

JCTVC-H0156



CE10.3: Simplification of Second Delta Calculation in Deblocking by SKT/SKKU

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Summary

- This contribution addresses simplification of the deblocking filter by simpler calculation for the second delta value
 - For the second delta value for the second pixels, use a scaled value of the first delta value for the first pixels
 - (HM5.0) $\Delta p = \text{Clip}(-(t_c \gg 1), (t_c \gg 1), (((p2 + p0 + 1) \gg 1) - p1 + \Delta) \gg 1)$
 $\Delta q = \text{Clip}(-(t_c \gg 1), (t_c \gg 1), (((q2 + q0 + 1) \gg 1) - q1 - \Delta) \gg 1)$
 $p1' = p1 + \Delta p ; q1' = q1 + \Delta q$
 - (Proposed) $p1' = p1 + \Delta \gg 1 ; q1' = q1 - \Delta \gg 1$
- BD-rate (Y) results are similar to the HM5.0 anchor, and in our viewing test, subjective quality is similar to the HM5.0.
 - Overall encoding/decoding complexity: 100% / 98%
 - 0.0% (AI_HE), 0.0% (AI_LC)
 - 0.0% (RA_HE), 0.1% (RA_LC)
 - -0.1% (LDB_HE), 0.1% (LDB_LC)
 - -0.1% (LDP_HE), 0.5% (LDP_LC)

■ Thank ETRI for the verification in JCTVC-H0157.

HM5.0: Luma Weak Filter

- For the first delta calculation for the first pixel

$$\Delta = \text{Clip}(-t_c, t_c, ((9 \times (q_0 - p_0) - 3 \times (q_1 - p_1) + 8) \gg 4))$$

$$p_0' = p_0 + \Delta \quad \text{and} \quad q_0' = q_0 - \Delta$$

- For the second delta calculation for the second pixel

- For second pixel p1 (If dEp1 is equal to 1)

$$\Delta p = \text{Clip}(-(t_c \gg 1), (t_c \gg 1), (((p_2 + p_0 + 1) \gg 1) - p_1 + \Delta) \gg 1)$$

$$p_1' = p_1 + \Delta p$$

- For second pixel q1 (If dEq1 is equal to 1)

$$\Delta q = \text{Clip}(-(t_c \gg 1), (t_c \gg 1), (((q_2 + q_0 + 1) \gg 1) - q_1 - \Delta) \gg 1)$$

$$q_1' = q_1 + \Delta q$$

- For the second delta calculation for each second pixels in HM5.0
 - The two delta calculation processes are required for the second pixels (p1 and q1)

Proposed Method: *Luma Weak Filter*

- For the first delta calculation for the first pixel

$$\Delta = \text{Clip}(-t_c, t_c, ((9 \times (q_0 - p_0) - 3 \times (q_1 - p_1) + 8) \gg 4))$$

$$p_0' = p_0 + \Delta \quad \text{and} \quad q_0' = q_0 - \Delta$$

- For the second delta calculation for the second pixel

- For second pixel p1 (If dEp1 is equal to 1)

$$p_1' = p_1 + \Delta \gg 1$$

- For second pixel q1 (If dEq1 is equal to 1)

$$q_1' = q_1 - \Delta \gg 1$$

- Benefit of the proposed second delta calculation for each second pixel
 - No need to newly calculate the second delta

Simulation Results (1)

	All Intra HE			All Intra LC		
	Y	U	V	Y	U	V
Class A	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class D	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class E	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Overall	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class F	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	100%			100%		
Dec Time[%]	99%			98%		

Simulation Results (2)

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	-0.1%	0.0%	-0.1%	0.0%	0.0%	-0.1%
Class B	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%
Class C	0.0%	0.0%	0.1%	0.0%	0.1%	0.1%
Class D	0.0%	-0.1%	-0.1%	0.1%	0.0%	0.1%
Class E						
Overall	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%
	0.0%	-0.1%	0.0%	0.1%	0.0%	0.0%
Class F	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	100%			100%		
Dec Time[%]	98%			97%		

Simulation Results (3)

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	-0.1%	0.1%	0.2%	0.1%	-0.3%	-0.2%
Class C	-0.2%	0.1%	0.1%	0.0%	0.1%	0.1%
Class D	-0.1%	-0.6%	0.1%	0.0%	0.4%	0.2%
Class E	-0.1%	0.6%	0.1%	0.2%	-0.7%	0.0%
Overall	-0.1%	0.0%	0.1%	0.1%	-0.1%	0.0%
	-0.1%	0.0%	0.1%	0.1%	0.0%	0.0%
Class F	-0.1%	0.1%	-0.3%	-0.1%	-0.6%	-0.5%
Enc Time[%]	101%			100%		
Dec Time[%]	99%			99%		

Simulation Results (4)

	Low delay P HE			Low delay P LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.0%	0.1%	0.0%	0.8%	0.1%	-0.6%
Class C	-0.1%	-0.1%	-0.3%	0.4%	0.1%	0.3%
Class D	0.0%	-0.1%	0.0%	0.2%	-0.2%	0.1%
Class E	-0.1%	0.3%	0.2%	1.2%	-0.9%	-0.8%
Overall	-0.1%	0.0%	0.0%	0.5%	-0.2%	-0.3%
	-0.1%	0.0%	0.0%	0.5%	-0.2%	-0.2%
Class F	-0.2%	-0.1%	0.1%	0.2%	-0.5%	-0.2%
Enc Time[%]	100%			100%		
Dec Time[%]	99%			98%		

Conclusion Remarks

- This contribution addresses simplification of the deblocking filter by simpler calculation for the second delta value
 - The second delta value for the second pixels is derived from a scaled value of the first delta value for the first pixels.
- Simulation results
 - BD-rate (Y) results are similar to the HM5.0 anchor. (0.0% (AI_HE), 0.0% (AI_LC), 0.0% (RA_HE), 0.1% (RA_LC), -0.1% (LDB_HE), 0.1% (LDB_LC), -0.1% (LDP_HE), and 0.5% (LDP_LC))
 - Encoding/Decoding times are also similar or smaller than the HM5.0
 - In our viewing test, subjective quality is similar to the HM5.0
- Recommended to employ this simple mechanism in coming HM design
- We thank ETRI for crosschecking our proposal (JCTVC-H0157)