

JCTVC-I0244:

Transform size dependent deblocking filter

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Block artifacts in HM6.0 (1)



HM-6.0 – Riverbed, Frame 31, QP32 (Y/Cb/Cr PSNR: 33.46/38.22/40.96 dB)

Block artifacts in HM6.0 (2) – VQEG sequence



HM-6.0 – ControlledBurn, Frame 273, QP27 (Y/Cb/Cr PSNR: 37.72/45.64/44.85 dB)

Block artifacts in HM6.0 (3) – VQEG sequence



HM-6.0 – WestWindEasy, Frame 26, QP32 (Y/Cb/Cr PSNR: 35.60/43.71/46.50 dB)

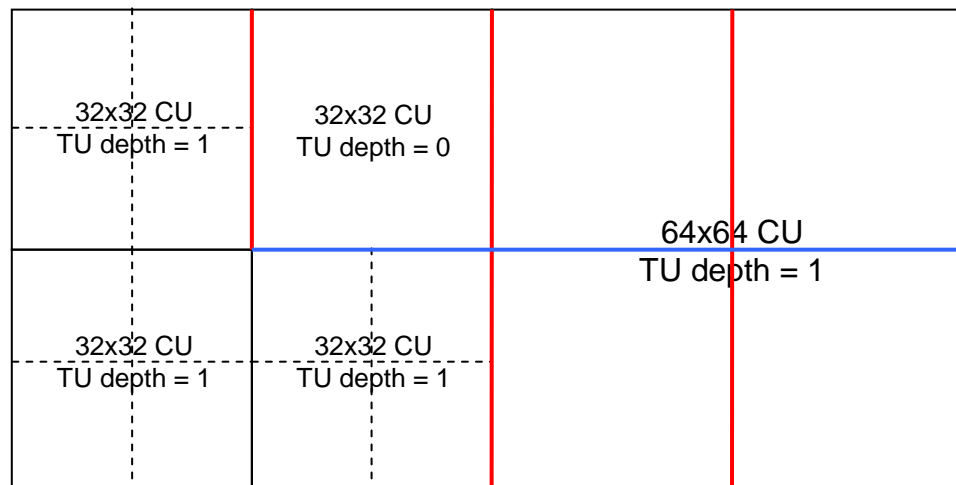
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Observations on blocking artifacts in HM-6.0

- Large TU increases discontinuities with neighboring blocks after quantization
 - Largest transform size is 32x32 in HEVC, while 8x8 in AVC
- Strong block artifacts exist at 32x32 TU boundaries even at lower QP
- TU size dependent deblocking is required

TU size dependent deblocking (1)

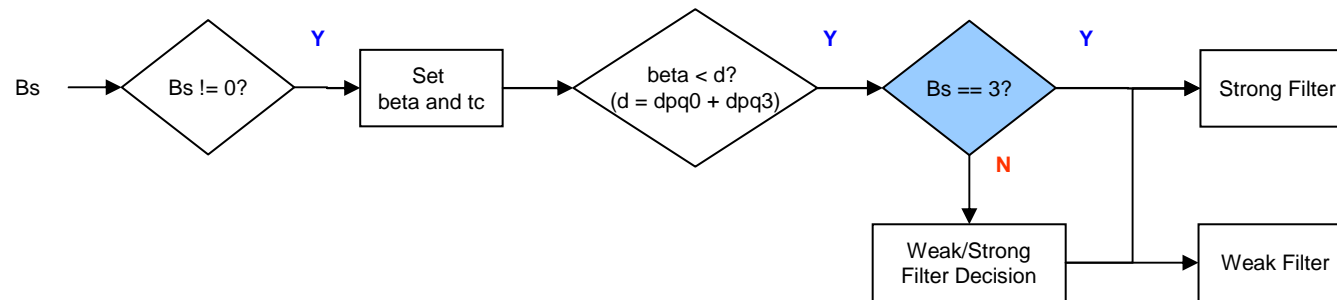
- Assign 32x32 TU boundary a higher Bs value so that it has more chance to be filtered by strong filter
 - 32x32 boundary between two blocks, P and Q, is 32x32 TU boundary if either P or Q is located in a 32x32 TU



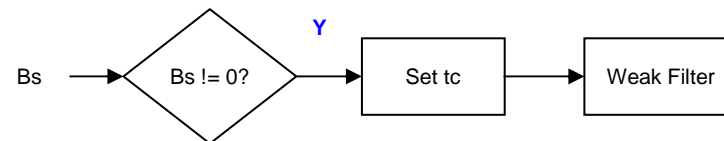
Example of vertical (red) and horizontal (blue) 32x32 TU boundaries

TU size dependent deblocking (2)

- Proposed TU size dependent filtering
 - Set Bs to 3 (intra) and 2 (inter) for 32x32 TU boundary



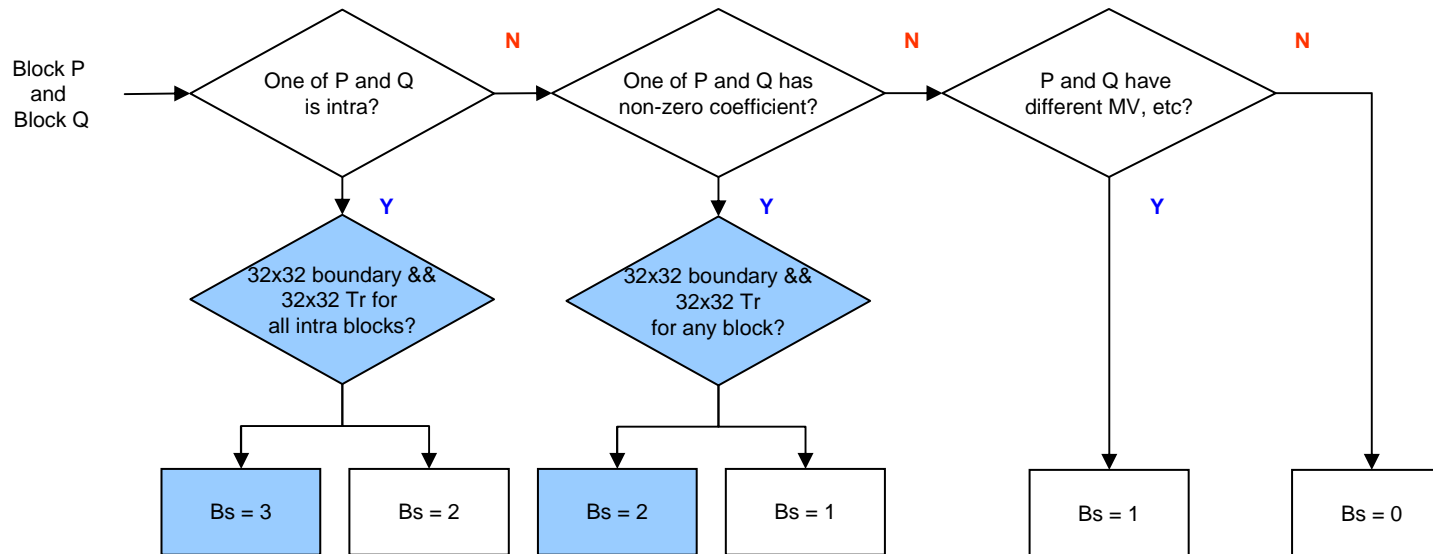
Proposed filtering method for Luma



Proposed filtering method for Chroma (No change)

TU size dependent deblocking (3)

- Proposed Bs Calculation



BD-Rate results

- BD-rate results on common test conditions when proposed TU-size dependent deblocking is always applied

		Y	U	V
Main	All Intra	0.6	0.0	0.0
	Random Access	0.3	0.3	0.3
	Low delay B	0.1	-0.1	0.0
	Low delay P	0.1	-0.7	-0.7
HE10	All Intra	0.6	0.0	0.0
	Random Access	0.3	0.3	0.3
	Low delay B	0.0	0.0	0.1
	Low delay P	0.0	-0.3	-0.4

- High level flag to disable tool also proposed to switch it off
- *TU-size independent application of strong filter leads to around 14-20% loss*

Visual Quality Comparison (1)



HM-6.0 – Riverbed, Frame 31, QP32 (Y/Cb/Cr PSNR: 33.46/38.22/40.96 dB)

Visual Quality Comparison (1)



Proposed – Riverbed, Frame 31, QP32 (Y/Cb/Cr PSNR: 33.33/38.16/40.95 dB)

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Visual Quality Comparison (2)



HM-6.0 – ControlledBurn, Frame 273, QP27 (Y/Cb/Cr PSNR: 37.72/45.64/44.85 dB)

Visual Quality Comparison (2)



Proposed – ControlledBurn, Frame 273, QP27 (Y/Cb/Cr PSNR: 37.70/45.58/44.70 dB)

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Visual Quality Comparison (3)



HM-6.0 – WestWindEasy, Frame 26, QP32 (Y/Cb/Cr PSNR: 35.60/43.71/46.50 dB)

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Visual Quality Comparison (3)



Proposed – WestWindEasy, Frame 26, QP32 (Y/Cb/Cr PSNR: 35.58/43.74/46.24 dB)

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Summary

- In HEVC, block artifacts still exist at 32x32 TU boundaries
- TU size dependent filtering is proposed in this contribution
- Visual quality is improved at the marginal BD-rate loss
- Propose to additionally add high-level control flag in APS and slice header to turn on/off the TU size dependent filtering
- Can be extended to Tile/Slice boundary
- Recommend the proposed method to be adopted

Many thanks to Ericsson for cross-checking this contribution