

Non-CE2: Intra block copy and Inter signaling unification

JCTVC-S0302

Chao Pang, Krishna Rapaka, Ye-Kui Wang,
Vadim Seregin, Marta Karczewicz (Qualcomm)
Xiaozhong Xu, Shan Liu, Shawmin Lei (MediaTek)
Bin Li, Jizheng Xu (Microsoft)

Proposed solution

- Put the current picture into the reference picture list
 - Mark it as LTRP before decoding
 - Mark it as STRP after decoding
- Identify the IBC mode by reference index
- Keep current SCM2.0 methods:
 - BVD coding methods
 - integer BV
- Benefits:
 - Not extra flag (intra_bc_flag)
 - Reused inter signaling without additional checks in the syntax table
 - No additional check during deblocking
 - No 4x4 block

Necessary constraints

- Collocated picture cannot be the current picture.
- If constrained intra is enabled:
 - IBC can use intra or IBC coded blocks for prediction
 - TMVP cannot be used for IBC

Spec text simplification

coding_unit(x0, y0, log2CbSize) {	Descriptor
if(transquant_bypass_enabled_flag)	
cu_transquant_bypass_flag	ae(v)
if(slice_type != I)	
cu_skip_flag [x0][y0]	ae(v)
nCbS = (1 << log2CbSize)	
if(cu_skip_flag[x0][y0])	
prediction_unit(x0, y0, nCbS, nCbS)	
else {	
if(intra_block_copy_enabled_flag)	-
intra_be_flag [x0][y0]	ae(v)
if(slice_type != I && !intra_be_flag [x0][y0])	
pred_mode_flag	ae(v)
if(palette_mode_enabled_flag && ChromaArrayType == 3 && CuPredMode[x0][y0] == MODE_INTRA && !intra_be_flag [x0][y0])	
palette_mode_flag [x0][y0]	ae(v)
if(palette_mode_flag[x0][y0])	
palette_coding(x0, y0, nCbS)	
else {	
if(CuPredMode[x0][y0] != MODE_INTRA ++ intra_be_flag [x0][y0] log2CbSize == MinCbLog2SizeY)	
part_mode	ae(v)
if(CuPredMode[x0][y0] == MODE_INTRA && !intra_be_flag [x0][y0]) {	
if(PartMode == PART_2Nx2N && pcm_enabled_flag && log2CbSize >= Log2MinIpcmCbSizeY && log2CbSize <= Log2MaxIpcmCbSizeY)	
pcm_flag [x0][y0]	ae(v)
if(pcm_flag[x0][y0]) {	
if(!pcm_flag[x0][y0]) {	
if((CuPredMode[x0][y0] != MODE_INTRA && !(PartMode == PART_2Nx2N && merge_flag[x0][y0])) (CuPredMode[x0][y0] == MODE_INTRA && !intra_be_flag [x0][y0]))	
rqt_root_cbf	ae(v)

Spec text simplification

0.1.1.1.1 ~~Specification of intra-block copying prediction mode~~

Inputs to this process are:

- a sample location $(xTb0, yTb0)$ specifying the top-left sample of the current transform block relative to the top-left sample of the current picture;
- a variable $nTbS$ specifying the transform block size;
- a variable $trafoDepth$ specifying the hierarchy depth of the current block relative to the coding unit;
- a variable $bvIntra$ specifying the block-copying vector;
- a variable $cIdx$ specifying the colour component of the current block.

Output of this process is the predicted samples $predSamples[x][y]$, with $x, y = 0..nTbS - 1$.

The luma sample location $(xTbY, yTbY)$ specifying the top-left sample of the current luma transform block relative to the top-left luma sample of the current picture is derived as follows:

$$(xTbY, yTbY) = (cIdx == 0) ? (xTb0, yTb0) : (xTb0 * SubWidthC, yTb0 * SubHeightC) \quad (8-62)$$

Depending upon the values of $trafoDepth$, $PartMode$ and $nTbS$, the following applies:

- If $trafoDepth$ is equal to 0, $PartMode$ is not equal to $PART_2Nx2N$, and $nTbS$ is greater than 4, the following applies, for the variable $tempIdx$ proceeding over the values 0..3:
 - The variable $nTbS1$ is set equal to $nTbS / 2$.
 - The variable $xTb1$ is set equal to $xTb0 + nTbS1 * (blkIdx \% 2)$.
 - The variable $yTb1$ is set equal to $yTb0 + nTbS1 * (blkIdx / 2)$.
- The general intra-block copying process as specified in this subclause is invoked with the location $(xTb1, yTb1)$, the variable $nTbS$ set equal to $nTbS1$, the variable $bvIntra$, the variable $trafoDepth$ is set equal to 1, and the variable $cIdx$ as inputs, and the output is an $(nTbS1) \times (nTbS1)$ array $predSamples$. [Ed.: This should be $tempSamples$, and then copied into $predSamples$]

Results

HEVC AMVP for Intra BC

	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	-3.1%	-4.7%	-4.8%	-4.6%	-6.6%	-6.6%	-4.7%	-6.3%	-6.2%
RGB, text & graphics with motion,720p	-1.7%	-2.9%	-2.8%	-1.7%	-3.2%	-3.2%	-1.4%	-2.6%	-2.6%
RGB, mixed content, 1440p	-1.8%	-2.3%	-2.5%	-1.4%	-2.6%	-2.8%	-1.3%	-2.3%	-2.2%
RGB, mixed content, 1080p	-1.1%	-2.0%	-2.1%	-1.3%	-2.7%	-2.9%	-0.9%	-2.9%	-3.3%
RGB, Animation, 720p	0.0%	0.0%	0.0%	-0.1%	-0.2%	-0.2%	0.0%	0.1%	0.0%
RGB, camera captured, 1080p	0.1%	0.0%	0.1%	-0.1%	-0.1%	-0.2%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p	-1.4%	-3.0%	-3.0%	-4.5%	-6.3%	-6.3%	-4.8%	-6.4%	-6.2%
YUV, text & graphics with motion,720p	-1.3%	-2.3%	-2.5%	-1.2%	-2.6%	-2.9%	-1.1%	-1.8%	-2.3%
YUV, mixed content, 1440p	-1.2%	-2.0%	-2.1%	-1.2%	-2.8%	-2.7%	-1.3%	-2.9%	-2.7%
YUV, mixed content, 1080p	-0.8%	-2.4%	-2.4%	-1.0%	-3.7%	-3.7%	-1.5%	-4.6%	-5.8%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.2%	0.1%	-0.3%	-0.2%
YUV, camera captured, 1080p	0.1%	0.1%	0.1%	-0.2%	0.1%	0.0%	0.0%	-0.1%	0.1%
Enc Time[%]	113%			99%			99%		
Dec Time[%]	95%			88%			92%		

HEVC AMVP + CE1 Test 2.1 binarization for IBC

	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	-3.4%	-5.0%	-5.1%	-6.8%	-8.8%	-8.7%	-7.4%	-8.9%	-8.8%
RGB, text & graphics with motion,720p	-1.9%	-3.0%	-2.9%	-2.1%	-3.5%	-3.6%	-2.3%	-3.3%	-3.4%
RGB, mixed content, 1440p	-1.8%	-2.3%	-2.5%	-1.5%	-2.6%	-2.9%	-1.1%	-2.3%	-2.5%
RGB, mixed content, 1080p	-1.2%	-2.1%	-2.1%	-1.3%	-2.8%	-2.9%	-1.7%	-3.6%	-3.3%
RGB, Animation, 720p	0.0%	0.0%	0.1%	-0.1%	-0.2%	-0.3%	-0.1%	-0.2%	-0.1%
RGB, camera captured, 1080p	0.1%	0.0%	0.0%	-0.1%	0.0%	-0.2%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p	-1.7%	-3.3%	-3.3%	-7.0%	-8.7%	-8.7%	-7.8%	-9.2%	-9.1%
YUV, text & graphics with motion,720p	-1.2%	-2.3%	-2.5%	-1.9%	-3.4%	-3.6%	-2.3%	-3.4%	-3.7%
YUV, mixed content, 1440p	-1.2%	-2.1%	-2.3%	-1.4%	-2.9%	-2.8%	-1.4%	-2.6%	-2.7%
YUV, mixed content, 1080p	-0.9%	-2.4%	-2.4%	-1.1%	-3.5%	-3.5%	-1.5%	-5.6%	-6.2%
YUV, Animation, 720p	0.0%	0.0%	0.0%	-0.1%	-0.4%	-0.2%	0.0%	-0.4%	-0.5%
YUV, camera captured, 1080p	0.1%	0.1%	0.1%	-0.1%	0.0%	-0.2%	0.2%	-0.1%	0.1%
Enc Time[%]	109%			100%			100%		
Dec Time[%]	92%			86%			88%		

Results

SCM2.0 BVP with BV line buffer for IBC

	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	-3.1%	-4.8%	-4.9%	-4.4%	-6.4%	-6.4%	-4.6%	-6.2%	-6.1%
RGB, text & graphics with motion,720p	-1.8%	-2.9%	-2.8%	-1.7%	-3.1%	-3.1%	-1.2%	-2.5%	-2.6%
RGB, mixed content, 1440p	-1.8%	-2.3%	-2.6%	-1.5%	-2.6%	-2.9%	-1.4%	-2.5%	-2.6%
RGB, mixed content, 1080p	-1.2%	-2.1%	-2.1%	-1.3%	-2.8%	-2.9%	-1.4%	-3.0%	-3.0%
RGB, Animation, 720p	0.0%	0.0%	0.0%	-0.1%	-0.2%	-0.2%	-0.1%	0.0%	0.0%
RGB, camera captured, 1080p	0.1%	0.0%	0.0%	-0.2%	-0.1%	-0.2%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p	-1.4%	-3.0%	-3.0%	-4.3%	-6.2%	-6.2%	-4.7%	-6.3%	-6.0%
YUV, text & graphics with motion,720p	-1.3%	-2.3%	-2.7%	-1.3%	-2.8%	-3.0%	-1.1%	-2.3%	-2.8%
YUV, mixed content, 1440p	-1.2%	-2.0%	-2.3%	-1.4%	-2.9%	-2.8%	-1.4%	-3.2%	-2.9%
YUV, mixed content, 1080p	-0.8%	-2.4%	-2.4%	-1.0%	-3.4%	-3.8%	-1.4%	-6.0%	-5.9%
YUV, Animation, 720p	-0.1%	-0.1%	-0.1%	-0.1%	-0.3%	-0.4%	0.1%	-0.2%	0.1%
YUV, camera captured, 1080p	0.1%	0.1%	0.1%	-0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	113%			102%			102%		
Dec Time[%]	91%			89%			92%		

SCM2.0 BVP with BV line buffer + CE1 Test 2.1 binarization for IBC

	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	-3.3%	-5.0%	-5.1%	-6.5%	-8.5%	-8.4%	-7.3%	-8.8%	-8.7%
RGB, text & graphics with motion,720p	-1.8%	-2.9%	-2.9%	-2.2%	-3.6%	-3.6%	-2.2%	-3.5%	-3.4%
RGB, mixed content, 1440p	-1.8%	-2.4%	-2.6%	-1.5%	-2.7%	-2.9%	-1.4%	-2.7%	-2.7%
RGB, mixed content, 1080p	-1.2%	-2.2%	-2.1%	-1.4%	-3.0%	-3.0%	-1.6%	-3.4%	-3.8%
RGB, Animation, 720p	0.0%	0.0%	0.0%	-0.1%	-0.3%	-0.3%	-0.1%	-0.3%	-0.1%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	-0.2%	-0.1%	-0.2%	0.0%	0.0%	0.1%
YUV, text & graphics with motion, 1080p	-1.7%	-3.3%	-3.3%	-6.7%	-8.4%	-8.4%	-7.7%	-9.1%	-8.9%
YUV, text & graphics with motion,720p	-1.5%	-2.3%	-2.8%	-1.9%	-3.2%	-3.6%	-2.3%	-3.4%	-4.2%
YUV, mixed content, 1440p	-1.3%	-2.2%	-2.3%	-1.4%	-3.2%	-3.0%	-1.4%	-2.8%	-2.7%
YUV, mixed content, 1080p	-0.9%	-2.5%	-2.5%	-1.1%	-3.8%	-3.8%	-1.9%	-5.6%	-5.6%
YUV, Animation, 720p	0.0%	0.0%	-0.1%	-0.1%	-0.6%	-0.4%	-0.1%	-0.8%	-0.3%
YUV, camera captured, 1080p	0.1%	0.1%	0.1%	-0.1%	-0.1%	-0.2%	0.2%	0.0%	0.1%
Enc Time[%]	115%			104%			106%		
Dec Time[%]	95%			92%			95%		

Results

SCM2.0 BVP with line buffer (anchor) vs HEVC AMVP (test) for IBC on top of SCM 2.0

	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	1.0%	1.0%	1.0%	0.6%	0.6%	0.5%	0.5%	0.4%	0.5%
RGB, text & graphics with motion,720p	0.5%	0.5%	0.5%	0.3%	0.2%	0.3%	0.2%	0.0%	0.1%
RGB, mixed content, 1440p	0.3%	0.3%	0.3%	0.2%	0.2%	0.2%	-0.2%	0.2%	0.0%
RGB, mixed content, 1080p	0.4%	0.3%	0.4%	0.2%	0.3%	0.3%	-0.1%	0.3%	0.1%
RGB, Animation, 720p	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%
YUV, text & graphics with motion, 1080p	1.4%	1.4%	1.4%	0.7%	0.7%	0.7%	0.5%	0.4%	0.4%
YUV, text & graphics with motion,720p	0.7%	0.7%	0.6%	0.4%	0.5%	0.5%	0.1%	0.0%	0.3%
YUV, mixed content, 1440p	0.4%	0.4%	0.4%	0.3%	0.3%	0.4%	0.1%	0.4%	0.5%
YUV, mixed content, 1080p	0.5%	0.5%	0.5%	0.3%	0.2%	0.3%	0.6%	0.8%	1.0%
YUV, Animation, 720p	0.1%	0.1%	0.1%	0.0%	0.1%	0.1%	-0.1%	0.1%	-0.1%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
Enc Time[%]	98%			99%			100%		
Dec Time[%]	97%			96%			98%		

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