

Simplification on zero merge candidate derivation

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Summary

□ Proposal

- ❖ Zero merge candidate derivation process regardless of slice_type

□ Benefits

- ❖ Simplified design
 - Unified zero merge candidate derivation process for P-slice and B-slice
- ❖ Simplified text
 - 1/3 of text in “8.5.2.1.4 Derivation process for zero motion vector merging candidates” is removed.
- ❖ Reduced MC complexity
 - MC complexity for B-slice is reduced when zero merge candidate is selected.

□ Results

- ❖ No coding loss

HM 7.0

❑ Zero merge candidate derivation in merge mode

1. Zero merge candidate addition **depends on slice_type**
 - For P-slice, L0 uni-predictive zero merge candidate (increasing refIdx by 1)
 - For B-slice, Bi-predictive zero merge candidate (increasing refIdx by 1)
2. Zero merge candidate fill-up **depends on slice_type**
 - For P-slice, L0 uni-predictive zero merge candidate (refIdx == 0)
 - For B-slice, Bi-predictive zero merge candidate (refIdx == 0)

Variable	1) Zero merge candidate addition process		2) Zero merge candidate fill-up process	
	P-slice	B-slice	P-slice	B-slice
predFlagL0	1	1	1	1
predFlagL1	0	1	0	1
mvL0	(0, 0)	(0, 0)	(0, 0)	(0, 0)
mvL1	(0, 0)	(0, 0)	(0, 0)	(0, 0)
refIdxL0	r	r	0	0
refIdxL1	-1	r	-1	0

Proposal

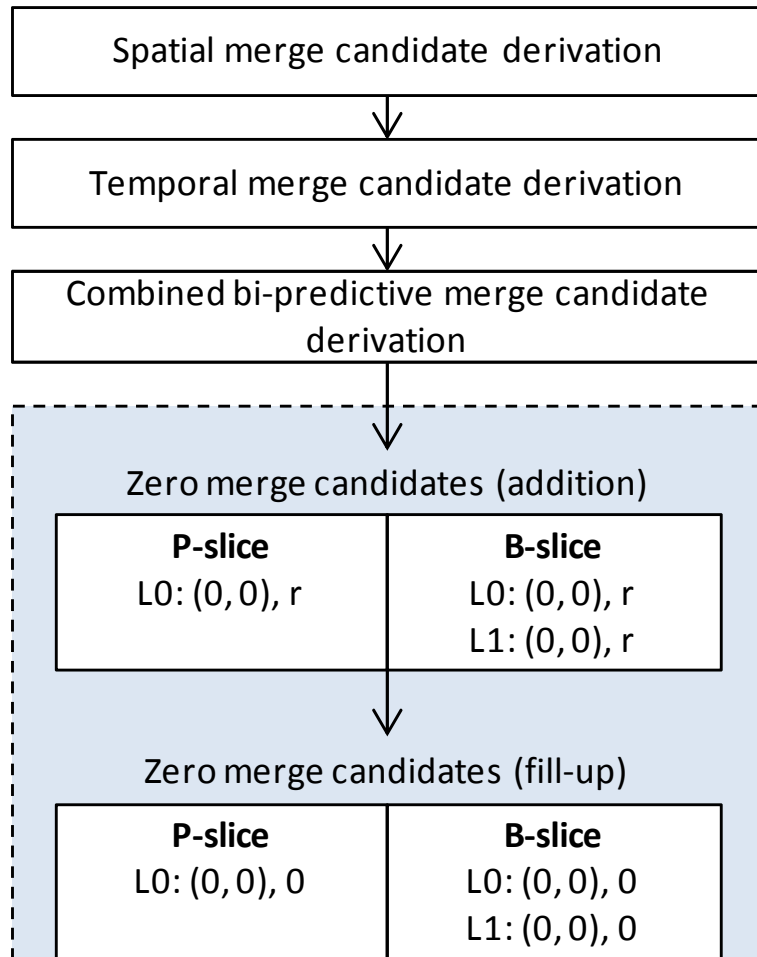
❑ Use L0 uni-predictive zero merge candidate for both P-slice and B-slice

1. Zero merge candidate addition **regardless of slice_type**
 - L0 uni-predictive zero merge candidate (increasing refIdx by 1)
2. Zero merge candidate fill-up **regardless of slice_type**
 - L0 uni-predictive zero merge candidate (refIdx == 0)

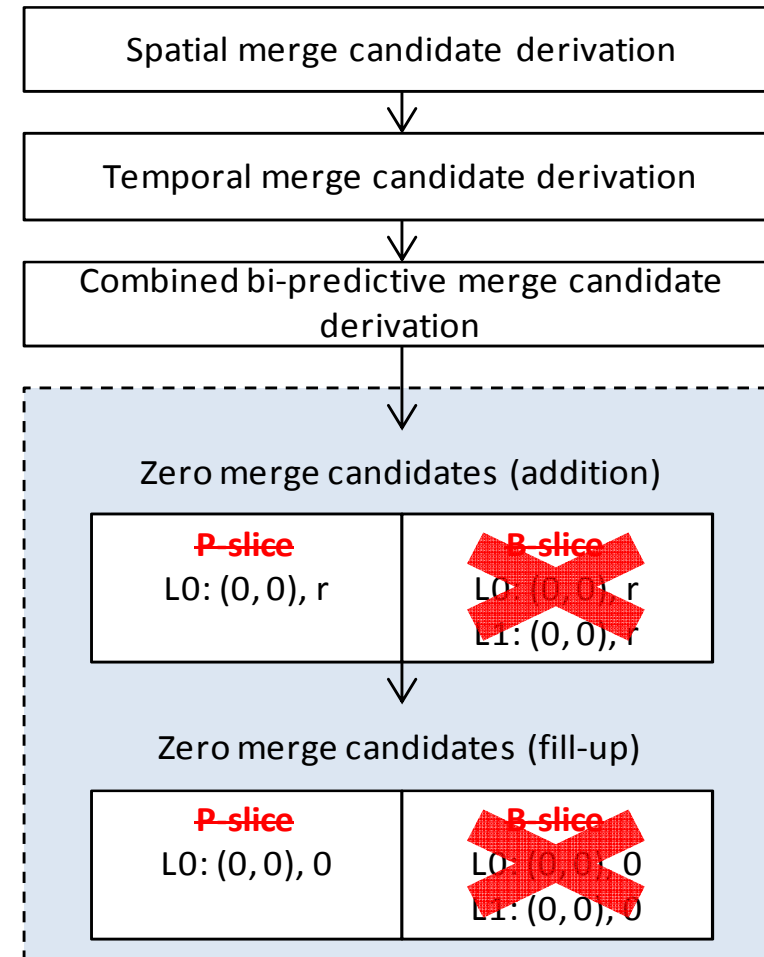
Variable	1) Zero merge candidate addition process	2) Zero merge candidate fill-up process
predFlagL0	1	1
predFlagL1	0	0
mvL0	(0, 0)	(0, 0)
mvL1	(0, 0)	(0, 0)
refIdxL0	r	0
refIdxL1	-1	-1

Comparison

HM 7.0



Proposal



Benefits

❑ Simplified design

- ❖ Unified zero merge candidate derivation process for P-slice and B-slice

❑ Simplified text

- ❖ No additional line is added.
- ❖ 1/3 of text in “8.5.2.1.4 Derivation process for zero motion vector merging candidates” is removed.

❑ Reduced MC complexity

- ❖ MC complexity for B-slice is reduced when zero merge candidate is selected.

8.5.2.1.4 Derivation process for zero motion vector merging candidates:

Inputs of this process are

- a merging candidate list mergeCandList,
- reference indices refIdxL0N and refIdxL1N of every candidate N being in mergeCandList,
- prediction list utilization flags predFlagL0N and predFlagL1N of every candidate N being in mergeCandList,
- motion vectors mvL0N and mvL1N of every candidate N being in mergeCandList,
- the number of elements numMergeCand within mergeCandList,

Outputs of this process are

- the merging candidate list mergeCandList,
- the number of elements numMergeCand within mergeCandList,
- reference indices refIdxL0zeroCand₀ and refIdxL1zeroCand₀ of every new candidate zeroCand₀ being added in mergeCandList during the invocation of this process,
- prediction list utilization flags predFlagL0zeroCand₀ and predFlagL1zeroCand₀ of every new candidate zeroCand₀ being added in mergeCandList during the invocation of this process,
- motion vectors mvL0zeroCand₀ and mvL1zeroCand₀ of every new candidate zeroCand₀ being added in mergeCandList during the invocation of this process,

The variable numRefIdx is defined as follows:

- **If slice_type is equal to P, numRefIdx is set to num_ref_idx_l0_active_minus1 + 1**

- **Otherwise (slice_type is equal to B), numRefIdx is set to min(num_ref_idx_l0_active_minus1 + 1, num_ref_idx_l1_active_minus1 + 1)**

When numMergeCand is less than MaxNumMergeCand, the variable numInputMergeCand is set to numMergeCand, the variable zeroIdx is set to 0, and the following steps are repeated until numMergeCand is equal to MaxNumMergeCand.

1. For the derivation of the reference indices, the prediction list utilization flags and the motion vectors of the zero motion vector merging candidate, the following applies:

- **If slice_type is equal to P:** The candidate zeroCand₀ with m equal to (numMergeCand - numInputMergeCand) is added at the end of mergeCandList (mergeCandList[numMergeCand] = zeroCand₀) and the reference indices, the prediction list utilization flags and the motion vectors of zeroCand₀ are derived as follows and numMergeCand is incremented by 1.

refIdxL0zeroCand₀ = (zeroIdx - numRefIdx) ? zeroIdx : 0 (8-99)

refIdxL1zeroCand₀ = -1 (8-100)

predFlagL0zeroCand₀ = 1 (8-101)

predFlagL1zeroCand₀ = 0 (8-102)

mvL0zeroCand₀[0] = 0 (8-103)

mvL0zeroCand₀[1] = 0 (8-104)

mvL1zeroCand₀[0] = 0 (8-105)

mvL1zeroCand₀[1] = 0 (8-106)

numMergeCand = numMergeCand + 1 (8-107)

- **Otherwise (slice_type is equal to B):** the candidate zeroCand₀ with m equal to (numMergeCand - numInputMergeCand) is added at the end of mergeCandList (mergeCandList[numMergeCand] = zeroCand₀) and the reference indices, the prediction list utilization flags and the motion vectors of zeroCand₀ are derived as follows and numMergeCand is incremented by 1:

refIdxL0zeroCand₀ = (zeroIdx - numRefIdx) ? zeroIdx : 0 (8-108)

refIdxL1zeroCand₀ = (zeroIdx - numRefIdx) ? zeroIdx : 0 (8-109)

predFlagL0zeroCand₀ = 1 (8-110)

predFlagL1zeroCand₀ = 1 (8-111)

mvL0zeroCand₀[0] = 0 (8-112)

mvL0zeroCand₀[1] = 0 (8-113)

mvL1zeroCand₀[0] = 0 (8-114)

mvL1zeroCand₀[1] = 0 (8-115)

numMergeCand = numMergeCand + 1 (8-116)

2. The variable zeroIdx is incremented by 1.

Experimental results

□ Results

❖ No coding loss (0.0%) on average in all common test conditions

Confirmed by
Panasonic
(JCTVC-J0443)

	Random Access Main			Random Access HE10		
	Y	U	V	Y	U	V
Class A	0.0%	-0.3%	-0.2%	0.0%	0.1%	0.1%
Class B	0.0%	0.0%	0.1%	0.1%	0.1%	0.0%
Class C	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%
Class D	0.0%	0.1%	-0.1%	0.0%	0.0%	-0.1%
Class E						
Overall	0.0%	0.0%	-0.1%	0.0%	0.1%	0.0%
	0.0%	0.0%	-0.1%	0.0%	0.1%	0.0%
Class F	0.0%	0.1%	0.0%	0.0%	0.1%	0.1%
Enc Time[%]	100%			98%		
Dec Time[%]	100%			100%		

	Low delay B Main			Low delay B HE10		
	Y	U	V	Y	U	V
Class A						
Class B	0.0%	0.0%	0.1%	0.0%	0.0%	0.4%
Class C	0.0%	0.3%	0.0%	0.0%	-0.1%	0.0%
Class D	0.0%	0.2%	0.0%	-0.1%	0.0%	0.2%
Class E	-0.1%	-0.2%	-0.5%	0.2%	0.1%	0.3%
Overall	0.0%	0.1%	-0.1%	0.0%	0.0%	0.2%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%
Class F	-0.1%	-0.1%	0.0%	0.1%	0.0%	1.1%
Enc Time[%]	99%			97%		
Dec Time[%]	100%			100%		

Conclusions

☐ **Proposal**

- ❖ Zero merge candidate derivation process regardless of slice_type

☐ **Benefits**

- ❖ Simplified design, simplified text, reduced MC complexity

☐ **Source code modification**

- ❖ Replacement of only one line and removal of five lines

☐ **Results**

- ❖ No coding loss

☐ **Identical to JCTVC-J0180 (USTC & Huawei)**

☐ **We suggest the proposal to be included in DIS.**



Thank You Very Much !

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