



CE12-related: Universal low complexity reshaper for SDR and HDR video

JVET-L0247

12th Meeting: Macao, CN, 3–12 Oct. 2018

Overview

- Conceptual View of reshaping/mapping
- Objectives: a reshaping architecture that provides
 - Significant coding gains ($> 1\%$)
 - Low complexity consistent with enabling both **SDR and HDR reshaping**
- Summary of Results
 - HDR
 - SDR
- Implementation Discussion
- Proposals

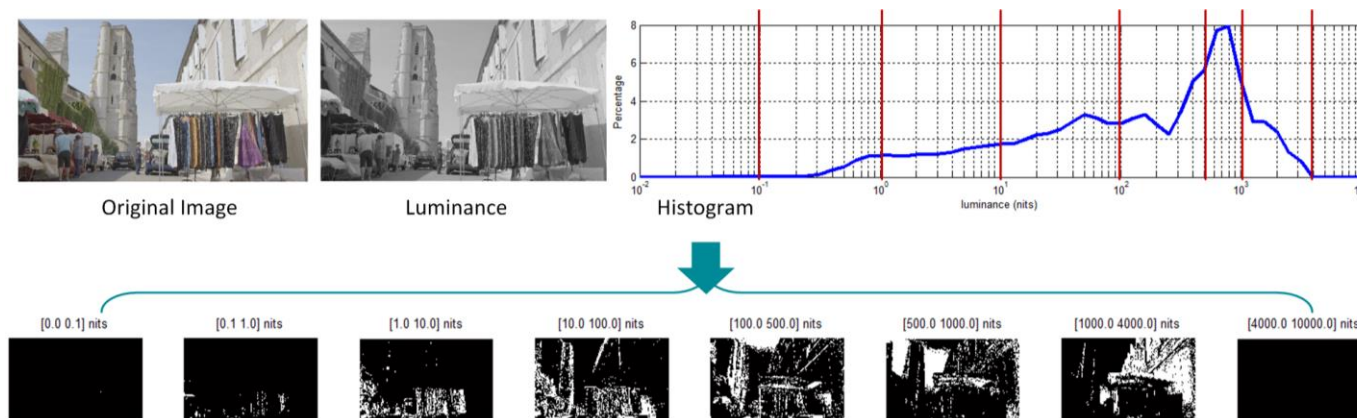
A Conceptual View of Reshaping/Mapping

- Reshaping → modulation of the “effective bit depth” of the signal at the pixel level

Areas of higher ‘importance’ → increased effective bit depth → preserves noticeable details

Areas of lower ‘importance’ → lower effective bit depth → reduces less noticeable details

- Regions are identified in terms of luma ranges



- ‘Importance’ can be quantified in terms of variance within a luma range or by other methods

A Conceptual View of Reshaping/Mapping: Luma

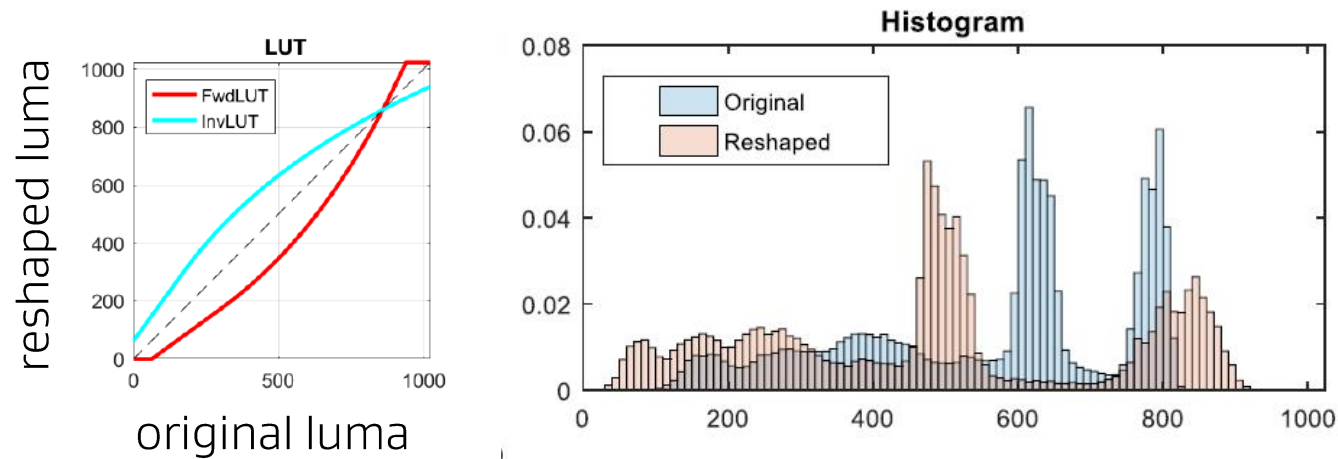
Reshaping is implemented with Forward (FWD)/Inverse (INV) LUTs and chroma scaling



Original luma

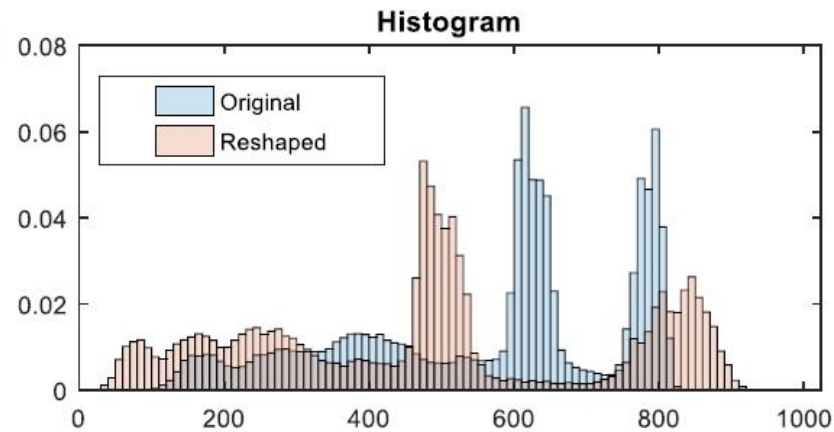
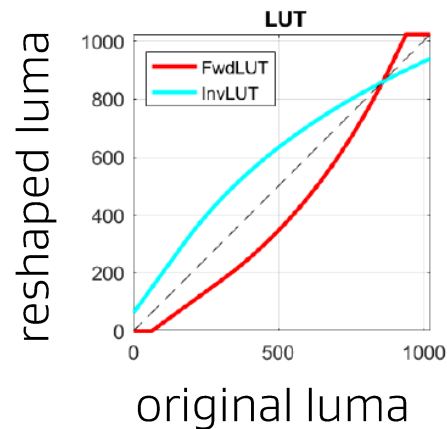
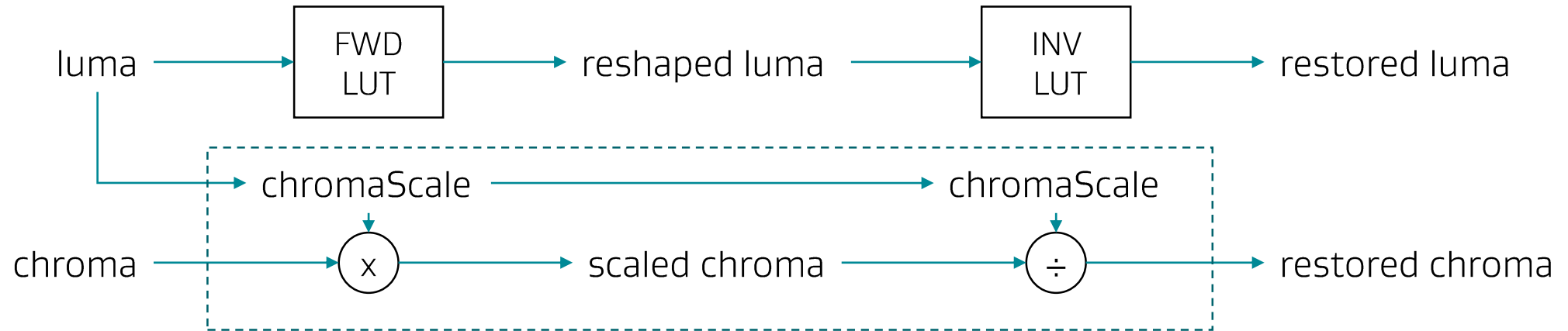
Reshaped luma

Restored luma



A Conceptual View of Reshaping/Mapping: Chroma

Luma-dependent chroma scaling compensates for luma-chroma interaction



Universal Reshaper for SDR and HDR

Figure 1. Intra slice reconstruction with in-loop luma reshaper

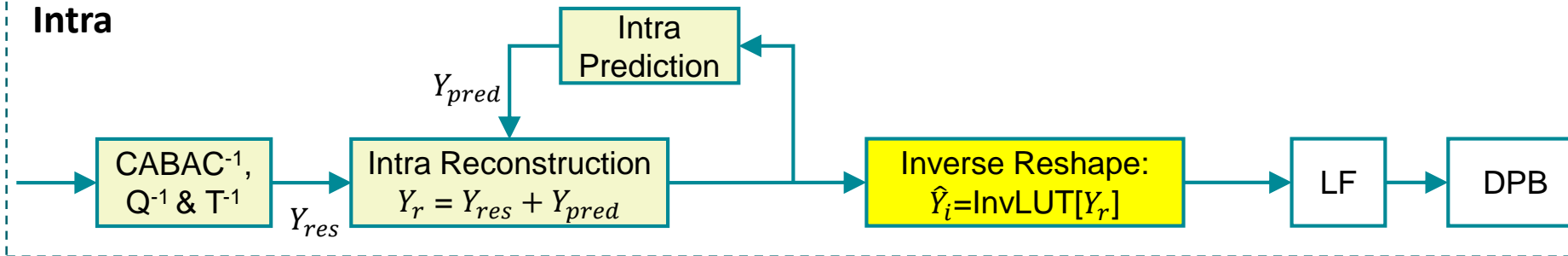
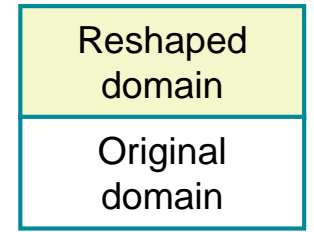
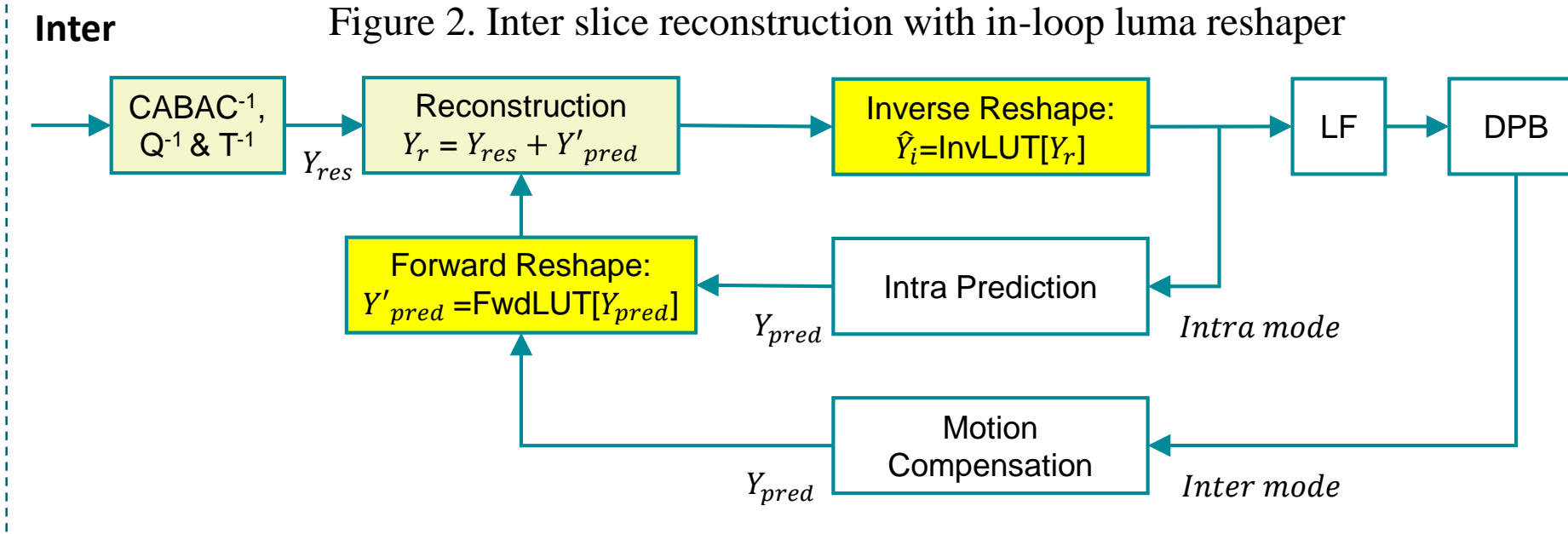


Figure 2. Inter slice reconstruction with in-loop luma reshaper



1 INV LUT
(in-place mapping)

(only 1 LUT
needs to be signaled)

1 FWD LUT
(in-place mapping)

+

$cRes = cResScale / cScale$

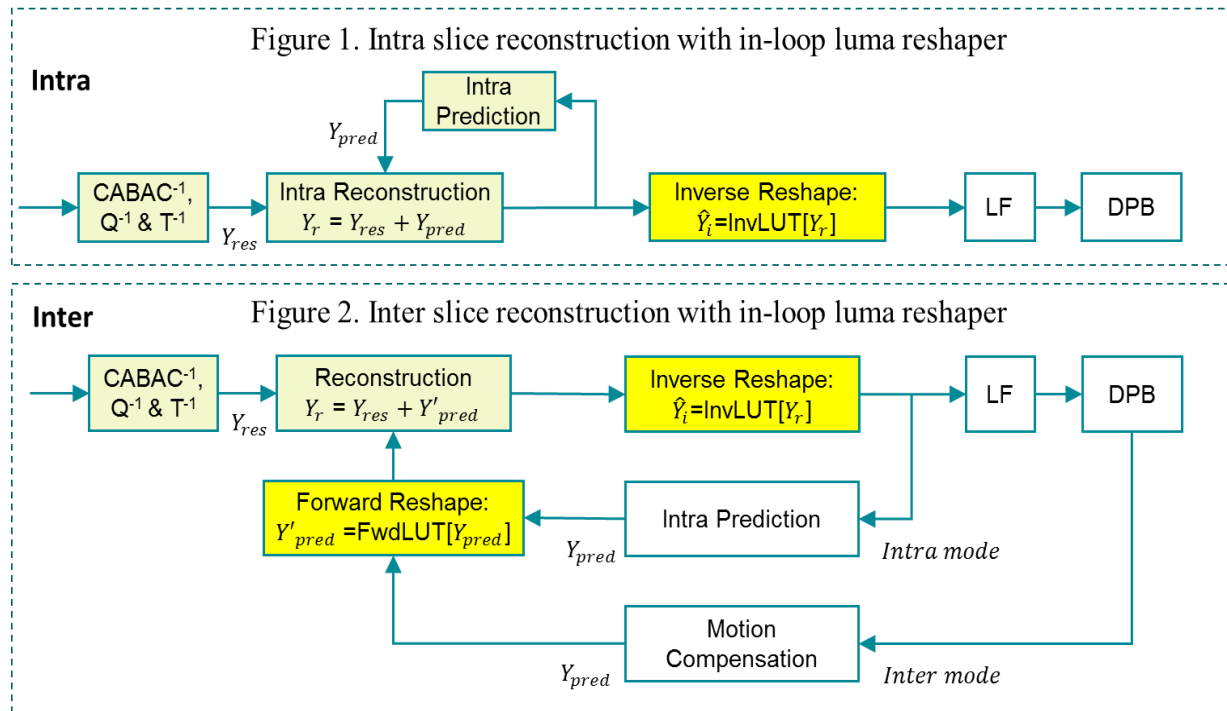
(luma-dependent scalar value)

Summary of Results

		HDR			
		wPsnrY	PSNRL100	DE100	EncT DecT
All Intra Random Access		-1.70%	-2.00%	1.40%	100% 101%
		-1.80%	-2.00%	2.30%	101% 103%

		SDR			
		psnrY	psnrU	psnrV	EncT DecT
All Intra Random Access		-0.96%	2.56%	2.13%	107% 105%
		-1.32%	2.07%	1.62%	106% 105%

Implementation Discussion (Decoding)



- LUTs
 - FwdLUT and InvLUT
 - Only 1 LUT signaled (other is derived)
 - LUT signaled as 32-bin 10-bit PWL model
- Signaling of reshaper model
 - 38 bits (w/o slice adaptation)
 - 80 bits (with slice adaptation)
- Intra picture
 - Intra reconstruction in reshaped domain
 - InvLUT applied to reconstructed picture
- Inter picture
 - Fwd LUT applied to reference picture
 - Blockwise Inter/Intra reconstruction in reshaped domain
 - InvLut applied to reconstructed block

- Chroma
 - Scalar multiplication of reshaped residual
 - Scale factor derived from mean luma
 - Alternatively, chroma scaling implemented in chromaScaleLUT

Proposal

- Continue optimization of a universal reshaping architecture that provides
 - Significant coding gains for both **SDR and HDR (RA: 1.3% SDR, 1.8% HDR)**
 - Low complexity consistent with enabling both **SDR and HDR reshaping**
- Subjective viewing
 - HDR – planned before or at 13th meeting of JVET (January, 2019)
 - SDR – planned during 12th meeting of JVET (October, 2018)
- Further study
 - Implementation
 - impact on pipelining of the block-wise prediction loop
 - dependency between luma and chroma, etc.
 - interdependency with CCLM
 - Investigate performance in low QP range (to see if quality saturates)
 - Investigate impact of reshaping on the quality difference of I vs B pictures

