

G787: Additional merge candidates with MV dependent offsets

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Introduction

❖ HM4.0

- The fixed list size of Merge/AMVP candidates is adopted with additional Merge/AMVP candidates which made by retrieved merge candidates in early stage
- But there is still chance to be empty in candidates list if some motion information doesn't exist or duplicated
- Moreover, adopted additional merge candidates except zero predictors are bi-directional which work only in B Slice

❖ Proposed

- Additional Merge/AMVP candidates are introduced to improve performance and which also work in P Slice

Offset added candidates

- ❖ In several CE13 tests, additional candidates by adding offsets to the first existing candidate's each MV component are tested
 - Tested with the fixed offset value by 1, 4 or 8 with sign changes in turn
 - Offset added candidates can be uni-directional if the first existing candidate is uni-directional which work also in P slice
 - Since offset added candidates are distinct from each other, the actual number of comparison for duplicates checking is reduced
 - Additional 6(=3+2+1) comparisons in the worst case, where
3 (except the first one) of 4 existing cand are compared with the first new cand;
2 (except the first two) of 4 existing cand are compared with the second new cand;
1 (except the first three) of 4 existing cand is compared with the third new cand;
the last new cand is inserted without comparison if 3 new cand are the same as 3 existing cand
 - Zero candidates are disabled or only one of those is allowed so that 8 comparisons for zero candidates' duplication checking in the worst case are reduced
 - Which means $+6-8=-2$ additional comparison for duplicates check in worst case

MV dependent offset

❖ MV dependent offset

- In offset added candidates, the offset value can be regarded as MVD in merge mode
- Since MVD tends to be various when motion is larger, the offset value needs to be adjusted in that way
- Non-constant offset value which is dependent on MV value of the first existing candidate is proposed
- The offset value v to be added to one MV component m is determined as follows:
 - If the magnitude of m is larger than 16, v is set to 8
 - Else if it is larger than 8, v is set to 4
 - Else if it is larger than 4, v is set to 2
 - Otherwise, v is set to 1

MV dependent offset (Cont'd)

- ❖ MV dependent offset is tested on top of CE13 3.5.1 (which use the fixed offset)

Compared to HM4.0

	Fixed offset	MV dependent offset
HE_RA	-0.2%	-0.2%
LC_RA	-0.3%	-0.3%
HE_LB	-0.5%	-0.4%
LC_LB	-0.4%	-0.3%
HE_LD	-0.3%	-0.4%
LC_LD	-0.4%	-0.7%
Avg.	-0.3%	-0.4%

Compared to HM4.0 + MrgEncFix

	Fixed offset	MV dependent offset
HE_RA	-0.1%	-0.2%
LC_RA	-0.2%	-0.2%
HE_LB	-0.2%	-0.1%
LC_LB	-0.3%	-0.2%
HE_LD	-0.1%	-0.3%
LC_LD	-0.3%	-0.7%
Avg.	-0.2%	-0.3%

- By adaptation of offset value depending on MV value, performance is improved especially in LD case and it achieves 0.3% gain compared to HM4.0+Merge_Enc_Fix in average (0.4% gain compared to HM4.0)

Rounding candidates

- ❖ In CE13 3.1.1, Rounded candidates are introduced which doesn't require interpolation process by rounding the first existing candidate to the nearest integer pel
- ❖ In this proposal, combination of 1 rounded candidate and upto 4 MvDepOffset added candidates is tested

Compared to HM4.0 + MrgEncFix

	MvDepOffset	MvDepOffset + Rounding
HE_RA	-0.2%	-0.1%
LC_RA	-0.2%	-0.2%
HE_LB	-0.1%	-0.1%
LC_LB	-0.2%	-0.2%
HE_LD	-0.3%	-0.3%
LC_LD	-0.7%	-0.6%
Avg.	-0.3%	-0.3%

Fast encoding algorithm

- ❖ Fast encoding algorithm in G240 is applied to MvDepOffset test
 - Early termination rule when estimating the rate distortion cost of the 2Nx2N Merge candidates
 - 5.5% enc time is reduced with 0.04% loss in average

Compared to HM4.0 + MrgEncFix

	MvDepOffset	MvDepOffset + FastEnc
HE_RA	-0.2%	-0.1%
LC_RA	-0.2%	-0.2%
HE_LB	-0.1%	-0.1%
LC_LB	-0.2%	-0.1%
HE_LD	-0.3%	-0.3%
LC_LD	-0.7%	-0.6%
Avg.	-0.3%	-0.2%

Summary of results

❖ Summary of experimental results

- Summary of experimental results with possible combinations
- Provided runtime may not be correct due to running on clustered system
- The number of comparisons for duplication checking is provided as in the worst case calculation
 - Note that -8 is resulted from removal of zero candidates

Compared to HM4.0 + MrgEncFix

	RA_HE	RA_LC	LB_HE	LB_LC	LP_HE	LP_LC	Avg	Enc	Dec	Comp
MvDepOffset	-0.2	-0.2	-0.1	-0.2	-0.3	-0.7	-0.29	104	100	-8+6= -2
MvDepOffset+Round	-0.1	-0.2	-0.1	-0.2	-0.3	-0.6	-0.26	103	100	-8+10= 2
MvDepOffset+Fast	-0.1	-0.2	-0.1	-0.1	-0.3	-0.6	-0.25	98	99	-8+6= -2

Conclusion

- ❖ In this proposal, offset added candidates with non-constant value are inserted by replacing zero predictors
- ❖ Offset added candidates can achieve 0.3% gain in average with less number of comparison for duplicates checking compared to HM4.0+Merge_Enc_Fix
- ❖ Offset added candidates can achieve upto 0.7% gain in LC_LD because it works in P slice unlike the previously adopted additional candidates which are made by existing candidates
- ❖ Encoding runtime for it can be reduced by applying early termination rule in merge estimation with almost no loss
- ❖ By adding rounded candidate, interpolation process can be saved in decoder when it is hit
- ❖ It is proposed to adopt MV dependent offset added candidates in the next HM

Thank you !