

# **JCT3V-E0222:CE6.h: CE results on removal of division operation for SDC**

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# Summary

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- Motivation
  - ◆ Remove division operations for SDC
- Experimental results
  - ◆ 0.0% / -0.1% for CTC, 0.0% / 0.0% for All-intra on video / synthesized view
- Cross-checker: LGE

# Division operation in DMM and SDC

- DMM might partition a square block into two non-rectangular partitions
  - ◆ Problem: The number of samples can't be represented as  $2^N$ , which means the division for DC calculation can't be simply achieved by the right shift operation
  - ◆ The values of numerator and denominator are changed in same time that cause the size of look-up table (LUT) for the storage of division results is extremely large

	Numerator (summary of samples value)	Denominator (number of samples)	LUT size
SDC	$2^{18}$	$2^{10}$	$2^{28}$

# General concept for division free

- Same concept as motion vector scaling in HEVC
  - ◆ Separate the calculation of denominator and numerator into two steps
$$tx = ( 16384 + ( Abs( td ) \gg 1 ) ) / td$$
$$distScaleFactor = Clip3( -4096, 4095, ( tb * tx + 32 ) \gg 6 )$$
  - ◆ The LUT size is much smaller by using the separation calculation

# Proposed solution

- Same as the method for motion vector scaling
  - ◆ Step 1: calculate the reciprocal of denominator
$$iX = (0x10000 + numPred \gg 1) / numPred$$
  - ◆ Step 2: Calculate DC value
$$dcPred[p] = \text{Clip}(0, 255, (iX \times sumPred + 0x8000) \gg 16) \text{ (SDC)}$$
  - ◆ The LUT size is significantly reduced
    - SDC:  $2^{28}$  to  $2^{10}$

# Experimental results

## ● Solution1 (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%	0.00%	0.01%	0.01%	100.0%	100.2%	98.5%
Kendo	0.0%	0.0%	0.0%	0.00%	0.00%	-0.06%	100.0%	101.3%	99.2%
Newspaper_CC	0.0%	0.0%	0.0%	0.00%	-0.01%	-0.02%	99.9%	102.4%	98.7%
GT_Fly	0.0%	0.0%	0.0%	0.00%	0.03%	0.04%	101.6%	99.8%	99.5%
Poznan_Hall2	0.0%	0.0%	0.0%	0.00%	-0.03%	-0.07%	98.0%	100.5%	101.1%
Poznan_Street	0.0%	0.0%	0.0%	0.00%	0.02%	0.07%	100.7%	90.6%	101.3%
Undo_Dancer	0.0%	0.0%	0.0%	0.00%	0.00%	0.01%	100.5%	101.7%	100.6%
1024x768	0.0%	0.0%	0.0%	0.00%	0.00%	-0.02%	100.0%	101.3%	98.8%
1920x1088	0.0%	0.0%	0.0%	0.00%	0.00%	0.01%	100.2%	98.1%	100.6%
average	0.0%	0.0%	0.0%	0.00%	0.00%	0.00%	100.1%	99.5%	99.9%

# Experimental results (2)

## ● Solution1 (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%	-0.03%	-0.04%	-0.03%	99.9%	100.6%	99.7%
Kendo	0.0%	0.1%	-0.1%	0.00%	0.04%	0.01%	99.6%	110.3%	102.9%
Newspaper_CC	0.0%	0.1%	0.0%	0.02%	0.01%	0.07%	99.8%	103.0%	104.2%
GT_Fly	0.0%	0.1%	-0.1%	0.00%	0.00%	-0.06%	100.0%	100.7%	101.1%
Poznan_Hall2	0.0%	0.0%	0.4%	0.06%	0.04%	0.00%	99.8%	102.2%	102.6%
Poznan_Street	0.0%	-0.1%	0.0%	-0.03%	-0.01%	0.00%	99.8%	100.6%	99.3%
Undo_Dancer	0.0%	-0.1%	0.1%	-0.01%	-0.03%	-0.03%	100.3%	97.2%	98.2%
1024x768	0.0%	0.1%	0.0%	0.00%	0.01%	0.02%	99.8%	104.7%	102.3%
1920x1088	0.0%	0.0%	0.1%	0.00%	0.00%	-0.02%	100.0%	100.2%	100.3%
average	0.0%	0.0%	0.0%	0.00%	0.00%	-0.01%	99.9%	102.1%	101.1%

# Conclusions

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- The proposed solution can remove division operation for SDC with LUT with considerable size and doesn't have impact on coding performance
- Suggest adopting the proposed solution





# Thank you!

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