

JVET-N0471, Non-CE4: Simplification of decoding process of SMVD reference indices

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Overall Summary

- ❑ In order to **simplify the decoding process of SMVD reference indices**, two methods are proposed.

- ❑ **Proposal #1**

- ❖ The only **first L0 and L1 reference picture** are only considered as reference pictures of SMVD

- ❑ **Proposal #2**

- ❖ **explicitly signal the reference indices** in the tile group header with SMVD enable flag in SPS and tile group header

- ❑ **Performance**

- ❖ Proposal #1: Y-BD rate 0.00%, Enc.Time: 100%, Dec.Time: 100%
 - ❖ Proposal #2: Y-BD rate 0.01%, Enc.Time: 100%, Dec.Time: 100%

Introduction

- ❑ At the 13th JVET meeting, SMVD (symmetric MVD) was adopted into VVC WD4
- ❑ **SMVD is only allowed under some conditions**
 - ❖ when reference picture list has the nearest forward reference picture in list 0 and nearest backward reference picture in list 1 or vice versa.
 - ❖ When there are a pair of nearest reference pictures in reference picture list, the 'sym_mvd_flag' can be parsed
- ❑ A variable 'RefIdxSymLX' is derived through **searching a pair of reference picture** nearest to a current picture in the L0/L1 reference picture list.
 - ❖ Indicates whether a pair of nearest reference picture exists or not
 - ❖ Used as reference indices of SMVD
- ❑ **8.3.4 Decoding process of symmetric motion vector reference indices**

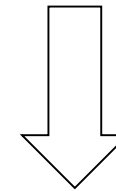
Introduction

Output of this process are RefIdxSymL0 and RefIdxSymL1 specifying the list 0 and list 1 reference picture indices for symmetric motion vector differences, i.e., when sym_mvd_flag is equal to 1 for a coding unit.

The variable RefIdxSymLX with X being 0 and 1 is derived as follows:

- The variable currPic specifies the current picture.
- RefIdxSymL0 is set equal to -1.
- For each index i with $i = 0..NumRefIdxActive[0]$, the following applies:
 - When all of the following conditions are true, RefIdxSymL0 is set to i:
 - $DiffPicOrderCnt(currPic, RefPicList[0][i]) > 0$,
 - $DiffPicOrderCnt(currPic, RefPicList[0][i]) < DiffPicOrderCnt(currPic, RefPicList[0][RefIdxSymL0])$ or RefIdxSymL0 is equal to -1.
- RefIdxSymL1 is set equal to -1.
- For each index i with $i = 0..NumRefIdxActive[1]$, the following applies:
 - When all of the following conditions are true, RefIdxSymL1 is set to i:
 - $DiffPicOrderCnt(currPic, RefPicList[1][i]) < 0$,
 - $DiffPicOrderCnt(currPic, RefPicList[1][i]) > DiffPicOrderCnt(currPic, RefPicList[1][RefIdxSymL1])$ or RefIdxSymL1 is equal to -1.
- When RefIdxSymL1 is equal to -1 or RefIdxSymL1 is equal to -1, the following applies:
 - For each index i with $i = 0..NumRefIdxActive[0]$, the following applies:
 - When all of the following conditions are true, RefIdxSymL0 is set to i:
 - $DiffPicOrderCnt(currPic, RefPicList[0][i]) < 0$,
 - $DiffPicOrderCnt(currPic, RefPicList[0][i]) > DiffPicOrderCnt(currPic, RefPicList[0][RefIdxSymL0])$ or RefIdxSymL0 is equal to -1.
 - For each index i with $i = 0..NumRefIdxActive[1]$, the following applies:
 - When all of the following conditions are true, RefIdxSymL1 is set to i:
 - $DiffPicOrderCnt(currPic, RefPicList[1][i]) > 0$,
 - $DiffPicOrderCnt(currPic, RefPicList[1][i]) < DiffPicOrderCnt(currPic, RefPicList[1][RefIdxSymL1])$ or RefIdxSymL1 is equal to -1.

First, search the nearest forward reference picture and the nearest backward reference picture list in L0/L1 reference picture list.



RefIdxSymL0 = -1 or
RefIdxSymL1 = -1

Search the nearest backward reference picture and the nearest forward reference picture list in L0/L1 reference picture list.

Proposals

❑ Proposal #1

- ❖ The **first L0 and L1 reference picture are only considered** as reference pictures of SMVD
- ❖ SMVD is only allowed when the first L0 and L1 reference picture satisfy the following condition

$\text{DiffPicOrderCnt}(\text{currPic}, \text{RefPicList}[0][0]) == \text{DiffPicOrderCnt}(\text{RefPicList}[1][0], \text{currPic})$

- ❖ Otherwise, SMVD is not allowed.

Output of this process are RefIdxSymL0 and RefIdxSymL1 specifying the list 0 and list 1 reference picture indices for symmetric motion vector differences, i.e., when sym_mvd_flag is equal to 1 for a coding unit.

The variable RefIdxSymLX with X being 0 and 1 is derived as follows:

- The variable currPic specifies the current picture.
- If $\text{DiffPicOrderCnt}(\text{currPic}, \text{RefPicList}[0][0])$ is equal to $\text{DiffPicOrderCnt}(\text{RefPicList}[1][0], \text{currPic})$
 - RefIdxSymL0 is set to 0 and RefIdxSymL1 is set to 0
- Otherwise,
 - RefIdxSymL0 is set to -1 and RefIdxSymL1 is set to -1

Proposals

❑ Proposal #2

- ❖ For the encoder flexibility, it is also proposed to **explicitly signal the reference indices in the tile group header** with SMVD enabled flag in SPS and tile group header

tile_group_header() {	Descriptor
...	
if (tile_group_type != I) {	
if(sps_temporal_mvp_enabled_flag)	
tile_group_temporal_mvp_enabled_flag	u(1)
if(tile_group_type == B)	
{	
mvd_l1_zero_flag	u(1)
if (mvd_l1_zero_flag == 0) {	
if (sps_smvd_enabled_flag) {	
tile_group_smvd_enabled_flag	u(1)
if (tile_group_smvd_enabled_flag) {	
for (i = 0; i < 2; i++) {	
if (NumRefIdxActive[i] > 1)	
sym_mvd_ref_idx[i]	ue(v)
}	
}	
}	
}	
}	

sym_mvd_ref_idx[i] specifies the list i-th reference picture index for symmetric motion vector difference used for inter prediction.

When **sym_mvd_ref_idx[i]** is not present, it is inferred as follows:

tile_group_smvd_enabled_flag is equal to 1, it is inferred to be equal to 0.

Otherwise (**tile_group_smvd_enabled_flag** is equal to 0), it is inferred to be equal to -1.

The values **RefIdxSymL0** and **RefIdxSymL1** are derived as follows:

RefIdxSymL0 = **sym_mvd_ref_idx[0]**

RefIdxSymL1 = **sym_mvd_ref_idx[1]**

It is a requirement of bitstream conformance that the following constraints apply:

- $\text{DiffPicOrderCnt}(\text{currPic}, \text{RefPicList}[0][\text{RefIdxSymL0}]) * \text{DiffPicOrderCnt}(\text{currPic}, \text{RefPicList}[0][\text{RefIdxSymL1}]) < 0$
- $\text{DiffPicOrderCnt}(\text{currPic}, \text{RefPicList}[0][\text{RefIdxSymL0}])$ is the smallest value among $\text{DiffPicOrderCnt}(\text{currPic}, \text{RefPicList}[0][i])$, for $i = 0.. \text{NumRefIdxActive}[0] - 1$.
- $\text{DiffPicOrderCnt}(\text{currPic}, \text{RefPicList}[1][\text{RefIdxSymL1}])$ is the smallest value among among $\text{DiffPicOrderCnt}(\text{currPic}, \text{RefPicList}[0][j])$, for $j = 0.. \text{NumRefIdxActive}[1] - 1$.

Experimental results

□ Proposal #1

	Random access Main10				
	Over VTM-4.0			EncT	DecT
	Y	U	V		
Class A1	0.00%	0.00%	0.00%	100%	100%
Class A2	0.00%	0.00%	0.00%	100%	100%
Class B	0.00%	0.00%	0.00%	100%	100%
Class C	0.00%	0.00%	0.00%	101%	100%
Class E					
Overall	0.00%	0.00%	0.00%	100%	100%
Class D	0.00%	0.00%	0.00%	100%	100%
Class F	0.00%	0.00%	0.00%	101%	100%

□ Proposal #2

	Random access Main10				
	Over VTM-4.0			EncT	DecT
	Y	U	V		
Class A1	0.00%	0.00%	0.00%	101%	100%
Class A2	0.00%	0.00%	0.00%	101%	100%
Class B	0.01%	0.01%	0.01%	100%	100%
Class C	0.02%	0.02%	0.02%	100%	100%
Class E					
Overall	0.01%	0.01%	0.01%	100%	100%
Class D	0.06%	0.06%	0.06%	100%	100%
Class F	0.03%	0.03%	0.03%	100%	100%

Conclusion

❑ SUMMARY

- ❖ **Proposal 1:** The only **first L0 and L1 reference picture** are only considered as reference pictures of SMVD
- ❖ **Proposal 2:** **explicitly signal the reference indices** in the tile group header with SMVD enable flag in SPS and tile group header
- ❖ **Performance**
 - Proposal 1: Y BD-rate 0.00%, Enc Time 100%, Dec Time 100 % for RA
 - Proposal 2: Y BD-rate 0.01%, Enc Time 100%, Dec Time 100 % for RA

❑ **Suggest to adopt the proposed method to the VVC WD5 and VTM-5.0 in order to simplify the decoding process of SMVD reference indices**

❑ **Thanks to [InterDigital](#) for cross-checking (JVET-N0770)**