

JCTVC-U0104
ON UNIFICATION FRAMEWORK
OF INTRA BLOCK COPY

Xiaoyu Xiu, Yan Ye, Yuwen He
InterDigital Communications Inc.
June 2015



Introduction

- The existing IBC unification framework
 - Current picture is added into reference picture list L0, but is not allowed to appear in reference picture list L1
 - SCM-4.0 supports both full-frame IBC search and local IBC search. However, there is no high level signaling to indicate IBC search range which may be useful information for decoder
 - Weighted prediction (WP) is allowed to be applied to current picture
- In this contribution, three design modifications are proposed
 - Add the current picture to both initial **reference picture list L0 and L1**
 - Signal **IBC search range** in SPS
 - **Disable** WP signaling for the current picture

Proposal #1: reference picture list initialization with IBC

- It is proposed to include the current picture into both initial reference picture lists L0 and L1 for B-slices

```
rIdx = 0
while( rIdx < NumRpsCurrTempList1 ) {
    for( i = 0; i < NumPocStCurrAfter && rIdx < NumRpsCurrTempList1; rIdx++, i++ )
        RefPicListTemp1[ rIdx ] = RefPicSetStCurrAfter[ i ]
    for( i = 0; i < NumPocStCurrBefore && rIdx < NumRpsCurrTempList1; rIdx++, i++ ) (8-10)
        RefPicListTemp1[ rIdx ] = RefPicSetStCurrBefore[ i ]
    for( i = 0; i < NumPocLtCurr && rIdx < NumRpsCurrTempList1; rIdx++, i++ )
        RefPicListTemp1[ rIdx ] = RefPicSetLtCurr[ i ]
    if( curr_pic_as_ref_enabled_flag )
        RefPicListTemp1[ rIdx++ ] = currPic
}
```

- Propose to keep the current CTC unchanged, i.e., to include the current picture only in reference picture list L0. Software is included to exclude the current picture from L1 through RPLM

Proposal #1: reference picture list initialization with IBC

- Propose to include the current picture into both initial reference picture lists L0 and L1 for B-slices
- Propose the current CTC unchanged
- No impact on average BD-rate

	All Intra			Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p & 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, mixed content, 1440p & 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p & 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, mixed content, 1440p & 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]		102%			98%			100%	
Dec Time[%]		105%			100%			102%	

Proposal #2: signaling IBC search range in SPS

- IBC search range may significantly impact the complexity of HEVC SCC decoder
 - Full IBC search will likely use off-chip memory
 - Local IBC search may only use on-chip memory
- It is proposed to signal maximum absolute BV values in SPS

sps_scc_extension() {	Descriptor
.....	
if(curr_pic_as_ref_enabled_flag) {	
max_block_vector_present_flag	u(1)
if(max_block_vector_present_flag) {	
log2_max_hor_block_vector_minus3	ue(v)
log2_max_ver_block_vector_minus3	ue(v)
}	
}	
}	

max_block_vector_present_flag equal to 1 specifies that the syntax elements log2_max_hor_block_vector_minus3 and log2_max_ver_block_vector_minus3 are present. max_block_vector_present_flag equal to 0 specifies that the syntax elements log2_max_hor_block_vector_minus3 and log2_max_ver_block_vector_minus3 are not present. When not present, it is inferred to be 0.

Proposal #2: signaling IBC search range in SPS

$\log_2_max_hor_block_vector_minus3$ plus 3 specifies the base 2 logarithm of the maximum value for horizontal motion vectors for which the reference picture is the coded picture.

$\log_2_max_ver_block_vector_minus3$ plus 3 specifies the base 2 logarithm of the maximum value for vertical motion vectors for which the reference picture is the coded picture.

The variables $MaxHorizontalBV$ and $MaxVerticalBV$ are derived as follows:

$MaxHorizontalBV = max_block_vector_present_flag ? 1 \ll (\log_2_max_hor_block_vector_minus3 + 3) : pic_width_in_luma_samples - MinCbSizeY$

$MaxVerticalBV = max_block_vector_present_flag ? 1 \ll (\log_2_max_ver_block_vector_minus3 + 3) : pic_height_in_luma_sample - MinCbSizeY$

8.5.3.2 Derivation process for motion vector components and reference indices

8.5.3.2.1 General

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It is a requirement of bitstream conformance that when the reference picture is the current picture, the luma motion vector $mvLX$ shall obey the following constraints:

- The absolute value of $(mvLX[0] \gg 2)$ is less than or equal to $MaxHorizontalBV$.
- The absolute value of $(mvLX[1] \gg 2)$ is less than or equal to $MaxVerticalBV$.

Proposal #3: disable WP signaling for the current picture

- It is proposed to skip the signaling of WP parameters for the current picture
- Benefits
 - IBC PUs could be truly derived by copying samples
 - Reserve WP parameters for temporal reference pictures (the total WP parameters are restricted to be no larger than 24)

	Descriptor
pred_weight_table() {	
.....	
for(i = 0; i <= num_ref_idx_l0_active_minus1; i++)	
if(PicOrderCnt(RefPicList0[i]) != PicOrderCnt(CurrPic))	
luma_weight_l0_flag[i]	u(1)
if(ChromaArrayType != 0)	
for(i = 0; i <= num_ref_idx_l0_active_minus1; i++)	
if(PicOrderCnt(RefPicList0[i]) != PicOrderCnt(CurrPic))	
chroma_weight_l0_flag[i]	u(1)
.....	
for(i = 0; i <= num_ref_idx_l1_active_minus1; i++)	
if(PicOrderCnt(RefPicList1[i]) != PicOrderCnt(CurrPic))	
luma_weight_l1_flag[i]	u(1)
if(ChromaArrayType != 0)	
for(i = 0; i <= num_ref_idx_l1_active_minus1; i++)	
if(PicOrderCnt(RefPicList1[i]) != PicOrderCnt(CurrPic))	
chroma_weight_l1_flag[i]	u(1)
.....	
}	

Closing remarks

- Several modifications to the IBC unification framework
 - Add the current picture to both initial reference picture list L0 and L1
 - Signal IBC search range in SPS
 - Disable WP signaling for the current picture
- Suggest to adopt into SCC