MEDIATEK

JVET-O0292
CE6-related: Simplifications for LFNST

Authors: Man-Shu Chiang, Chih-Wei Hsu, Yu-Wen Huang, Shaw-Min Lei

Presenter: Man-Shu Chiang

Overall Summary

- Two methods are proposed to simplify transform for intra coding unit (CU)
  - Method 1: Disable LFNST when MTS is used
  - Method 2: Remove the option of LFNST index equal to 2 and select the LFNST kernel using the intra prediction mode for LFNST index equal to 1

#		Config.	VTM-5.0				
			Y	U	V	encT	decT
Proposed method 1	Normative change	AI	0.07%	0.06%	0.10%	94%	101%
		RA	-0.04%	-0.07%	-0.02%	98%	97%
	Encoder only change	AI	0.09%	0.06%	0.12%	95%	101%
		RA	0.07%	0.00%	-0.09%	98%	97%
Proposed method 2	Normative change	AI	0.12%	0.82%	0.88%	82%	100%
		RA	0.09%	0.45%	0.51%	94%	98%
	Encoder only change	AI	0.67%	1.11%	1.13%	82%	100%
		RA	0.33%	0.56%	0.58%	94%	98%

Introduction to LFNST Signalling

- An LFNST index specifies whether LFNST is enabled and which one of the two LFNST kernels in a selected transform set is used
  - lfnst_idx 0: LFNST is not used
  - lfnst_idx 1 (or 2): The first (or second) kernel in the selected transform set is used
- The transform set is selected according to the intra prediction mode of the current CU

Intra prediction mode (predModeIntra)	Transform set
predModeIntra < 0	1
0 <= predModeIntra <= 1	0
2 <= predModeIntra <= 12	1
13 <= predModeIntra <= 23	2
24 <= predModeIntra <= 44	3
45 <= predModeIntra <= 55	2
56 <= predModeIntra <= 80	1
81 <= predModeIntra <= 83	0

- Proposed to decouple MTS and LFNST and reduce the syntax of LFNST as simplification

Proposed Method 1

- Disable LFNST when MTS is used (tu_mts_idx > 0)

Normative change

	AI				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1	0.06%	0.15%	0.20%	94%	100%
Class A2	0.03%	0.11%	0.05%	95%	100%
Class B	0.07%	0.08%	0.16%	94%	100%
Class C	0.08%	-0.04%	0.09%	94%	103%
Class E	0.08%	0.04%	-0.01%	94%	100%
Overall	0.07%	0.06%	0.10%	94%	101%
Class D	0.08%	0.20%	-0.10%	94%	99%
Class F	0.04%	0.07%	0.12%	96%	100%

	RA				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1	-0.10%	-0.14%	0.09%	98%	98%
Class A2	-0.01%	0.02%	-0.03%	98%	100%
Class B	-0.04%	-0.06%	-0.11%	98%	96%
Class C	-0.04%	-0.11%	0.01%	97%	97%
Class E					
Overall	-0.04%	-0.07%	-0.02%	98%	97%
Class D	0.06%	-0.04%	0.38%	96%	100%
Class F	0.03%	-0.10%	-0.03%	96%	97%

Encoder only change

	AI				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1	0.07%	0.05%	0.18%	95%	100%
Class A2	0.04%	0.06%	0.06%	96%	103%
Class B	0.09%	0.06%	0.12%	95%	102%
Class C	0.11%	0.06%	0.11%	94%	99%
Class E	0.13%	0.09%	0.15%	95%	99%
Overall	0.09%	0.06%	0.12%	95%	101%
Class D	0.16%	0.24%	-0.05%	94%	99%
Class F	0.07%	0.09%	0.05%	96%	100%

	RA				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1	0.02%	-0.18%	0.08%	99%	97%
Class A2	0.05%	0.06%	0.05%	98%	99%
Class B	0.08%	0.05%	-0.13%	98%	97%
Class C	0.11%	0.03%	-0.29%	97%	98%
Class E					
Overall	0.07%	0.00%	-0.09%	98%	97%
Class D	0.14%	0.04%	0.31%	97%	99%
Class F	0.06%	0.02%	0.01%	97%	104%

Proposed Method 2

- Remove LFNST index 2 and select the LFNST kernel in a transform set with intra prediction mode if LFNST index is equal to 1
  - lfnst_idx 0: LFNST is not used
  - lfnst_idx 1: The LFNST kernel A, where A is 1 or 2, is selected by intra prediction mode (CCLM, INTRA_PLANAR, INTRA_DC, INTRA_ANGULAR2~INTRA_ANGULAR65)
    - If intra prediction mode is one of INTRA_DC, INTRA_ANGULAR34-1, and INTRA_ANGULAR34+1, A is set to be 2
    - Otherwise if intra prediction mode is one of INTRA_ANGULAR2 ~INTRA_ANGULAR30, A is set to be “Intra prediction mode % 2 == 0 ? 2 : 1”
    - Otherwise if intra prediction mode is one of INTRA_ANGULAR38~INTRA_ANGULAR66, A is set to be “Intra prediction mode % 2 == 0 ? 1 : 2”
    - Otherwise, A is set to be 1

Proposed Method 2

Normative change

	AI				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1	0.15%	0.89%	0.96%	82%	99%
Class A2	0.04%	0.67%	0.63%	81%	100%
Class B	0.10%	0.85%	1.02%	81%	100%
Class C	0.11%	0.62%	0.87%	82%	99%
Class E	0.20%	1.10%	0.79%	86%	106%
Overall	0.12%	0.82%	0.88%	82%	100%
Class D	0.07%	0.79%	0.69%	82%	99%
Class F	0.09%	0.58%	0.46%	89%	102%

	RA				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1	0.17%	0.22%	0.65%	94%	99%
Class A2	0.10%	0.64%	0.52%	95%	100%
Class B	0.09%	0.65%	0.43%	94%	97%
Class C	0.03%	0.22%	0.50%	94%	96%
Class E					
Overall	0.09%	0.45%	0.51%	94%	98%
Class D	0.07%	0.32%	1.03%	94%	99%
Class F	0.05%	0.49%	0.40%	94%	98%

Encoder only change

	AI				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1	0.86%	1.17%	1.35%	83%	99%
Class A2	0.51%	0.86%	0.99%	81%	99%
Class B	0.57%	1.07%	1.09%	82%	99%
Class C	0.66%	1.00%	1.12%	82%	102%
Class E	0.83%	1.49%	1.12%	83%	99%
Overall	0.67%	1.11%	1.13%	82%	100%
Class D	0.59%	1.31%	0.93%	82%	98%
Class F	0.53%	0.82%	0.77%	90%	100%

	RA				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1	0.50%	0.34%	0.77%	94%	98%
Class A2	0.26%	0.55%	0.61%	95%	100%
Class B	0.30%	0.74%	0.63%	95%	97%
Class C	0.31%	0.52%	0.36%	94%	97%
Class E					
Overall	0.33%	0.56%	0.58%	94%	98%
Class D	0.26%	0.50%	0.87%	94%	99%
Class F	0.21%	0.44%	0.39%	95%	98%

Conclusions

- Method 1 and method 2 simplify transform for intra luma CU in terms of transform processing and LFNST signaling, respectively
- Compared to VTM5.0,
  - Method 1 (normative) results in 0.07% and -0.04% luma BD-rates in AI and RA condition with 6% and 2% encoding time reduction, respectively
  - Method 2 (normative) results in 0.12% and 0.09% luma BD-rates in AI and RA condition with 18% and 6% encoding time reduction, respectively
- It is suggested to consider method 1 and 2 into VVC