

The background is a solid green color with a repeating pattern of white line-art icons. These icons include various nautical items like anchors, lifebuoys, and compasses, as well as outdoor and travel-related items like a camera, a backpack, a tent, and a bird. The icons are scattered across the entire slide.

MEDIATEK

CE7-related: Modified dequantization scaling (JVET-L0095)

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Overall Summary

- When the transform block size is not a power of 4, the values of the transform coefficient levels are further scaled by a normalization factor $1/\sqrt{2}$ in the scaling process
- Proposes a modified look-up table (LUT) for performing de-quantization scaling and normalization scaling in one scaling operation
- Leads to average luma BD-rates
 - -0.03%, 0.00%, and -0.03% for the AI, RA, and LB, respectively, under the VTM-2.0.1 CTCs using the scaling factors with 6 fractional bits

Introduction to Scaling Process in VVC WD2

- When the transform block size is not a power of 4, the transform coefficient levels are further scaled by $1/\sqrt{2}$
 - $d[x][y] = (\text{TransCoeffLevel}[x][y] * m[x][y] * \text{levelScale}[qP \% 6] * \text{rectNorm} + ((1 \ll \text{bdShift}) \gg 1)) \gg \text{bdShift}$
 - $\text{rectNorm} = ((\text{Log2}(\text{nTbW}) + \text{Log2}(\text{nTbH})) \& 1) == 1 ? 181 : 1$
 - $\text{bdShift} = \text{bitDepth} + (((\text{Log2}(\text{nTbW}) + \text{Log2}(\text{nTbH})) \& 1) * 8 + (\text{Log2}(\text{nTbW}) + \text{Log2}(\text{nTbH})) / 2) - 5 - (qP / 6)$
- The number of fractional bits is further increased by 8 for the scaling process for some non-square transform blocks
- Different precisions for scaling different transform block shapes
- The number of the remaining bits for representing the transform coefficient levels and the scaling list entries can be reduced when the 32-bit integer is still used for scaling operation

Proposed Method

- The cascaded scaling operations by the dequantization scaling factor and the normalization scaling factor is replaced by one scaling operation with a normalized scaling factor, given by
 - $d[x][y] = (\text{TransCoeffLevel}[x][y] * m[x][y] * \text{levelScaleRectNorm}[\text{rectNormFlag}][qP \% 6] * \text{rectNorm} + ((1 \ll \text{bdShift}) \gg 1)) \gg \text{bdShift}$
 - $\text{rectNormFlag} = (\text{Log2}(\text{nTbW}) + \text{Log2}(\text{nTbH})) \& 1$
 - $\text{bdShift} = \text{bitDepth} + \cancel{((\text{Log2}(\text{nTbW}) + \text{Log2}(\text{nTbH})) \& 1) * 8} + (\text{Log2}(\text{nTbW}) + \text{Log2}(\text{nTbH})) / 2 - 5 - (qP / 6)$
- The list $\text{levelScaleRectNorm}[\][\]$ with 6 fractional bits is specified as
 - $\text{levelScaleRectNorm}[j][k] = \{$
 $\{ 40, 45, 51, 57, 64, 72 \},$
 $\{ 29, 32, 36, 40, 45, 51 \}$
 $\}$ with $j = 0$ or 1 , and $k = 0..5$

Simulation Results Using levelScaleRectNorm[][]: 6 Fractional Bits (Left) and 8 Fractional Bits (Right)

	All Intra Main10 Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1	-0.03%	0.24%	0.27%	100%	100%
Class A2	-0.05%	0.34%	0.28%	100%	101%
Class B	-0.02%	0.31%	0.36%	100%	100%
Class C	-0.05%	0.17%	0.38%	100%	99%
Class E	-0.03%	0.15%	0.25%	100%	99%
Overall	-0.03%	0.25%	0.32%	100%	100%
Class D	-0.03%	0.34%	0.05%	100%	100%
Class F (optional)	-0.03%	0.08%	0.08%	100%	100%

	All Intra Main10 Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1	-0.02%	0.01%	0.05%	97%	100%
Class A2	-0.04%	0.21%	0.08%	97%	97%
Class B	-0.01%	0.10%	0.15%	101%	106%
Class C	-0.02%	-0.01%	0.15%	99%	103%
Class E	-0.03%	0.03%	-0.06%	101%	106%
Overall	-0.02%	0.07%	0.09%	99%	103%
Class D	-0.03%	0.21%	-0.13%	99%	101%
Class F (optional)	0.01%	-0.03%	0.20%	99%	102%

	Random Access Main 10 Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1	-0.02%	0.09%	0.10%	99%	106%
Class A2	-0.01%	0.16%	0.01%	100%	107%
Class B	0.00%	0.15%	0.22%	99%	102%
Class C	0.02%	0.24%	0.14%	100%	101%
Overall	0.00%	0.16%	0.13%	100%	103%
Class D	0.03%	-0.24%	0.31%	99%	99%
Class F (optional)	0.00%	0.09%	-0.01%	100%	101%

	Random Access Main 10 Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1	-0.04%	-0.01%	0.06%	95%	96%
Class A2	-0.02%	-0.12%	-0.12%	98%	100%
Class B	0.02%	-0.07%	0.08%	100%	102%
Class C	0.01%	0.14%	-0.07%	106%	113%
Overall	0.00%	-0.01%	0.00%	100%	103%
Class D	0.02%	-0.23%	0.19%	105%	109%
Class F (optional)	-0.03%	-0.08%	0.03%	104%	107%

	Low delay B Main10 Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class B	0.00%	0.02%	0.12%	100%	103%
Class C	-0.02%	0.08%	-0.03%	100%	101%
Class E	-0.10%	0.75%	-0.10%	100%	99%
Overall	-0.03%	0.22%	0.01%	100%	101%
Class D	0.00%	1.13%	0.29%	100%	100%
Class F (optional)	-0.07%	0.95%	-0.20%	100%	101%

	Low delay B Main10 Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class B	0.05%	0.35%	0.08%	110%	116%
Class C	0.03%	0.06%	-0.21%	105%	111%
Class E	-0.25%	0.65%	-0.71%	104%	109%
Overall	-0.03%	0.33%	-0.22%	107%	113%
Class D	-0.05%	0.63%	-0.10%	103%	108%
Class F (optional)	-0.08%	0.07%	0.18%	108%	111%

Thank Samsung for cross check

Conclusions

- Proposes the modified LUT for performing de-quantization scaling and normalization scaling in one scaling operation
- The same precision is employed for the scaling process for different transform block shapes
- The number of fractional bits for the scaling process is kept the same as that of HEVC when the 6 fractional bits are employed for representing the LUT entry values
- It is shown experimentally that the BD-rate impact is negligible
- Recommend for adoption into the VVC draft