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Adaptive Loop Filter Merge in Temporal Domain

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2011.07

Outline

- ☐ Algorithm description
- ☐ Simulation results
- ☐ Conclusions



Algorithm description

□ Basic idea:

- Reuse the ALF parameters of the prior decoded frames for current frame

□ Notations

- Filter bank generating from current picture, F1
- Filter bank utilized in prior picture, F2



Algorithm description

- For intra frame
 - No change, the same as the current ALF
 - Update filter parameters in F2 with that in F1
- For inter frame
 - Calculate the RD cost with F1
 - If ALF enable, calculate the RD cost with F2
 - Select the best filter bank with minimum RD cost between F1 and F2



Algorithm description

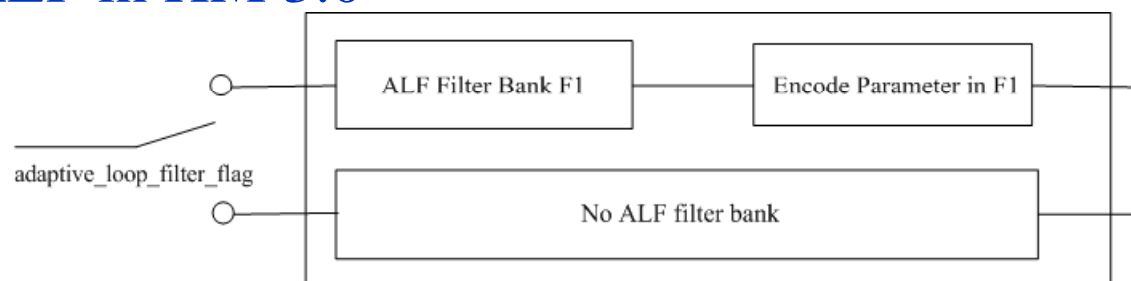
- Update parameters for F2
 - If F1 is employed for current frame, update the parameters in F2 with that in F1
 - If F2 is employed for current frame, do not update
- Filter parameters in F2
 - Block based ALF parameters
 - Region based ALF parameters



Algorithm description

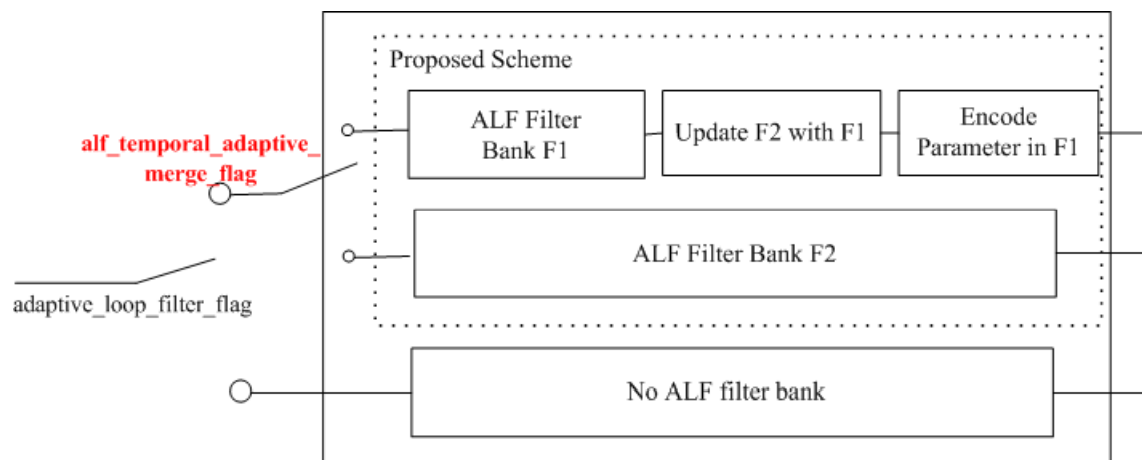
□ Filtering flowchart

■ ALF in HM 3.0



■ Proposed Scheme

Selection of F1 and F2 is based on the rate distortion cost



Simulation results

□ Compared to HM 3.0

	Intra		
	Y BD-rate	U BD-rate	V BD-rate
Class A	0.0	0.0	0.0
Class B	0.0	0.0	0.0
Class C	0.0	0.0	0.0
Class D	0.0	0.0	0.0
Class E	0.0	0.0	0.0
All	0.0	0.0	0.0
Enc Time[%]	103%		
Dec Time[%]	100%		

	Random access		
	Y BD-rate	U BD-rate	V BD-rate
Class A	-0.2	-0.3	0.0
Class B	-0.1	-0.2	-0.2
Class C	-0.3	-0.2	-0.2
Class D	-0.5	-0.5	-0.5
Class E			
All	-0.3	-0.3	-0.2
Enc Time[%]	102%		
Dec Time[%]	105%		



Simulation results

□ Compared to HM 3.0

	Low delay		
	Y BD-rate	U BD-rate	V BD-rate
Class A			
Class B	-0.1	0.2	-0.2
Class C	-0.2	-0.4	-0.3
Class D	-0.4	-0.8	0.0
Class E	0.0	-0.5	-0.3
All	-0.2	-0.3	-0.2
Enc Time[%]	102%		
Dec Time[%]	103%		

	Low delay (P)		
	Y BD-rate	U BD-rate	V BD-rate
Class A			
Class B	-0.1	-0.1	-0.3
Class C	-0.1	-0.1	-0.3
Class D	-0.4	-0.6	-0.9
Class E	-0.1	0.1	-0.5
All	-0.2	-0.2	-0.5
Enc Time[%]	102%		
Dec Time[%]	102%		



Conclusions

- ❑ Adaptive loop filter merge in temporal domain
- ❑ Bit rate reduction
 - 0.3 for HE_RA, 0.2 for HE_LD, 0.2 for HE_LD_P
- ❑ Time increase
 - Encoder : 2%
 - Decoder: 2-5%
- ❑ It is recommended to add the ALF merging in temporal domain



Thanks!

