



# TE4.4: Inter-layer Adaptive Filter on Upsampled BL

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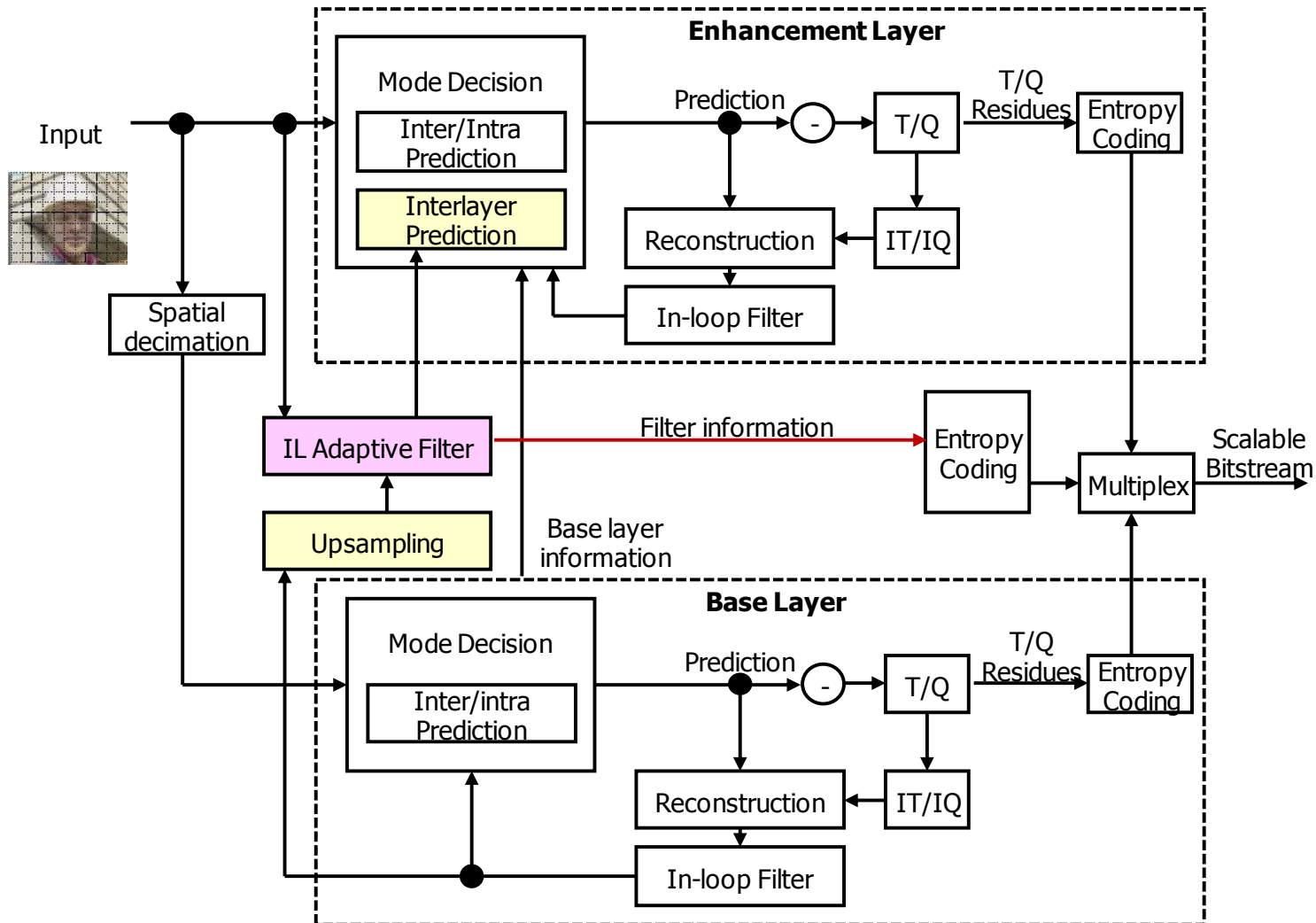
Presented by Yu-Wen Huang  
12<sup>th</sup> JCT-VC Meeting in Shanghai  
14-23 Jan. 2013

# Overall Summary

- Wiener filter is applied to upsampled BL samples for improving inter-layer intra prediction
  - Filter shape is 7x7Cross+3x3Square
  - Filter coefficients are coded in slice header
  - One filter per color component per slice
  
- Experimental results
  - Anchor is SMuC-0.1.1
  - Negligible encoding time increase
  - 2.6% decoding time increase

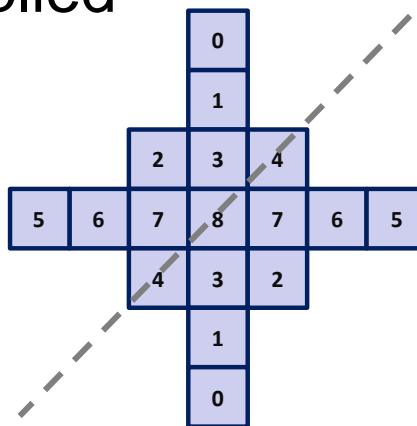
BD-Rate	AI-2x	AI-1.5x	RA-2x	RA-1.5x	RA-SNR	LD-2x	LD-1.5x	LD-SNR
Luma	-0.1%	-0.3%	-0.1%	-0.3%	-2.1%	-0.3%	-0.8%	-3.3%

# Inter-layer Adaptive Filter



# Inter-layer Adaptive Filter

- Apply Wiener filter to upsampled BL samples for improving inter-layer intra prediction
- One filter per color component per slice
- Filter coefficients are coded in slice header
- Filter footprint is 7x7Cross + 3x3 Square
- $\frac{1}{2}$  symmetry is applied



# Syntax Design

slice_segment_header( ) {	<b>Descriptor</b>
..	
if(!dependent_slice_segment_flag ) {	
..	
if(        loop_filter_across_slices_enabled_flag        && (   slice_sao_luma_flag                 slice_sao_chroma_flag          !slice_disable_deblocking_filter_flag ) )	
<b>slice_loop_filter_across_slices_enabled_flag</b>	u(1)
if(LayerId>0){	
<b>interlayer_adaptive_filter_enabled_flag</b>	u(1)
if(interlayer_adaptive_filter_enabled_flag){	
for(cIdx=0;cIdx<3;cIdx++){	
<b>interlayer_adaptive_filter_component_enabled_flag[cIdx]</b>	u(1)
if(interlayer_adaptive_filter_component_enabled_flag[cIdx])	
for(i=0;i<9;i++){	
<b>interlayer_adaptive_filter_coef[cIdx][i]</b>	se(v)
}	
}	
}	
}	
..	
}	

# BD-Rate

Thank Intel for the crosscheck report, JCTVC-L0308.

## ■ Anchor is SMuC-0.1.1

	AI HEVC 2x			AI HEVC 1.5x					
	Y	U	V	Y	U	V			
Class A	0.0%	0.0%	0.0%						
Class B	-0.1%	-0.2%	-0.1%	-0.3%	-0.5%	-0.3%			
<b>Overall (EL+BL)</b>	-0.1%	-0.1%	-0.1%	-0.3%	-0.5%	-0.3%			
<b>Overall (EL)</b>	-0.2%	-0.3%	-0.2%	-1.3%	-2.0%	-1.1%			
Enc Time[%]	100.0%			100.2%					
Dec Time[%]	101.9%			103.6%					
Enc Mem[%]	#DIV/0!			#DIV/0!					
BL Match	Matched			Matched					
	RA HEVC 2x			RA HEVC 1.5x			RA HEVC SNR		
	Y	U	V	Y	U	V	Y	U	V
Class A	0.1%	0.1%	0.1%				-4.3%	-2.6%	-2.2%
Class B	-0.2%	-0.1%	0.0%	-0.3%	-0.5%	-0.1%	-1.3%	-0.8%	-0.2%
<b>Overall (EL+BL)</b>	-0.1%	-0.1%	0.0%	-0.3%	-0.5%	-0.1%	-2.1%	-1.3%	-0.8%
<b>Overall (EL)</b>	-0.2%	-0.2%	0.0%	-1.0%	-1.6%	-0.3%	-4.5%	-3.1%	-2.0%
Enc Time[%]	99.9%			99.6%			99.8%		
Dec Time[%]	101.2%			102.7%			103.7%		
Enc Mem[%]	#DIV/0!			#DIV/0!			#DIV/0!		
BL Match	Matched			Matched			Matched		
	LD-P HEVC 2x			LD-P HEVC 1.5x			LD-P HEVC SNR		
	Y	U	V	Y	U	V	Y	U	V
Class A	0.0%	0.0%	0.0%				-6.0%	-3.1%	-2.9%
Class B	-0.4%	-0.6%	-0.3%	-0.8%	-1.2%	-0.6%	-2.2%	-1.4%	-0.7%
<b>Overall (EL+BL)</b>	-0.3%	-0.4%	-0.2%	-0.8%	-1.2%	-0.6%	-3.3%	-1.9%	-1.3%
<b>Overall (EL)</b>	-0.6%	-0.7%	-0.5%	-2.2%	-3.4%	-1.6%	-6.1%	-4.1%	-3.1%
Enc Time[%]	99.7%			99.5%			100.0%		
Dec Time[%]	101.1%			102.2%			104.1%		
Enc Mem[%]	#DIV/0!			#DIV/0!			#DIV/0!		
BL Match	Matched			Matched			Matched		

# Conclusion

- Apply Wiener filter to upsampled BL samples for improving inter-layer intra prediction
  - Filter shape is 7x7Cross+3x3Square
  - Filter coefficients are coded in slice header
  - One filter per color component per slice
  
- Experimental results
  - 0.1%-0.8% luma BD-rate gain for spatial scalability
  - 2.1%-3.3% luma BD-rate gain for SNR scalability
  - Negligible encoding time increase
  - 2.6% decoding time increase