



Method for Deriving Chroma QP from Luma QP

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Introduction

- Chroma QP is derived from Luma QP
- A fixed table is used in current HM

ChromaScale[52] =

{0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,
,24,25,26,27,28,29,29,30,31,32,32,33,34,34,35,35,36,36,37,37,
37,38,38,38,39,39,39,39}

$$QP_{Chroma} = QP_{Luma} \text{ if } QP_{Luma} \leq 29$$

$$Max(QP_{Chroma}) = 39$$

- This table is used for all pictures (I and B)

Proposed Chroma QP derivation

- Propose to use different tables for deriving Chroma QP from Luma QP for different temporal layer pictures.
 - Three additional tables
 - Two methods
 - Apply to RA and LD
- Method 1
 - Intra frames use table_1
 - Next layer B frames ($QP_{B_luma} = QP_{I_luma} + 1$) use table_2
 - All other B frames use default table_HM
- Method 2
 - Intra frames use table_1
 - Next layer B frames ($QP_{B_luma} = QP_{I_luma} + 1$) use table_2
 - Second layer B frame ($QP_{B_luma} = QP_{I_luma} + 2$) use table_HM
 - All other layers use table_3

Proposed Chroma QP derivation

- Chroma QP table_1

ChromaScale_1[52]={
0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,21,22,23,24,24,25,
26,27,28,29,29,30,31,32,33,34,35,35,36,36,37,37,37,38,38,38,39,39,39,39}

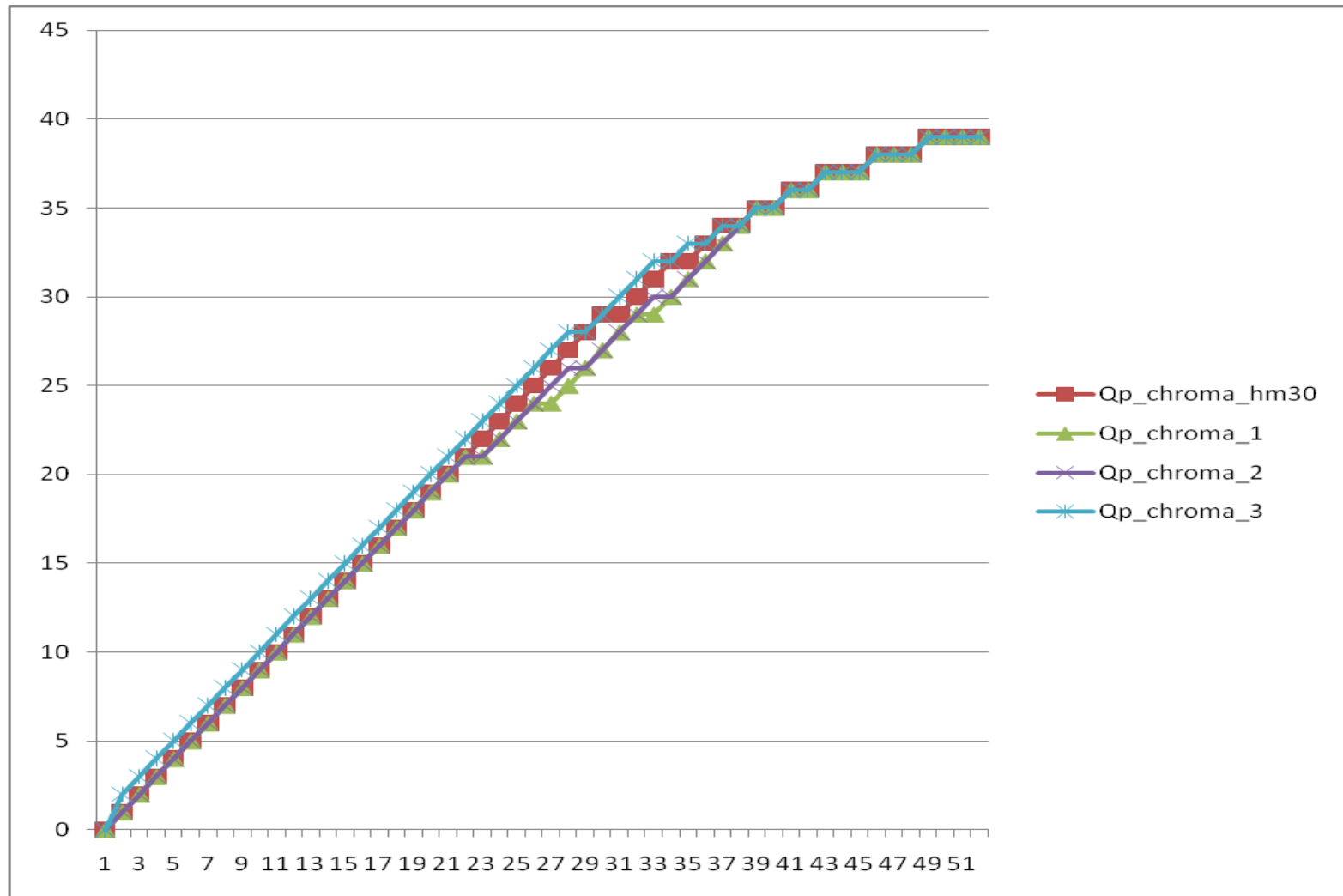
- Chroma QP table_2

ChromaScale_2[52]={
0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,21,22,23,24,25,26,
26,27,28,29,30,30,31,32,33,34,35,35,36,36,37,37,37,38,38,38,39,39,39,39}

- Chroma QP table_3

ChromaScale_3[52]={
0,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28
,28,29,30,31,32,32,33,33,34,34,35,35,36,36,37,37,37,38,38,38,39,39,39,39}

Proposed Chroma QP derivation



Simulation results (Method 1 vs. HM3.0 Anchor)

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.2	-5.2	-5.6	0.3	-4.3	-5.1
Class B	0.4	-5.6	-5.8	0.4	-5.7	-6.1
Class C	0.3	-4.3	-4.2	0.4	-4.2	-4.0
Class D	0.4	-4.8	-4.9	0.3	-4.5	-4.5
Class E						
All	0.3	-5.0	-5.2	0.4	-4.7	-5.0
Enc Time[%]	99%			101%		
Dec Time[%]	100%			100%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.2	-2.4	-2.7	0.3	-3.3	-3.9
Class C	0.2	-1.9	-2.0	0.2	-2.1	-2.2
Class D	0.1	-2.1	-1.4	0.2	-2.9	-2.3
Class E	0.0	-1.7	-2.5	0.2	-6.8	-6.4
All	0.1	-2.1	-2.1	0.2	-3.6	-3.5
Enc Time[%]	100%			100%		
Dec Time[%]	100%			100%		

Simulation results (Method 2 vs. HM3.0 Anchor)

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.2	-5.0	-5.5	0.3	-4.1	-5.0
Class B	0.4	-5.6	-5.8	0.4	-5.6	-6.1
Class C	0.3	-4.3	-4.2	0.4	-4.3	-4.1
Class D	0.4	-4.7	-5.0	0.3	-4.6	-4.6
Class E						
All	0.3	-5.0	-5.2	0.3	-4.7	-5.0
Enc Time[%]	99%			101%		
Dec Time[%]	100%			100%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.2	-2.4	-2.5	0.2	-3.2	-3.5
Class C	0.2	-1.9	-2.0	0.2	-2.2	-2.2
Class D	0.1	-2.2	-1.5	0.2	-2.6	-2.5
Class E	-0.1	-2.0	-2.4	0.1	-7.1	-6.1
All	0.1	-2.1	-2.1	0.2	-3.5	-3.4
Enc Time[%]	100%			100%		
Dec Time[%]	100%			100%		

Adaptive Chroma QP Offset

- Current Chroma QP derivation is not content adaptive
- Content dependant QP offset might work better than fix table(s)
 - Some sequences achieve significant (>8%) BD-rate savings for Chroma at very small (~0.1%) BD-rate increase for Luma.

pic_parameter_set_rbsp() {	Descriptor
pic_parameter_set_id	ue(v)
seq_parameter_set_id	ue(v)
entropy_coding_mode_flag	u(1)
num_temporal_layer_switching_point_flags	ue(v)
for(i = 0; i < num_temporal_layer_switching_point_flags; i++)	
temporal_layer_switching_point_flag[i]	u(1)
num_ref_idx_l0_default_active_minus1	ue(v)
num_ref_idx_l1_default_active_minus1	ue(v)
pic_init_qp_minus26 /* relative to 26 */	se(v)
chroma_qp_index_offset	se(v)
constrained_intra_pred_flag	u(1)
slice_granularity	u(2)
shared_pps_info_enabled_flag	u(1)
if(shared_pps_info_enabled_flag)	
if(adaptive_loop_filter_enabled_flag)	
alf_param()	
if(cu_qp_delta_enabled_flag)	
max_cu_qp_delta_depth	u(4)
rbsp_trailing_bits()	
}	

Conclusions

- A set of Luma to Chroma QP mapping tables are proposed.
- Two schemes for deriving Chroma QP from Luma QP using the proposed tables are presented.
- Experimental results report
 - Average 4.9% BD rate decrease for Chroma with average 0.3% BD rate increase for Luma for HE-RA.
 - Average 2.8% BD rate decrease for Chroma with average 0.15% BD rate increase for Luma for HE-LD.
 - Encoding and decoding time remain the same.
- It might also be worthwhile to consider including chroma_qp_index_offset in PPS.

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Thank you!