positions in the MVP list for merge mode by
 1. Truncating the first available MVP to integer precision
 2. Adding 1 pixel to the x-coordinate of the first available MVP

- The truncation candidate is simple that does not need the interpolation process
 - The decoding time can be reduced.

Additional Merge Candidates Priority

- Combined bi-predictive Merge candidate (5)
- Scaled bi-predictive Merge candidate (1)
- Rounding first Merge candidate (1)
- Add an offset to the first Merge candidate (1)
- Zero vector Merge/AMVP candidate (2)

Note : Black items indicate what have been in HM4.0 and red items indicate additional candidates.

Description of Experiments

- Experiments are conducted according to the common test conditions defined in JCTVC-F900
- The software is based on HM-4.0 with the merge estimation bug fix in the encoder
 - The bug fix can result in 0.1% coding efficiency gain.
- Anchor: HM-4.0 + bug fix
- Six configurations: HE-RA, LC-RA, HE-LDB, LC-LDB, HE-LDP, and LC-LDP

Test 1 (Tool 1)

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	-0.1%	-0.2%	-0.1%	-0.2%	-0.1%	-0.2%
Class B	-0.1%	0.0%	0.1%	-0.2%	0.1%	0.0%
Class C	-0.1%	0.0%	0.0%	-0.1%	-0.1%	0.0%
Class D	-0.1%	0.0%	0.0%	-0.1%	-0.1%	0.0%
Class E						
Overall	-0.1%	0.0%	0.0%	-0.1%	-0.1%	-0.1%
	-0.1%	0.0%	0.0%	-0.1%	-0.1%	-0.1%
Enc Time[%]	101.1%			100.6%		
Dec Time[%]	100.2%			98.8%		

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	-0.1%	0.0%	0.1%	-0.2%	0.0%	-0.3%
Class C	-0.2%	-0.3%	-0.2%	-0.2%	0.1%	0.2%
Class D	-0.2%	-0.1%	0.2%	-0.2%	-0.1%	0.3%
Class E	0.0%	-0.3%	-0.2%	-0.3%	-0.2%	0.0%
Overall	-0.2%	-0.1%	0.0%	-0.2%	-0.1%	0.0%
	-0.1%	-0.1%	0.0%	-0.2%	-0.1%	0.0%
Enc Time[%]	100.3%			100.8%		
Dec Time[%]	99.7%			100.3%		

	Low delay P HE			Low delay P LC		
	Y	U	V	Y	U	V
Class A						
Class B	-0.3%	0.0%	-0.1%	-0.7%	-0.5%	-0.5%
Class C	-0.2%	-0.1%	-0.3%	-0.5%	-0.4%	-0.7%
Class D	-0.2%	0.3%	-0.4%	-0.4%	-0.1%	-0.6%
Class E	0.0%	-0.2%	0.5%	-0.4%	0.9%	0.7%
Overall	-0.2%	0.0%	-0.1%	-0.5%	-0.1%	-0.3%
	-0.2%	-0.1%	-0.1%	-0.5%	-0.1%	-0.3%
Enc Time[%]	103.0%			103.0%		
Dec Time[%]	98.8%			97.7%		

Additional Tests: Test3d and Test3e

All with bug fix	Additional candidates	Fixed List Size	Adaptive List Size by Merge Index	Adaptive List Size by CU Size
HM-4.0 (Anchor)	Off	(5,2)	Off	Off
Test1	On	(5,2)	Off	Off
Test3d: Test1+Test2d	On	Off	On	Off
Test3e: Test1+Test2e	On	Off	Off	On

Test2d: Adaptive list size by merge indices in JCTVC-G232

Test2e: Adaptive list size by CU size in JCTVC-G232

Test 3d

(Test1+Test2d)

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	0.1%	0.1%	-0.2%	0.1%	0.0%	-0.1%
Class B	0.1%	0.1%	0.3%	0.0%	0.1%	0.1%
Class C	0.0%	0.0%	0.1%	0.0%	-0.1%	-0.1%
Class D	0.2%	0.2%	0.4%	0.1%	-0.1%	0.1%
Class E						
Overall	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
	0.1%	0.1%	0.2%	0.0%	0.0%	0.0%
Enc Time[%]	98%			98%		
Dec Time[%]	100%			100%		

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.0%	0.3%	-0.1%	-0.1%	0.0%	-0.1%
Class C	-0.1%	-0.2%	0.0%	-0.1%	0.1%	0.0%
Class D	0.0%	0.1%	0.3%	-0.1%	-0.4%	0.5%
Class E	0.6%	0.5%	0.3%	0.1%	-0.2%	-0.2%
Overall	0.1%	0.2%	0.1%	-0.1%	-0.1%	0.1%
	0.1%	0.2%	0.1%	-0.1%	-0.2%	0.0%
Enc Time[%]	99%			100%		
Dec Time[%]	100%			102%		

	Low delay P HE			Low delay P LC		
	Y	U	V	Y	U	V
Class A						
Class B	-0.3%	-0.1%	0.0%	-0.6%	-0.4%	-0.5%
Class C	-0.2%	-0.2%	-0.1%	-0.4%	-0.6%	-0.5%
Class D	-0.1%	0.2%	-0.1%	-0.3%	-0.3%	-0.3%
Class E	0.2%	-0.2%	0.5%	-0.3%	0.4%	0.7%
Overall	-0.1%	-0.1%	0.0%	-0.4%	-0.3%	-0.2%
	-0.1%	-0.1%	0.0%	-0.4%	-0.3%	-0.2%
Enc Time[%]	102%			103%		
Dec Time[%]	99%			101%		

Test 3e

(Test1+Test2e)

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	0.0%	0.0%	-0.1%	-0.1%	-0.1%	-0.1%
Class B	-0.1%	0.0%	0.2%	-0.1%	0.0%	0.0%
Class C	0.0%	0.0%	0.0%	-0.1%	0.1%	0.0%
Class D	0.0%	0.2%	0.4%	0.0%	-0.1%	0.0%
Class E						
Overall	0.0%	0.0%	0.1%	-0.1%	0.0%	0.0%
	0.0%	0.0%	0.1%	-0.1%	0.0%	0.0%
Enc Time[%]	100%			101%		
Dec Time[%]	100%			100%		

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	-0.1%	0.1%	0.1%	-0.1%	-0.1%	-0.1%
Class C	0.0%	0.0%	0.1%	0.0%	0.3%	0.2%
Class D	0.0%	0.0%	0.3%	0.0%	-0.5%	0.0%
Class E	-0.1%	0.2%	-0.4%	-0.4%	-0.3%	-0.2%
Overall	0.0%	0.1%	0.0%	-0.1%	-0.1%	0.0%
	0.0%	0.1%	0.0%	-0.1%	-0.2%	0.0%
Enc Time[%]	100%			100%		
Dec Time[%]	100%			101%		

	Low delay P HE			Low delay P LC		
	Y	U	V	Y	U	V
Class A						
Class B	-0.3%	0.0%	0.2%	-0.6%	-0.4%	-0.4%
Class C	-0.2%	-0.4%	-0.3%	-0.5%	-0.5%	-0.7%
Class D	-0.2%	0.0%	-0.5%	-0.4%	-0.5%	-0.2%
Class E	0.0%	0.1%	0.7%	-0.5%	0.7%	0.7%
Overall	-0.2%	-0.1%	0.0%	-0.5%	-0.2%	-0.2%
	-0.2%	-0.1%	0.0%	-0.5%	-0.3%	-0.2%
Enc Time[%]	102%			102%		
Dec Time[%]	100%			101%		

Conclusions

- Propose two additional MVP candidates:
 1. Truncating the first available MVP to integer precision
 2. Adding a constant value to the first available MVP
- Results:
 - 0.1-0.5% BD-rate gain
 - An average of 101% encoding time and 99% decoding time

Comparisons to Other CE13 Proposals

- Anchor : HM-4.0 + bug fix

	RA-HE	RA-LC	LB-HE	LB-LC	LP-HE	LP-LC	Avg	Enc Time	Dec Time	Worst case
MTK (G231-Test1)	-0.1	-0.1	-0.2	-0.2	-0.2	-0.5	-0.21%	101%	99%	2
Samsung (G776: offset = 1/4)	-0.1	-0.2	-0.1	-0.1	-0.1	-0.4	-0.14%	103%	100%	4
*Canon (G240: offset = 8)	-0.1	-0.2	-0.2	-0.3	-0.2	-0.3	-0.21%	106%	102%	4
*Joint Proposal (G787: MVdepOffset)	-0.2	-0.2	-0.1	-0.2	-0.3	-0.7	-0.29%	104%	100%	4
*Joint Proposal (G787: MVdepOffset + Rounding)	-0.1	-0.2	-0.1	-0.2	-0.3	-0.6	-0.26%	103%	100%	4

* The additional MVP candidates are applied to both AMVP and Merge mode