

CE5.h related: Simplification on DMM1 pattern generation mechanism

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Summary

● Motivation

- ◆ Simplify DMM1 pattern generation
- ◆ Reduce the number of DMM1 patterns
- ◆ Reduce encoding time

● Experimental results

- ◆ All-intra: -0.1% / 0.0% gain on video / synthesized view with 10% encoding time reduction
- ◆ CTC: -0.1% / -0.1% gain on video / synthesized view with on impact on encoding time

● Cross-check: JCT3V-E0237 by Qualcomm

Shortcomings of current DMM1 pattern generation method

- DMM1 patterns are generated by the all possible combinations of the start and end points located at two image block boundaries. The number of patterns and the storage cost is huge

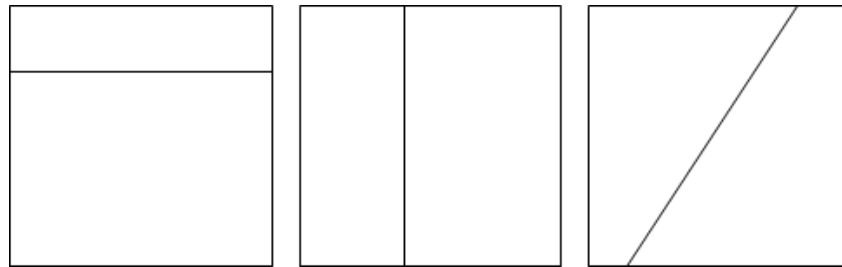
	4 x 4	8 x 8	16 x 16	32 x 32
Num. of patterns	86	782	1394	1503
Length of signalling bits	7	10	11	11

- The number of patterns doesn't reach the maximum allowed number for the signalling bits at each block-size
- The redundant generated patterns need to be checked and removed at pattern initialization process that complicate the pattern generation mechanism

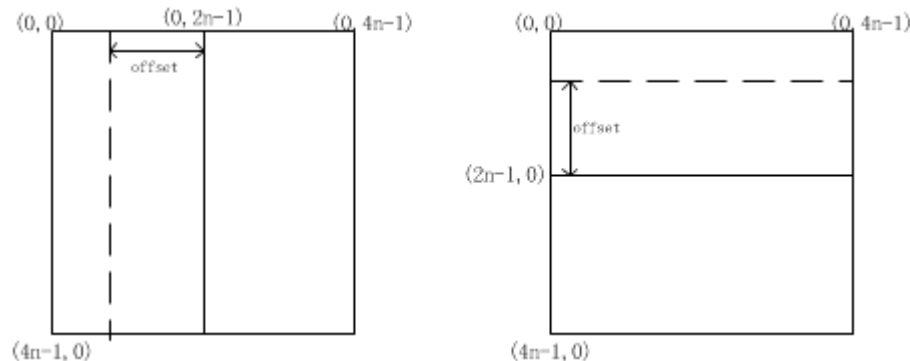
Proposed simplification method

- Basic concept

- ◆ Categorize and signal the pattern partition according to pattern's geometry properties
- ◆ Three main categories are signaled by the syntax *partition_type*

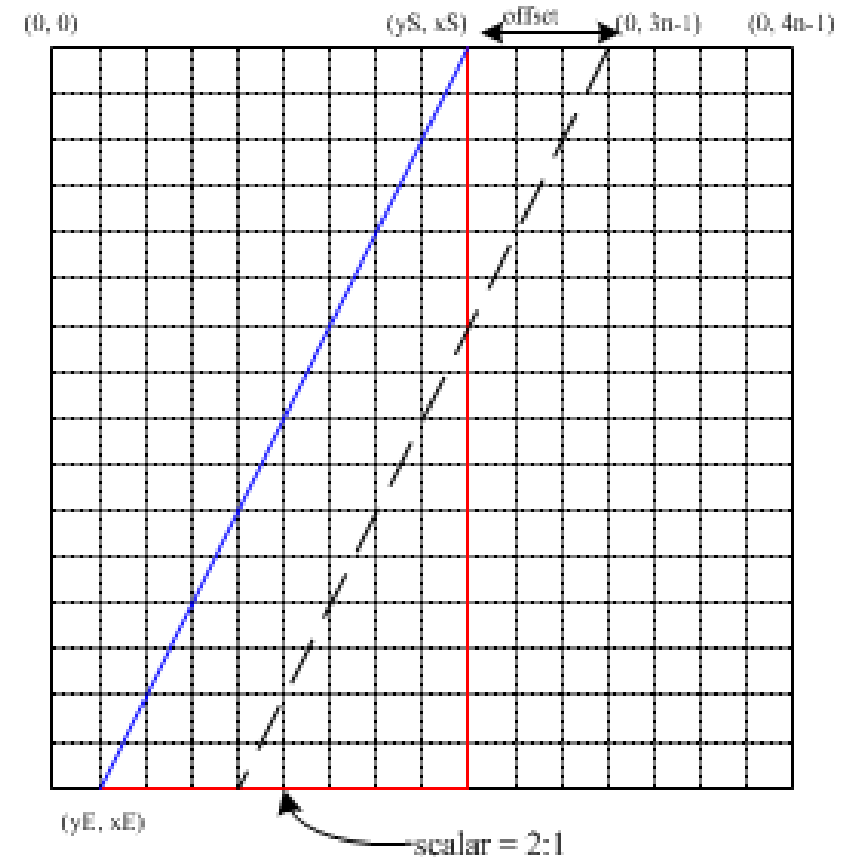


- The location of pattern partition line of horizontal and vertical rectangle partition is signaled by the *offset* parameter



Proposed simplification method (2)

- Non-rectangle pattern partition is signaled by *scalar*, *ori*, *offset*
 - ◆ *scalar*: the slope of the pattern partition line
 - 1:1, 2:1, 1:2, 4:1 and 1:4 scalars are provided
 - ◆ *ori*: the left-up to right-down or left-down-right-up partition line orientation
 - ◆ *offset*: the location of the partition line



Benefits

- The total amount for DMM1 patterns is significantly reduced
 - ◆ The cost of memory storage for the patterns is reduced compared to the current DMM1 design
 - ◆ The signaling bits for pattern index is also shorten

	4 x 4		8 x 8		16 x 16		32 x 32	
	current	proposed	current	proposed	current	proposed	current	proposed
Num. of patterns	86	32	782	100	1394	212	1503	436
Length of signalling bits	7	4~7	10	5~8	11	6~9	11	7~10

- The pattern generation method is easier than current design
 - ◆ Removal of the redundant patterns checking process
 - ◆ The pattern generation process is simplified

Benefits (2)

- The pseudo-code for the generation process

Horizontal partition:

$\text{terminalPos} = 8 * 4n / 16$

Partition 0: if $y > \text{terminalPos} - \text{offset}$

Partition1: others

Vertical partition:

$\text{terminalPos} = 8 * 4n / 16$

Partition 0: if $x > \text{terminalPos} - \text{offset}$

Partition1: others

Non-rectangle partition

if (!ori) {

$\text{terminalPos} = 4n - 1 + (4n \times \text{basePointOffset}[\text{scalar}] / 16)$

Partition 0: if $\text{terminalPos} - \text{offset} - x > y / \text{scalarFactor}[\text{scalar}]$

Partition 1: others }

else {

$\text{terminalPos} = -(4n \times \text{basePointOffset}[\text{scalar}] / 16)$

Partition 0: if $x - \text{terminalPos} - \text{offset} < y / \text{scalarFactor}[\text{scalar}]$

Partition 1: others }

Experimental results

● AI

	video 0	video 1	video 2	video PSNR / video bitrate	video PSNR / total bitrate	synth PSNR / total bitrate	enc time	dec time	ren time
Balloons	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	90.0%	95.3%	95.7%
Kendo	0.0%	0.0%	0.0%	0.0%	-0.2%	-0.1%	90.2%	97.5%	96.4%
Newspaper_CC	0.0%	0.0%	0.0%	0.0%	-0.2%	0.0%	91.0%	102.5%	101.1%
GT_Fly	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	90.4%	98.8%	99.4%
Poznan_Hall2	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.4%	90.8%	99.8%	100.5%
Poznan_Street	0.0%	0.0%	0.0%	0.0%	-0.1%	0.1%	90.2%	101.1%	99.5%
Undo_Dancer	0.0%	0.0%	0.0%	0.0%	-0.1%	0.3%	89.6%	100.3%	102.9%
1024x768	0.0%	0.0%	0.0%	0.0%	-0.2%	0.0%	90.4%	98.4%	97.7%
1920x1088	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	90.3%	100.0%	100.6%
average	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	90.3%	99.3%	99.3%

Experimental results (2)

● CTC

	video 0	video 1	video 2	video PSNR / video bitrate	video PSNR / total bitrate	synth PSNR / total bitrate	enc time	dec time	ren time
Balloons	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%	99.3%	95.9%	100.3%
Kendo	0.0%	0.1%	-0.1%	0.0%	-0.1%	-0.1%	99.4%	105.2%	104.2%
Newspaper_CC	0.0%	-0.2%	-0.1%	-0.1%	-0.2%	-0.3%	98.9%	96.7%	101.3%
GT_Fly	0.0%	0.1%	-0.3%	0.0%	-0.1%	-0.1%	98.5%	92.9%	94.1%
Poznan_Hall2	0.0%	0.2%	0.3%	0.1%	0.0%	-0.1%	99.8%	96.3%	98.9%
Poznan_Street	0.0%	-0.1%	0.0%	0.0%	-0.1%	0.0%	101.1%	101.5%	102.1%
Undo_Dancer	0.0%	0.0%	0.1%	0.0%	0.0%	0.2%	101.4%	98.3%	96.2%
1024x768	0.0%	0.0%	-0.1%	0.0%	-0.1%	-0.2%	99.2%	99.3%	101.9%
1920x1088	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	100.2%	97.3%	97.8%
average	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%	99.8%	98.1%	99.6%

Conclusions

- Suggest adopting the simplified DMM1 pattern generation mechanism due to the reduction of pattern number, the reduction of encoding time and the simplification of pattern generation process



Thank you!

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