

JVET-Q0322

CE1-related: Long luma deblocking filter decision
modification

Han Boon Teo, Chutong Wang, Chong Soon Lim

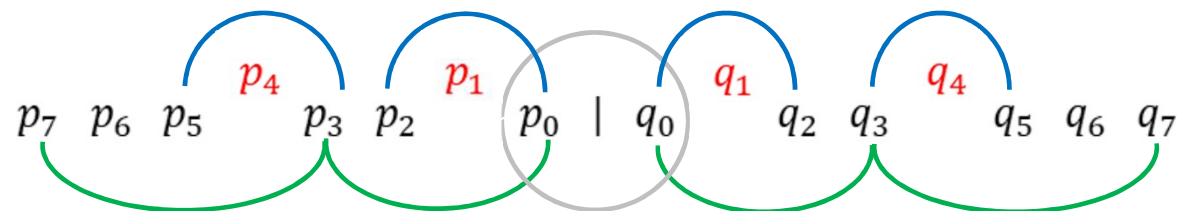
Introduction

In VVC draft 7, three checks for long luma deblocking filter decision is shown below:

- dpq is less than $(\beta \gg 2)$, low spatial activity on the side of block boundary?
- $sp + sq$ is less than $sThr$, signal on the sides of the block boundary is flat?
- spq is less than $(5 * tC + 1) \gg 1$ difference in intensities of the immediate samples on two sides of the block < threshold?

Wherein for $maxfilterlength = 7$,

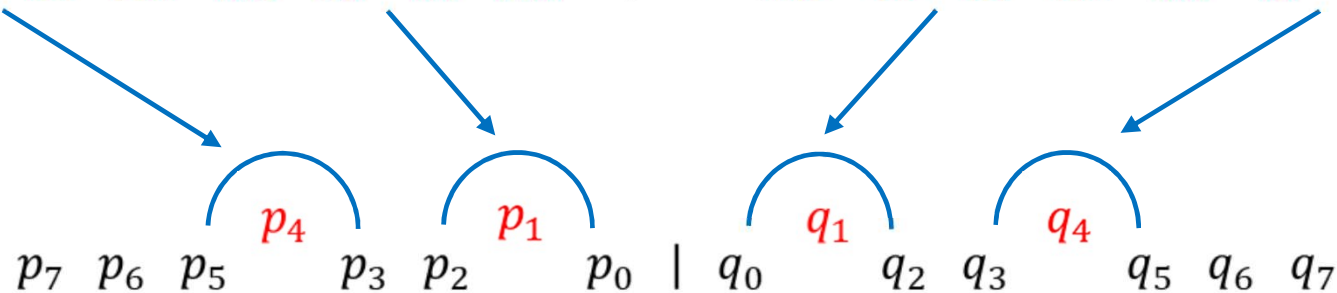
- $dpq = (|p_2 - 2 * p_1 + p_0| + |p_5 - 2 * p_4 + p_3| + 1) \gg 1 + (|q_2 - 2 * q_1 + q_0| + |q_5 - 2 * q_4 + q_3| + 1) \gg 1$
- $sp = (|p_3 - p_0| + |p_7 - p_3| + 1) \gg 1$; $sq = (|q_3 - q_0| + |q_7 - q_3| + 1) \gg 1$
- $spq = |p_0 - q_0|$



Issues to be solved

- This gradient check only includes 4 detections on **4 points** (p_4, p_1, q_4, q_1).

- $\bullet \text{ dpq} = (|p_5 - 2 * p_4 + p_3| + |p_2 - 2 * p_1 + p_0| + 1) \gg 1 + (|q_5 - 2 * q_4 + q_3| + |q_2 - 2 * q_1 + q_0| + 1) \gg 1$
 $= (|(p_5 - p_4) - (p_4 - p_3)| + |(p_2 - p_1) - (p_1 - p_0)| + 1) \gg 1 + (|(q_5 - q_4) - (q_4 - q_3)| + |(q_2 - q_1) - (q_1 - q_0)| + 1) \gg 1$



But gradient check doesn't cover all the samples

Proposal

The main idea to solve the mentioned problem is to cover more samples into the gradient check.

Our proposal is to extend the interval of gradient from **1** to **2**.

$$\text{Before: } |p_2 - 2 * p_1 + p_0| = |(p_2 - p_1) - (p_1 - p_0)|$$

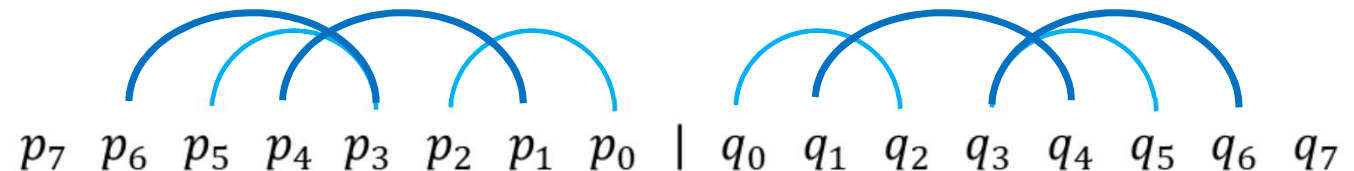
$$\text{After modified: } |p_4 - p_3 - p_2 + p_1| = |(p_4 - p_2) - (p_3 - p_1)|$$



$$\text{Before: } dpq = (|p_5 - 2 * p_4 + p_3| + |p_2 - 2 * p_1 + p_0| + 1) \gg 1 + (|q_5 - 2 * q_4 + q_3| + |q_2 - 2 * q_1 + q_0| + 1) \gg 1$$

$$\text{After modified: } dpq = (|p_6 - p_5 - p_4 + p_3| + |p_4 - p_3 - p_2 + p_1| + 1) \gg 1 + (|q_6 - q_5 - q_4 + q_3| + |q_4 - q_3 - q_2 + q_1| + 1) \gg 1$$

No change to complexity!



Subjective example (ALF on)



Figure 1: POC 97 DayStreet at QP 37 ALF ON, Left: Anchor, Right: Proposed fix with modified gradient check in VTM-7.0.

Subjective example (ALF off)



Figure 2: POC 97 DayStreet at QP 37 ALF OFF, Left: Anchor, Right: Proposed fix with modified gradient check in VTM-7.0.

Objective results SDR (ALF on)

	All Intra Main10				
	Over VTM-7.0				
	Y	U	V	EncT	DecT
Class A1	0.00%	0.00%	-0.01%	107%	98%
Class A2	0.00%	0.00%	0.00%	104%	101%
Class B	0.00%	0.00%	0.00%	102%	99%
Class C	0.00%	0.00%	0.00%	102%	101%
Class E	0.00%	0.00%	0.00%	101%	97%
Overall	0.00%	0.00%	0.00%	103%	99%
Class D	0.00%	0.00%	0.00%	99%	99%
Class F	0.00%	0.00%	0.00%	102%	99%

	Random Access Main 10				
	Over VTM-7.0				
	Y	U	V	EncT	DecT
Class A1	0.01%	-0.04%	0.00%	97%	98%
Class A2	-0.01%	-0.02%	-0.01%	98%	92%
Class B	0.01%	-0.01%	-0.06%	99%	101%
Class C	0.01%	-0.04%	0.01%	99%	100%
Class E					
Overall	0.01%	-0.03%	-0.02%	99%	98%
Class D	-0.01%	0.01%	-0.01%	102%	99%
Class F	0.01%	0.06%	-0.03%	85%	99%

	Low delay B Main10				
	Over VTM-7.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.04%	-0.38%	-0.06%	99%	97%
Class C	-0.03%	-0.20%	-0.28%	108%	96%
Class E	-0.13%	0.06%	-0.48%	98%	97%
Overall	-0.02%	-0.21%	-0.24%	102%	97%
Class D	-0.08%	0.44%	0.74%	108%	98%
Class F	0.02%	-0.71%	0.66%	107%	101%

	Low delay P Main10				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	-0.01%	0.28%	-0.10%	117%	119%
Class C	-0.01%	0.14%	-0.11%	113%	111%
Class E	0.14%	0.16%	-0.28%	109%	125%
Overall	0.03%	0.20%	-0.15%	114%	118%
Class D	0.00%	0.22%	0.30%	114%	108%
Class F	0.05%	-0.04%	0.00%	112%	121%

Conclusion

- Proposed to modify gradient check for long luma deblocking filter decision.
 - This modification improves subjective quality.
 - Complexity is not increased.
 - Negligible BDR impact.
-
- It is proposed include this modification for next version of VVC.

Thanks
Peking University &
SZ DJI Technology Co., Ltd.
for cross-checking
JVET-Q0733