JVET-Y0076

Non-EE2: Template Matching-based OBMC Design

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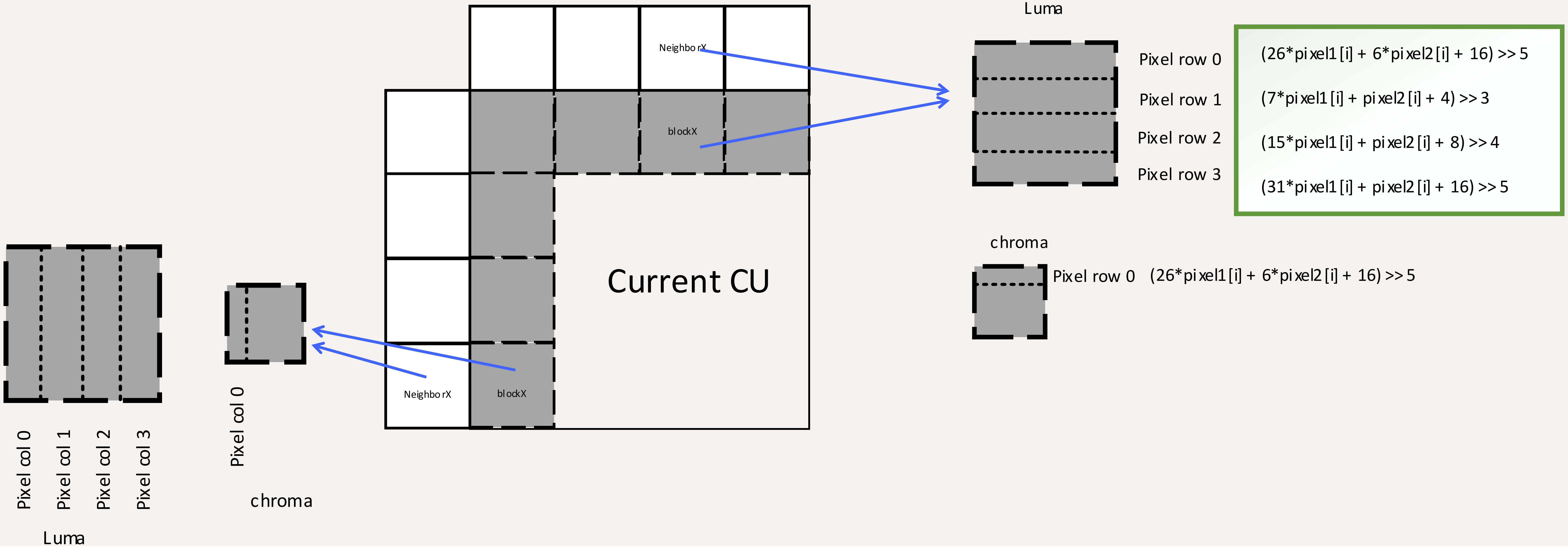
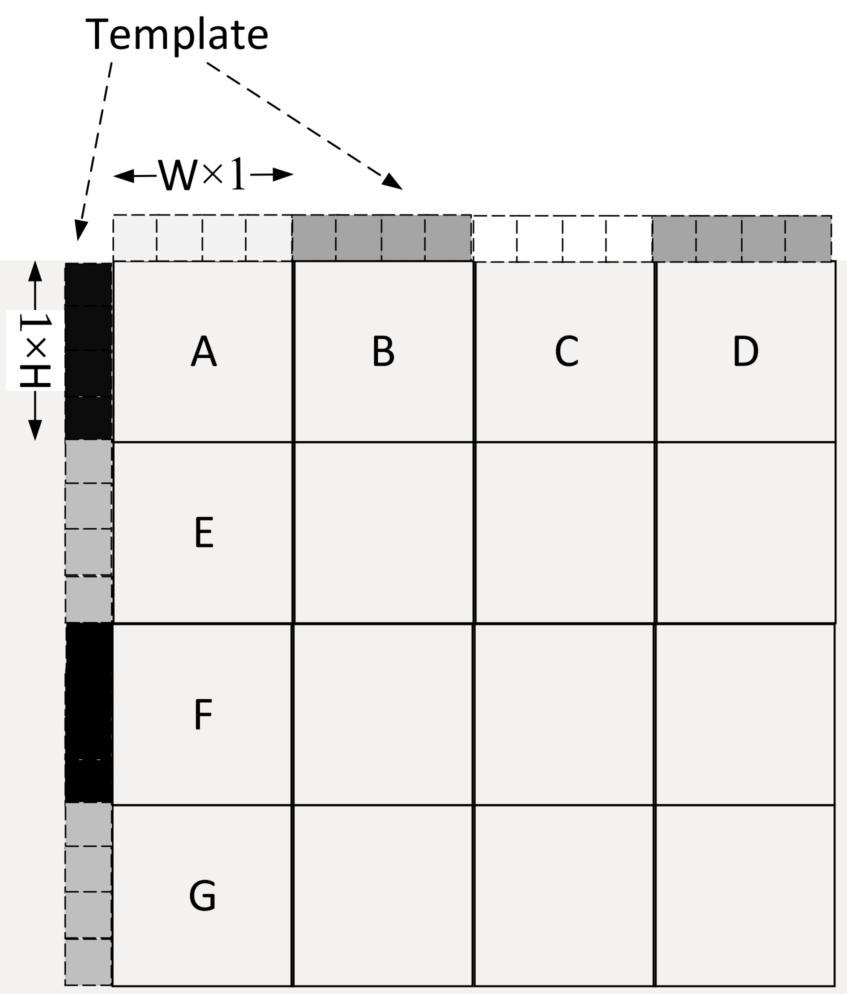
Introduction

- In ECM, when OBMC is applied, the top and left boundary samples of a CU are refined using neighboring block's motion information with a weighted prediction.
- The OBMC sample blending operation is processed for each top/left block at the top/left CU boundaries.
- The original MC results using current block's motion information (denoted as *pixel1*) and the additional MC results using neighboring block's motion information (denoted as *pixel2*) are blended to obtain the new prediction results.



Proposed method



- A template matching-based OBMC scheme is proposed.
- Templates
  - ☐ For each top block with a size of 4×4 at the top CU boundary, the above template size equals to 4×1.
  - ☐ If N adjacent blocks have the same motion information, then the above template size is enlarged to 4N×1 since the MC operation can be processed at one time, in the same manner in ECM-OBMC.
- The prediction value of boundary samples is derived following the below steps.
  - ☐ First, three template matching costs are measured by SAD between the reconstructed samples of a template and its corresponding reference samples derived by MC process according to the following three types of motion information.
    Cost1: uses current block's motion information.
    Cost2: uses neighbor block's motion information.
    Cost3: uses weighted prediction of current block's and neighbor block's motion information with weighting factors as 3⁄4 and 1⁄4 respectively.
  - ☐ Second, choose the approach to derive the final prediction results of boundary samples by comparing Cost1, Cost2 and Cost 3.

➢ If *Cost1* is minimum, then OBMC is skipped.

➢ If *Cost2* is minimum, then blending mode 1 is used.

For luma blocks, the number of blending pixel rows/columns is 4.

$$NewPixel(i,j) = (26 \times Pixel1(i,j) + 6 \times Pixel2(i,j) + 16) \gg 5$$

$$NewPixel(i,j) = (7 \times Pixel1(i,j) + Pixel2(i,j) + 4) \gg 3$$

$$NewPixel(i,j) = (15 \times Pixel1(i,j) + Pixel2(i,j) + 8) \gg 4$$

$$NewPixel(i,j) = (31 \times Pixel1(i,j) + Pixel2(i,j) + 16) \gg 5$$

For chroma blocks, the number of blending pixel rows/columns is 1.

$$NewPixel(i,j) = (26 \times Pixel1(i,j) + 6 \times Pixel2(i,j) + 16) \gg 5$$

➢ If *Cost3* is minimum, then blending mode 2 is used.

For luma blocks, the number of blending pixel rows/columns is 2.

$$NewPixel(i,j) = (15 \times Pixel1(i,j) + Pixel2(i,j) + 8) \gg 4$$

$$NewPixel(i,j) = (31 \times Pixel1(i,j) + Pixel2(i,j) + 16) \gg 5$$

For chroma blocks, the number of blending pixel rows/columns is 1.

$$NewPixel(i,j) = (15 \times Pixel1(i,j) + Pixel2(i,j) + 8) \gg 4$$

- The original MC results using current block's motion information (denoted as *pixel1*) and the additional MC results using neighboring block's motion information (denoted as *pixel2*) are blended to obtain the new prediction results.

Simulation results (1/2)

- Test 1 is the abovementioned method.
- Test 2. Further optimization to reduce the complexity was tested, in which integer precision is used while 2-tap bilinear filter is used to generate the reference template.
- Test 3. In ECM, OBMC is enabled for each CU by a CU-level flag. For regular inter modes, the flag is set by comparing the RD cost in the encoder and transmitted to the decoder. Considering that this proposed method may decide whether use OBMC or not based on template, one more test was conducted, in which for inter mode, the RD cost comparison is skipped and the CU-level OBMC flag needs not to be transmitted.

Test 1.

	Random Access Main 10				
	Over ECM-3.1				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	-0.14%	-0.10%	-0.01%		
Class C	-0.22%	-0.21%	-0.11%	115%	115%
Class E					
Overall					
Class D	-0.21%	-0.24%	0.03%	114%	118%
Class F					

Test 2.

	Random Access Main 10				
	Over ECM-3.1				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B					
Class C	-0.19%	-0.08%	-0.10%	101%	102%
Class E					
Overall					
Class D	-0.23%	-0.04%	-0.03%	101%	103%
Class F	-0.11%	-0.24%	-0.17%		

	Low delay B Main10				
	Over ECM-3.1				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B					
Class C	-0.22%	-0.11%	-0.18%		
Class E	-0.05%	0.98%	-0.15%		
Overall					
Class D	-0.06%	0.05%	-1.10%		
Class F					

Test 3.

	Random Access Main 10				
	Over ECM-3.1				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	-0.14%	-0.10%	-0.07%		
Class C	-0.19%	-0.10%	-0.15%	101%	102%
Class E					
Overall					
Class D	-0.23%	-0.06%	0.04%	101%	102%
Class F					

Simulation results (2/2)

- For RA configuration, the data shown in these tables was run not using per-class RA configurations in the cfg/per-class folder.
- For LDB configuration, the test duration is 10 sec.

Test 1. nonCTC

	Random Access Main 10				
	Over ECM-3.1				
	Y	U	V	EncT	DecT
Class A1	-0.08%	-0.09%	-0.11%		
Class A2	-0.15%	-0.11%	-0.12%		
Class B	-0.12%	-0.23%	-0.04%		
Class C	-0.16%	-0.25%	-0.16%	114%	118%
Class E					
Overall	-0.13%	-0.18%	-0.10%		
Class D	-0.19%	-0.06%	-0.11%	112%	106%
Class F	-0.14%	-0.26%	-0.38%		

Test 2. nonCTC

	Random Access Main 10				
	Over ECM-3.1				
	Y	U	V	EncT	DecT
Class A1	-0.09%	-0.24%	-0.17%		
Class A2	-0.15%	-0.21%	-0.21%		
Class B	-0.10%	-0.11%	-0.05%		
Class C	-0.18%	-0.31%	-0.25%	100%	102%
Class E					
Overall	-0.13%	-0.21%	-0.16%		
Class D	-0.18%	-0.12%	-0.21%	100%	101%
Class F	-0.12%	-0.24%	-0.17%		

	Low delay B Main10				
	Over ECM-3.1				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B					
Class C	-0.18%	-0.17%	-0.15%	101%	101%
Class E	-0.21%	0.60%	-0.31%		
Overall					
Class D	-0.09%	0.53%	-0.17%	101%	105%
Class F					

Test 3. nonCTC

	Random Access Main 10				
	Over ECM-3.1				
	Y	U	V	EncT	DecT
Class A1	-0.08%	-0.11%	-0.11%		
Class A2					
Class B	-0.10%	-0.17%	-0.13%		
Class C	-0.19%	-0.24%	-0.24%		
Class E					
Overall					
Class D	-0.17%	-0.06%	-0.10%		
Class F					

Conclusions

- The contribution proposes a template matching-based OBMC scheme to derive the prediction value for CU boundary samples.
- Simulation results show -0.13%, -0.21%, -0.16% coding gain in RA configuration with 100% and102% complexity for encoder and decoder sides.
- It is recommended to investigate the proposed method in the next EE2 meeting.

Thanks Yao-Jen Chang from Qualcomm for cross-checking our proposal (JVET-Y0164).

THANK YOU.

谢谢。