

JVET-N0373, Non-CE4: HMVP unification between the Merge and MVP list

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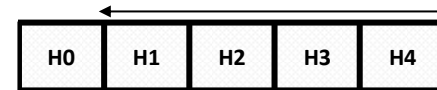


Introduction

❑ VVC WD4 and VTM-4.0

❖ HMVP in Merge list

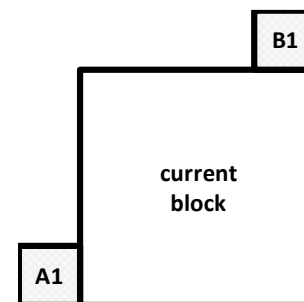
- The first 2 HMVP candidates, **from the last entry (H4) to the first entry (H0) in the HMVP table, are pruned to the left and above spatial candidates**
- At most 5 HMVP candidates can be available in the merge list



(a) HMVP candidates pre-defined order in Merge

❖ HMVP in MVP list

- HMVP candidates, **from the first entry (H0) to the last entry (H4) in the HMVP table, are added in the MVP list without redundancy check**
- The adding of HMVP candidates stops when the maximum number of checked HMVP candidates reaches **a threshold (= 4 in VTM-4)** or the MVP list is full



(b) The first 2 HMVP candidates are compared with the spatial candidates A1 and B1

Figure 1. HMVP candidate pre-defined order and pruned with spatial candidates in the merge list construction

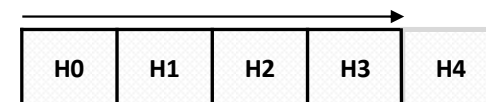


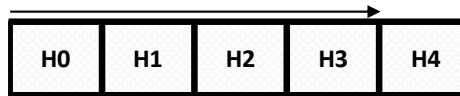
Figure 2. HMVP candidate pre-defined order and maximum threshold in MPV list

Proposed Methods

□ HMVP unification between Merge and MVP

❖ Proposal 1: **Change the scan order of HMVP candidates as in AMVP** and **remove a partial pruning with spatial candidates** in merge list

- The HMVP candidates, **from the first entry to the last entry in the HMVP table** (i.e. the most least HMVP candidate is checked first), are added in the merge list.



HMVP candidate predefined order (H0 → H4) in merge list

- Since the motivation of changing the scan order of HMVP candidate is to first check candidates that are more likely to be different from the existing candidate in the merge list, **a partial pruning (the maximum number of pruning is 4) is removed.**

❖ Proposal 2: **Remove the maximum HMVP candidate threshold** in AMVP mode

When numCurrMvpCand is less than 2 and NumHmvpCand is greater than 0, the following applies for $i = 1.. \text{Min}(-4, \text{NumHmvpCand})$ until numCurrMvpCand is equal to 2:

Experimental Results

□ Proposal 1

- ❖ Change scan order in HMVP table
- ❖ Remove a partial pruning with A1 and B1 in merge

	Random access Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	0.06%	0.17%	0.09%	100%	100%
Class A2	0.01%	-0.10%	0.07%	100%	100%
Class B	0.04%	0.05%	0.03%	100%	100%
Class C	0.06%	0.06%	0.02%	100%	100%
Class E					
Overall	0.04%	0.05%	0.05%	100%	100%
Class D	0.04%	-0.05%	0.04%	100%	100%
Class F	0.07%	-0.03%	-0.06%	100%	100%

	Low delay B Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.02%	-0.03%	-0.32%	100%	100%
Class C	-0.02%	0.47%	0.08%	100%	100%
Class E	0.04%	0.54%	0.12%	100%	100%
Overall	0.01%	0.28%	-0.08%	100%	100%
Class D	-0.02%	0.06%	-0.06%	100%	100%
Class F	-0.08%	0.25%	-0.17%	101%	100%

□ Proposal 2

- ❖ Remove the maximum HMVP candidate threshold in AMVP

	Random access Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	0.01%	-0.01%	0.01%	99%	100%
Class A2	-0.01%	0.09%	0.02%	99%	100%
Class B	0.00%	0.02%	0.08%	100%	100%
Class C	0.00%	0.00%	-0.06%	100%	100%
Class E					
Overall	0.00%	0.02%	0.02%	100%	100%
Class D	0.00%	-0.07%	-0.06%	100%	100%
Class F	0.00%	0.04%	-0.01%	100%	100%

	Low delay B Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.00%	-0.08%	-0.24%	100%	100%
Class C	-0.03%	0.28%	-0.27%	100%	100%
Class E	-0.02%	0.06%	-0.24%	100%	100%
Overall	-0.02%	0.07%	-0.25%	100%	100%
Class D	-0.02%	0.16%	-0.15%	100%	100%
Class F	0.03%	0.05%	-0.34%	100%	101%

Experimental Results

□ Proposal 1 + Proposal 2

	Random access Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	0.06%	0.18%	0.07%	100%	100%
Class A2	0.02%	-0.01%	0.11%	100%	100%
Class B	0.05%	0.02%	0.00%	100%	100%
Class C	0.05%	-0.04%	-0.01%	100%	100%
Class E					
Overall	0.04%	0.03%	0.03%	100%	100%
Class D	0.03%	-0.11%	-0.05%	100%	100%
Class F	0.07%	-0.05%	-0.07%	100%	100%

	Low delay B Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.01%	0.00%	-0.34%	100%	100%
Class C	0.00%	0.23%	0.13%	100%	100%
Class E	0.02%	0.47%	-0.13%	100%	100%
Overall	0.01%	0.19%	-0.13%	100%	100%
Class D	-0.03%	0.38%	-0.52%	100%	100%
Class F	0.02%	-0.12%	0.22%	100%	101%

□ Supplemental results

- ❖ only remove HMVP candidates partial pruning with A1 and B1 in merge list in VTM-4.0

	Random access Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	0.13%	0.11%	0.22%	99%	99%
Class A2	0.19%	0.18%	0.26%	100%	99%
Class B	0.20%	0.14%	0.16%	100%	99%
Class C	0.16%	0.14%	0.03%	100%	100%
Class E					
Overall	0.17%	0.14%	0.16%	100%	99%
Class D	0.12%	0.11%	0.15%	100%	99%
Class F	0.17%	0.15%	0.03%	101%	100%

	Low delay B Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.21%	-0.04%	0.09%	100%	100%
Class C	0.11%	0.19%	0.26%	100%	100%
Class E	0.17%	0.55%	-0.23%	100%	100%
Overall	0.17%	0.18%	0.06%	100%	100%
Class D	0.12%	0.28%	0.23%	100%	100%
Class F	0.01%	-0.16%	-0.30%	101%	100%

Conclusion

❑ SUMMARY

- ❖ **Proposal 1: Change the scan order of HMVP candidates as in AMVP and remove a partial pruning with spatial candidates** in merge list
- ❖ **Proposal 2: Remove the maximum HMVP candidate threshold** in AMVP mode
- ❖ **Performance (proposal 1 + proposal 2)**
 - **Y BD-rate 0.04%, Enc Time 100%, Dec Time 100 % for RA**
 - **Y BD-rate 0.01%, Enc Time 100%, Dec Time 100 % for LDB**

❑ **Suggest to adopt the proposed methods to the VVC WD5 and VTM-5.0 in order to unify HMVP in Merge and AMVP**

❑ **Thanks to [Ericsson](#) for cross-checking (JVET-N0674)**

VVC WD Changes

□ VVC WD changes

❖ 8.5.2.6 Derivation process for history-based merging candidates

For each candidate in `smrHmvpCandList[hMvpIdx]` with index `hMvpIdx = 1..smrNumHmvpCand`, the following ordered steps are repeated until `numCurrMergeCand` is equal to `(MaxNumMergeCand - 1)`:

~~1. The variable `sameMotion` is derived as follows:~~

~~— If all of the following conditions are true for any merging candidate `N` with `N` being `Ai` or `Bi`, `sameMotion` and `isPrunedN` are both set equal to `TRUE`:~~

~~— `hMvpIdx` is less than or equal to 2.~~

~~— The candidate `smrHmvpCandList[smrNumHmvpCand - hMvpIdx]` is equal to the merging candidate `N`.~~

~~— `isPrunedN` is equal to `FALSE`.~~

~~— Otherwise, `sameMotion` is set equal to `FALSE`.~~

~~2. When `sameMotion` is equal to `FALSE`, the candidate `smrHmvpCandList[smrNumHmvpCand - hMvpIdx]` is added to the merging candidate list as follows:~~

`mergeCandList[numCurrMergeCand++] =`
`smrHmvpCandList[smrNumHmvpCand - hMvpIdx hMvpIdx - 1]`

(8-355)

❖ 8.5.2.9 Derivation process for motion vector predictor candidate list

1. When `numCurrMvpCand` is less than 2 and `NumHmvpCand` is greater than 0, the following applies for `i = 1..Min(4, NumHmvpCand)` until `numCurrMvpCand` is equal to 2: