



JCTVC-I0187: Border decimation for LM mode

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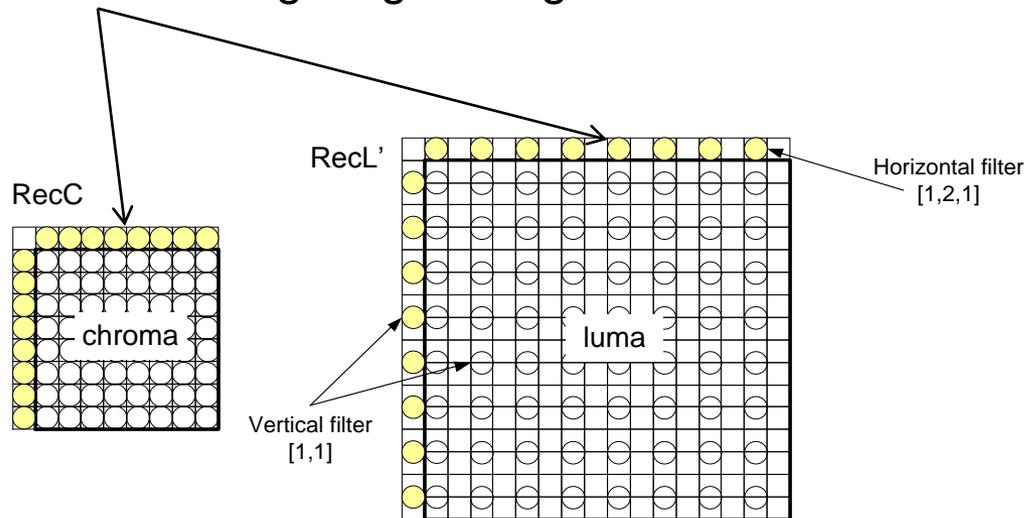
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Canon

LM chroma prediction mode in the HM

- Chroma derived as follows: $Pred_C[x, y] = \alpha \cdot Rec_L'[x, y] + \beta$
- With: $Rec_L'[x, y] = (Rec_L[2x, 2y] + Rec_L[2x, 2y + 1]) \gg 1$
 - $Rec_L[.]$ being the luma samples already reconstructed of the current block
 - The borders use slightly different formulas in HM4.0 but this is unimportant
- α, β are estimated using neighboring reconstructed luma/chroma samples



Border decimation (JCTVC-G129)

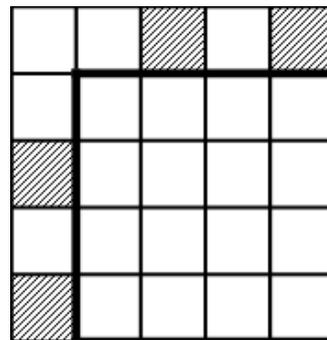
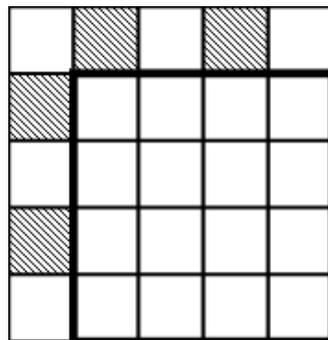
- Goal: reduce complexity of LM mode Least Mean Square method
- Subsample (decimate) 8x8 and 16x16 block borders by a given ratio
- Results for HM4.0:

Subsampling factor	Number multiplications per block for calculating alpha and beta			All Intra HE			All Intra LC		
	4x4	8x8	16x16	Y	U	V	Y	U	V
HM-4.0	16	32	64						
1:2 for 16x16	16	32	32	0.0%	0.2%	0.1%	0.0%	0.1%	0.0%
1:2 for 8x8, 16x16	16	16	32	0.1%	0.5%	0.4%	0.1%	0.5%	0.3%
1:2 for 8x8, 1:4 for 16x16	16	16	16	0.1%	0.8%	0.5%	0.1%	0.7%	0.3%

- Does not address the worst case: all CUs are 4x4

Proposal : decimation with 2 LM modes

- 2 LM modes: LMe uses samples of even index
LMO uses samples of odd index



Chroma mode	Codewords
DM	0
LMe	100
LMO	101
Planar	110
DC	1110
Vertical	1111

Decimation applies for all block sizes (4x4, 8x8, 16x16)

- Decoder has halved LMS complexity
- Encoder complexity roughly equivalent
- Simple encoder can test only one

Results

	All Intra Main + LM			All Intra HE10		
	Y	U	V	Y	U	V
Class A	0.0%	-2.2%	-2.1%	0.0%	-1.6%	-2.0%
Class B	0.0%	-0.5%	-0.4%	0.1%	-0.1%	-0.3%
Class C	0.0%	-0.6%	-0.8%	0.0%	-0.2%	-0.3%
Class D	0.0%	-0.3%	-0.5%	0.1%	-0.3%	-0.3%
Class E	0.1%	0.1%	0.2%	0.1%	0.1%	0.2%
Overall	0.0%	-0.7%	-0.8%	0.0%	-0.4%	-0.6%
	0.0%	-0.7%	-0.7%	0.0%	-0.4%	-0.6%
Class F	0.1%	-1.2%	-1.4%	0.1%	-1.0%	-1.2%
Enc Time[%]	101%			101%		
Dec Time[%]	100%			100%		

Conclusion

- Important simplification to the critical part of LM mode for hardware implementations, in particular for the worst case
 - Translate in actual runtime reduction at the decoder
- Minor modification to the LM mode (common code/hardware shared)
- Chroma BDR gain is ~0.7% over AI Main + LM, and 0.4% over AIHE10