
PRE-SAMPLE ADAPTIVE OFFSET FILTER (JVET-Q0434)

W. Lim, C. Helmrich, J. Erfurt, H. Schwarz, D. Marpe, T. Wiegand



Introduction

- Additional in-loop filter which operates jointly with the deblocking filter (DBF)
- Adjusting samples after the application of DBF guided by the MSE distortion
- No need for storing additional samples
- Two or three comparisons and three additions per sample in the worst-case scenario
- It operates only on the picture samples affected by DBF.

Pre-Sample Adaptive Offset

- Two SAO-like filterings SAOV and SAOH are applied for DBFV and DBFH, respectively.
- Threshold T is chosen (for Luma) among two pre-determined values at the encoder.
- Classification for SAOV (SAOH) is given by taking sample-wise difference between the picture samples before DBFV (DBFH) and ones after DBFV (DBFH).

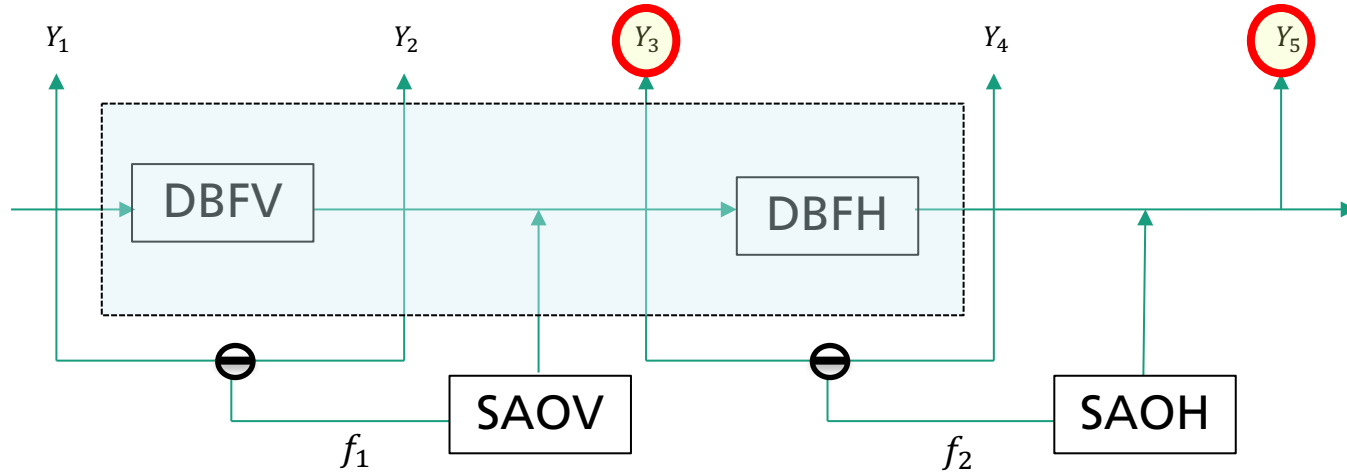
Classification for SAOV: $f_1(i) = Y_1(i) - Y_2(i)$

$$\{i \in I : f_1(i) > T\} \text{ and } \{i \in I : f_1(i) < -T\}$$

Classification for SAOH: $f_2(i) = Y_3(i) - Y_4(i)$

$$\{i \in I : f_2(i) > T\} \text{ and } \{i \in I : f_2(i) < -T\}$$

Pre-Sample Adaptive Offset



$$\text{SAOV: } Y_3(i) = \text{Clip1}(Y_2(i) + d_1 \cdot (f_1(i) > T ? 1 : 0) - d_2 \cdot (f_1(i) < -T ? 1 : 0))$$

$$\text{SAOH: } Y_5(i) = \text{Clip1}(Y_4(i) + \tilde{d}_1 \cdot (f_2(i) > \tilde{T} ? 1 : 0) - \tilde{d}_2 \cdot (f_2(i) < -\tilde{T} ? 1 : 0))$$

Pre-SAO Parameters

- Two configurations: Slice-level Pre-SAO and CTU-level Pre-SAO
- Pre-SAO parameters are signalled at the slice level (or CTU level)
- Two offset coefficients d_1 and d_2 are signalled for each channel type.
- **pre_sao_enabled_flag** determines if Pre-SAO is applied for each picture (or CTU).
- **pre_sao_thresh_index** specifies the selected threshold T for the Luma component.
- **pre_sao_ctu_merge_left_flag, pre_sao_ctu_merge_above_flag:**
is used only for CTU-level Pre-SAO and it specifies if Pre-SAO parameters for current CTU are derived from Pre-SAO parameters of respective neighboring CTUs.
- All abovementioned parameters are separately signalled for SAOH and SAOV.

Simulation results (Slice-level Pre-SAO)

	All Intra				
	Over VTM 7.1 (Git rev. 98ff0062)				
	Y	U	V	EncT	DecT
Class A1	-0,78%	-0,85%	-0,38%	103%	101%
Class A2	-0,64%	-0,82%	-0,92%	100%	100%
Class B	-0,79%	-0,90%	-0,90%	101%	102%
Class C	-0,47%	-0,89%	-0,94%	101%	104%
Class E	-0,47%	-0,47%	-0,22%	100%	98%
Overall	-0,64%	-0,81%	-0,71%	101%	101%
Class D	-0,42%	-0,72%	-0,69%	100%	101%
Class F	-0,34%	-0,87%	-1,02%	103%	100%

	Random Access				
	Over VTM 7.1 (Git rev. 98ff0062)				
	Y	U	V	EncT	DecT
Class A1	-0,33%	-0,65%	-0,38%	99%	103%
Class A2	-0,56%	-0,48%	-0,63%	101%	97%
Class B	-0,51%	-0,99%	-1,00%	99%	101%
Class C	-0,33%	-1,01%	-1,02%	101%	103%
Class E					
Overall	-0,43%	-0,83%	-0,81%	100%	101%
Class D	-0,24%	-0,81%	-0,88%	100%	102%
Class F	-0,30%	-1,21%	-1,32%	102%	103%

Simulation results (CTU-level Pre-SAO)

	All Intra				
	Over VTM 7.1 (Git rev. 98ff0062)				
	Y	U	V	EncT	DecT
Class A1	-0.77%	-0.84%	-0.37%	101%	104%
Class A2	-0.64%	-0.82%	-0.91%	101%	101%
Class B	-0.78%	-0.89%	-0.89%	101%	102%
Class C	-0.46%	-0.88%	-0.92%	101%	104%
Class E	-0.44%	-0.45%	-0.20%	100%	103%
Overall	-0.63%	-0.80%	-0.70%	101%	103%
Class D	-0.41%	-0.70%	-0.67%	100%	101%
Class F	-0.32%	-0.85%	-1.01%	101%	105%

	Random Access				
	Over VTM 7.1 (Git rev. 98ff0062)				
	Y	U	V	EncT	DecT
Class A1	-0.28%	-0.61%	-0.33%	99%	101%
Class A2	-0.49%	-0.42%	-0.56%	101%	99%
Class B	-0.43%	-0.91%	-0.92%	99%	102%
Class C	-0.28%	-0.96%	-0.97%	101%	102%
Class E					
Overall	-0.37%	-0.76%	-0.75%	100%	101%
Class D	-0.23%	-0.80%	-0.87%	100%	103%
Class F	-0.25%	-1.16%	-1.28%	101%	101%