JCT3V-I0080: Parameter Derivation for Illumination Compensation
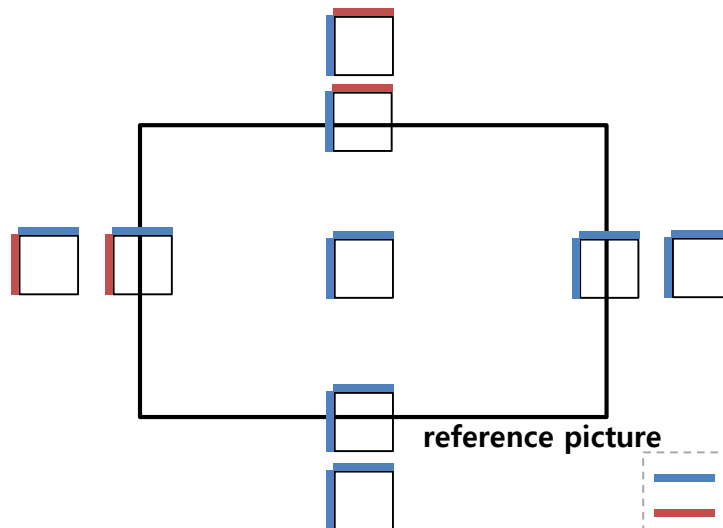
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Availability of Neighboring Samples

❖ In the current IC process,

- When the reference position is (x, y),
  - If x <= 0, ⟶ **useless condition**
    ➔ left neighboring samples are not used for the IC parameter derivation
  - If y <= 0, ⟶ **useless condition**
    ➔ above neighboring samples are not used for the IC parameter derivation
  - Otherwise,
    ➔ neighboring samples are used for the IC parameter derivation
    even if the neighboring samples are outside of the picture

Clipping operation is needed

reference picture

Proposed Method #1:
- **Remove 2 useless conditions**
- **Add clipping operation**

used neighboring samples
unused neighboring samples

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Simulation Results – Method 1

❖ Method 1

- ▪ Based on CTC and HTM 11
- ▪ No coding loss

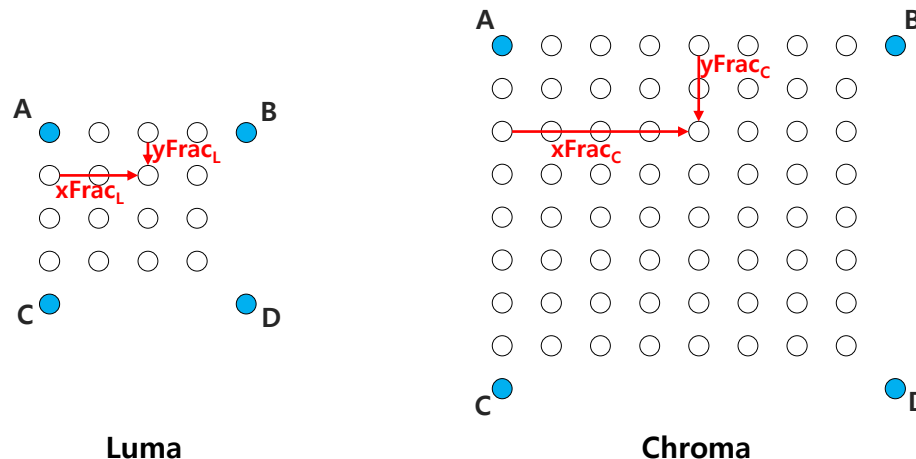|	video 0	video 1	video 2	video PSNR / video bitrate	video PSNR / total bitrate	synth PSNR / total bitrate	enc time	dec time	ren time
Balloons	0.00%	0.01%	0.00%	0.00%	-0.01%	0.04%	100.4%	94.9%	100.2%
Kendo	0.00%	-0.12%	0.00%	-0.02%	-0.02%	0.00%	99.7%	95.2%	98.5%
Newspaper_CC	0.00%	0.01%	0.00%	0.00%	0.03%	-0.02%	99.1%	96.2%	97.1%
GT_Fly	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	99.6%	104.5%	100.5%
Poznan_Hall2	0.00%	0.07%	0.00%	0.01%	0.01%	0.02%	99.0%	95.6%	100.1%
Poznan_Street	0.00%	0.11%	0.00%	0.01%	0.01%	0.01%	99.4%	95.0%	98.5%
Undo_Dancer	0.00%	0.04%	0.01%	0.00%	0.00%	0.03%	98.8%	99.1%	98.8%
Shark	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	99.6%	101.2%	103.2%
1024x768	0.00%	-0.03%	0.00%	-0.01%	0.00%	0.00%	99.7%	95.4%	98.6%
1920x1088	0.00%	0.04%	0.00%	0.01%	0.00%	0.01%	99.3%	99.1%	100.2%
average	**0.00%**	**0.02%**	**0.00%**	**0.00%**	**0.00%**	**0.01%**	**99.5%**	**97.7%**	**99.6%**

Allowing Fractional Sample

❖ Even though the reference block is in fractional sample position, the nearest integer samples are used for IC parameter derivation

❖ So, we proposes to use the fractional samples derived by the bi-linear interpolation (**Proposed Method #2**)

- Fraction sample can be calculated by following equations (NB_L: luma sample, NB_C: chroma sample)

$$NB_L = ((4 - xFrac_L)(4 - yFrac_L) * A + xFrac_L(4 - yFrac_L) * B$$
$$+ (4 - xFrac_L)yFrac_L * C + xFrac_L yFrac_L * D + 8) >> 4$$
$$NB_C = ((8 - xFrac_C)(8 - yFrac_C) * A + xFrac_C(8 - yFrac_C) * B$$
$$+ (8 - xFrac_C)yFrac_C * C + xFrac_C yFrac_C * D + 32) >> 6$$

Luma

Chroma

Simulation Results – Method 2

❖ Method 2 (Based on CTC and HTM 11)

- 0.1% bit-saving for coded views

  - 0.2% bit-saving for dependent views

	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	0.00%	-0.44%	-0.41%	-0.18%	-0.16%	-0.14%	100.9%	97.5%	102.6%
Kendo	0.00%	-0.46%	-0.39%	-0.19%	-0.23%	-0.09%	100.4%	96.9%	99.7%
Newspaper_CC	0.00%	-0.45%	-0.33%	-0.15%	-0.11%	-0.07%	99.3%	100.5%	100.6%
GT_Fly	0.00%	0.00%	0.01%	0.00%	0.00%	-0.01%	99.5%	98.6%	99.6%
Poznan_Hall2	0.00%	0.01%	-0.45%	-0.08%	-0.09%	-0.05%	99.5%	100.4%	99.9%
Poznan_Street	0.00%	0.00%	-0.17%	-0.07%	-0.07%	0.01%	99.1%	98.1%	99.0%
Undo_Dancer	0.00%	-0.05%	0.05%	0.00%	0.00%	0.07%	99.2%	99.2%	100.0%
Shark	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	98.9%	95.5%	100.5%
1024x768	0.00%	-0.45%	-0.38%	-0.17%	-0.17%	-0.10%	100.2%	98.3%	101.0%
1920x1088	0.00%	-0.01%	-0.11%	-0.03%	-0.03%	0.00%	99.3%	98.4%	99.8%
average	**0.00%**	**-0.18%**	**-0.21%**	**-0.08%**	**-0.08%**	**-0.03%**	**99.6%**	**98.4%**	**100.3%**

- Complexity comparison in terms of multiplication in the worst case

	Multiplication per pixel	Compared to HEVC
HEVC	57.0	100%
Current	59.7	105%
Proposed	60.7	106%

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Simulation Results

❖ Combining of Method 1 and 2
- Based on CTC and HTM 11
- 0.1% bit-saving for coded views

	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	0.00%	-0.43%	-0.41%	-0.18%	-0.17%	-0.14%	100.1%	98.1%	101.4%
Kendo	0.00%	-0.47%	-0.39%	-0.19%	-0.22%	-0.10%	99.8%	96.4%	98.5%
Newspaper_CC	0.00%	-0.52%	-0.33%	-0.17%	-0.10%	-0.08%	98.6%	97.3%	98.2%
GT_Fly	0.00%	0.00%	0.01%	0.00%	0.00%	-0.01%	99.5%	104.3%	101.0%
Poznan_Hall2	0.00%	0.01%	-0.45%	-0.08%	-0.08%	-0.02%	99.3%	99.6%	100.2%
Poznan_Street	0.00%	0.02%	-0.17%	-0.07%	-0.07%	0.02%	99.4%	98.6%	99.5%
Undo_Dancer	0.00%	-0.01%	0.05%	0.01%	0.01%	0.07%	99.0%	102.4%	99.6%
Shark	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	99.0%	98.7%	100.1%
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average	**0.00%**	**-0.17%**	**-0.21%**	**-0.09%**	**-0.08%**	**-0.03%**	**99.3%**	**99.4%**	**99.8%**

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Conclusion

❖ We proposed methods for improve the IC parameter derivation

- It is proposed to remove 2 useless conditions and to add a clipping operation
- It is also proposed to use a fractional position for neighboring samples
- 0.1% bit-saving for coded views

❖ We recommend to adopt the proposed method into next 3D-HEVC WD

Thanks Sharp for the cross check (JCT3V-I0158).

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