



Non-CE8: One-stage non-deblocking loop filtering

Ching-Yeh Chen, Chia-Yang Tsai, Chih-Ming Fu, Yu-Wen Huang, Shawmin Lei (MediaTek)
In Suk Chong, Marta Karczewicz (Qualcomm)
Tomoo Yamakage, Takayuki Itoh, Takashi Watanabe, Takeshi Chujoh (Toshiba)

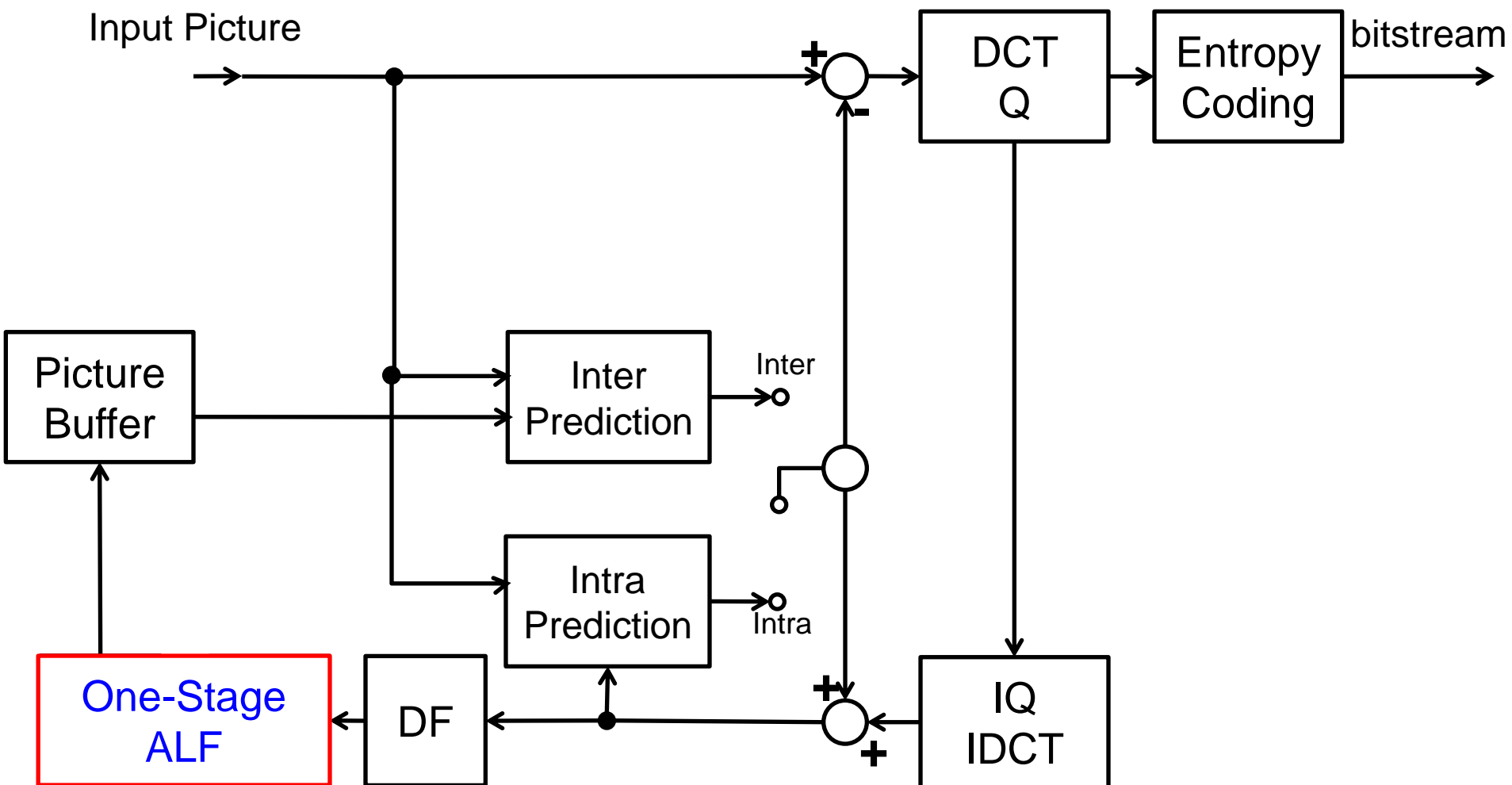


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Overall Summary

- Two-stage non-deblocking loop filtering (SAO & ALF) may require two additional encoding passes
- In this contribution, a one-stage non-deblocking loop filtering is reported
 - Block-based adaptation to switch among {ALF+SAO, SAO, OFF}
 - “ALF+SAO” means the ALF offsets is replaced by SAO (i.e. apply pixel classification to unfiltered pixels and then add one offset to each filtered pixel according to the pixel classification)
 - The block size is coded at picture level
 - In LC conditions, switch between only SAO and OFF
- Preliminary results
 - 0.0 - 0.1% bit rate savings for HE
 - 0.0 - 0.4% bit rate increases for LC
 - Suggest to be studied in the next CE8
 - Use LCU-based adaptation in the next version

Proposed One-Stage ALF



Features of One-Stage ALF

- Combine SAO and ALF into one stage
- Block-based adaptation to switch among three modes
 - {ALF+SAO, SAO, OFF}
 - The block size is first coded at picture level (in APS), and then block-by-block information is coded.
 - Merge-based syntax to allow copy information from the left or upper block
- Constrain the number of filters and offsets in a picture
 - Significantly reduce the worst-case buffer size
- Encoding algorithm
 - 1 encoding pass + N-pass coefficient re-design
 - N =1 in the reported results

The ALF+SAO Mode

- The filter selection is the same as the block-adaptation (BA) mode in the ALF of HM-4.0
- The offset selection (pixel classification) is the same as that in the SAO of HM-4.0
- Filter selection and pixel classification are applied to unprocessed pixels and can be done in parallel.
- Next, apply filtering on unprocessed pixels.
- Finally, add offsets to filtered pixels.

Simulation Results

- HM4.0 dev r1420
 - JCTVC-F900
- Summary
 - 0.1% BD-rate gain in HE
 - 0.2% BD-rate loss in LC

JCTVC-G218

	Intra			Intra LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-0.3	1.4	2.8	0.0	0.5	0.8
Class B	-0.1	-0.2	-0.1	0.1	0.3	0.4
Class C	-0.1	-0.1	-0.3	0.0	0.2	0.3
Class D	0.0	0.0	-0.1	0.0	0.0	0.0
Class E	-0.1	1.0	0.0	0.1	0.2	0.0
All	-0.1	0.4	0.4	0.0	0.2	0.3
Enc Time[%]	108%			101%		
Dec Time[%]	104%			103%		

	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	-0.1	2.1	2.9	0.1	1.3	1.0
Class B	-0.1	-0.5	-0.2	0.3	0.8	0.9
Class C	0.0	-0.3	-0.1	0.1	0.4	0.5
Class D	-0.3	0.3	0.4	0.0	0.4	0.2
Class E						
All	-0.1	0.4	0.7	0.1	0.7	0.7
Enc Time[%]	102%			100%		
Dec Time[%]	105%			101%		

	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	0.1	0.3	0.9	0.4	1.4	1.9
Class C	0.0	-0.5	-0.6	0.3	0.9	1.1
Class D	-0.1	1.6	0.8	0.1	0.5	0.3
Class E	0.1	4.4	1.7	0.8	1.6	0.4
All	0.0	1.2	0.6	0.4	1.1	1.0
Enc Time[%]	102%			100%		
Dec Time[%]	105%			102%		

	Low delay P			Low delay P LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.0	0.2	0.8	0.4	1.1	1.4
Class C	0.0	-0.5	-0.4	0.2	0.8	0.9
Class D	0.0	1.9	0.9	0.1	0.0	0.0
Class E	0.2	4.7	1.6	1.1	1.2	1.7
All	0.0	1.3	0.7	0.4	0.8	1.0
Enc Time[%]	103%			100%		
Dec Time[%]	107%			103%		

Conclusion

- One-stage non-deblocking loop filtering
 - Combine SAO and ALF into one stage
 - Block-based adaptation among {ALF+SAO, SAO, OFF}
 - 0.1% BD-rate gain in HE
 - 0.2% BD-rate loss in LC
 - Suggest to be studied in the next CE8