

JVET-K0032

CE12: Summary report on mapping for HDR content

Summary of proposed technologies

OUT-OF-LOOP - Tool	Acronym	Description
Dynamic range adaptation	DRA	luma mapping and luma-based chroma scaling as a pre-encoding process, inverse process as a post-decoding process
Harmonization of DRA chroma scale and QP	qpHarmoniz	adjusting the luma-based chroma scaling to preserve a luma/chroma bit allocation
DRA refinement	Refint_Flt/Refint_Fix	correction of the inverse DRA tables at the decoder to compensate the distortions

IN-LOOP - Tool	Acronym	Description
In-loop Luma reshaper	Reshap	Luma mapping in the loop Intra slice: reshaping of input signal. Inverse reshaping after LF and before DPB Inter slice: only inverse reshaping applies to the prediction signal before LF
luma-based Chroma QP Offset	chrQpOffset	Adds a luma-dependent QP offset to chroma signal, to compensate the Luma signal interaction with the Chroma signal
luma-based Chroma scaling	chrScaling	luma-based Chroma QP Offset by scaling the chroma residue signal in each TU
Loop Filter application to original domain	LF intraOrig or LF interOrig	Intra: LF is applied in the original domain, after applying the inverse reshaping Inter: LF is applied in the original domain.
Loop Filter application to reshaped domain	LF intraResh or LF interResh	Intra: LF in reshaped domain, before applying the inverse reshaping Inter: LF in reshaped domain. Fwd and inverse reshaping before and after LF
Region of Interest	ROI	Adaptively turns on/off reshaping of a CTU based on avg luma value in the CTU

Results - AI

Test#	Description	AI - Over VTM1.0				
		DE100	PSNRL	wPsnrY	wPsnrU	wPsnrV
out-of-loop						
CE12-1	DRA + RefintFlt	-18.8%	-0.7%	1.7%	-11.6%	-41.1%
CE12-3.1	DRA + RefintFlt + qpHarmoniz	-11.7%	-3.1%	-0.8%	-11.3%	-28.8%
CE12-3.2	DRA + RefintFix + qpHarmoniz	-11.7%	-3.1%	-0.8%	-11.4%	-28.8%
CE12-3.3	DRA + qpHarmoniz	-8.0%	-3.1%	-0.7%	-0.2%	-14.7%
in-loop						
CE12-5	Reshap	13.7%	-2.8%	-2.1%	12.3%	13.0%
CE12-6.1	Reshap + chrQpOffset	-1.5%	-2.8%	-2.0%	-1.9%	-4.8%
CE12-6.2	Reshap + chrScaling	0.5%	-2.8%	-2.1%	2.0%	2.6%
CE12-7.1	Reshap + LF_intraOrig_interOrig	-1.4%	-2.1%	-1.5%	-1.9%	-4.7%
CE12-7.2	Reshap + LF_intraResh_interOrig	-1.5%	-2.8%	-2.0%	-1.9%	-4.8%
CE12-7.3	Reshap + LF_intraResh_interResh					
CE12-8	Reshap + ROI					

Results - RA

Test#	Description	RA - Over VTM1.0				
		DE100	PSNRL	wPsnrY	wPsnrU	wPsnrV
out-of-loop						
CE12-1	DRA + RefintFlt	10.6%	-6.2%	-4.0%	35.1%	212.0%
CE12-3.1	DRA + RefintFlt + qpHarmoniz	10.3%	-6.6%	-4.4%	34.5%	68.5%
CE12-3.2	DRA + RefintFix + qpHarmoniz	10.4%	-6.6%	-4.4%	34.5%	68.4%
CE12-3.3	DRA + qpHarmoniz	15.6%	-6.5%	-4.3%	70.5%	118.1%
in-loop						
CE12-5	Reshap	11.0%	-2.6%	-2.0%	12.0%	10.3%
CE12-6.1	Reshap + chrQpOffset	-1.3%	-2.6%	-2.0%	0.0%	-0.1%
CE12-6.2	Reshap + chrScaling	2.0%	-2.6%	-2.0%	5.9%	8.9%
CE12-7.1	Reshap + LF_intraOrig_interOrig	-1.1%	-1.7%	-1.3%	0.1%	0.0%
CE12-7.2	Reshap + LF_intraResh_interOrig	-1.4%	-2.4%	-1.8%	-0.1%	-0.1%
CE12-7.3	Reshap + LF_intraResh_interResh	-1.3%	-2.6%	-2.0%	0.0%	-0.1%
CE12-8	Reshap + ROI	-1.2%	-2.2%	-1.7%	0.1%	-0.1%

Cross-checkers reports

test	xcheck	metrics	Visual	comments
CE12-1 and CE12-3.2/3 QCM/TCH	DBL	Match	Improvement in Market, Starting, Hurdles (R1 and R2)	Differences in runtime evaluation compared to proponent - CE12-1, dec 110% for AI, 116% for RA - CE12-3.3, dec 108% for AI, 117% for RA (proponent reported in K0298r1 Enc 93%, Dec 101%) Implementation checked - different luma/chroma repartition observed compared to anchor
CE12-3.2 QCM/TCH	Hisilicon	Match		
CE12-3.3 QCM/TCH	NHK	Match		Runtime - Enc 88%, Dec 94% (proponent reported in K0298r1 Enc 93%, Dec 101%)
12-5 DLB	QCM	Match		
12-6 DLB	Sharp	Match		
CE12-7 DLB	TCH	Match	Improvement in Market, Starting, Hurdles (mostly R2)	Differences in runtime evaluation compared to proponent CE12-7.3, RA (same as 12-6.1), enc 104%, dec 112% Implementation checked - Comments on luma/chroma balance reported to give over-improved chroma quality in anchor and CE12-5 to 8
CE12-8 DLB	TCH	Match		

Conclusions / recommendations

- Observations

- In-loop or out-of-loop mapping perform better than the anchor, both objectively and subjectively
- Different luma/chroma balance observed in both approaches

Test#	AI - Over VTM1.0					RA - Over VTM1.0				
	DE100	PSNRL	wPsnrY	wPsnrU	wPsnrV	DE100	PSNRL	wPsnrY	wPsnrU	wPsnrV
CE12-3.2	-11.7%	-3.1%	-0.8%	-11.4%	-28.8%	10.4%	-6.6%	-4.4%	34.5%	68.4%
CE12-6.1	-1.5%	-2.8%	-2.0%	-1.9%	-4.8%	-1.3%	-2.6%	-2.0%	0.0%	-0.1%

- Recommendations

- Reconduct the CE on mapping for HDR content to further investigate in-loop or out-of-loop mapping
- Investigate and align luma/chroma balance issue in anchors and proposals