Improvement of CAVLC table adaptation for coefficient coding (JCTVC-F467)

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Summary

❖ VLC table adaption for coefficient coding

❖ Change:
- Last level in run mode loop participates in VLC table adaptation for coefficient coding
- Modifying the threshold table for coefficient coding

❖ Coding efficiency impact:
- -0.2 / -0.1 / -0.1% on average

❖ Cross-check
- F623 by Qualcomm

Coefficient coding in CAVLC

❖ Three steps of coefficient coding:
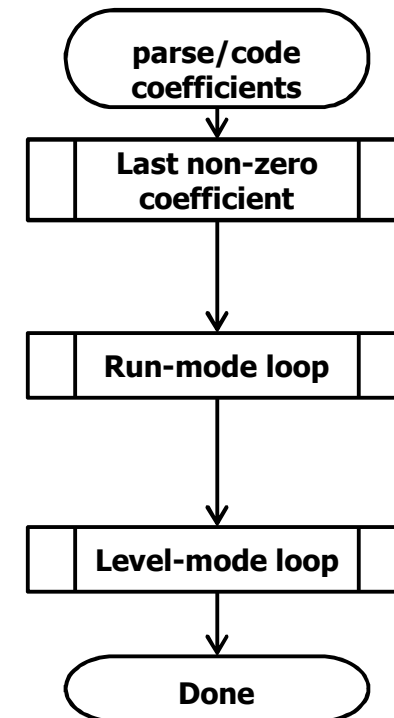
1. Last non-zero coefficient

2. Run-mode loop
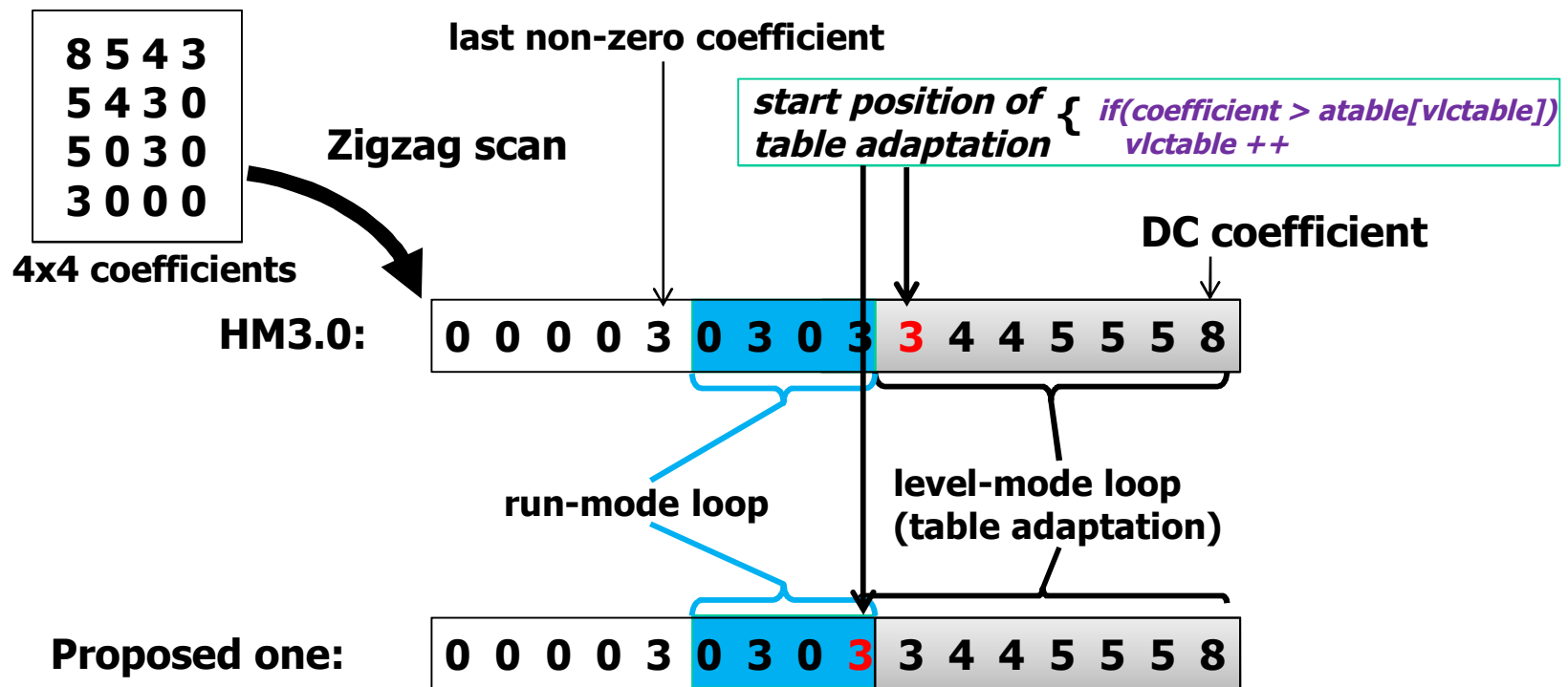   - code {run-lev} pairs
   - code level

1. Level mode loop
   - code coefficients one-by-one
   - VLC table number varies as current encoded coefficient is compared to threshold
     → table adaptation

```
┌─────────────────┐
│   parse/code    │
│   coefficients  │
└─────────────────┘
         │
         ▼
┌──┬──────────────┬──┐
│  │ Last non-zero│  │
│  │  coefficient │  │
└──┴──────────────┴──┘
         │
         ▼
┌──┬──────────────┬──┐
│  │ Run-mode loop│  │
└──┴──────────────┴──┘
         │
         ▼
┌──┬──────────────┬──┐
│  │Level-mode loop│ │
└──┴──────────────┴──┘
         │
         ▼
┌─────────────────┐
│      Done       │
└─────────────────┘
```

The proposed coefficient coding

❖ The level in last loop of run-mode is the one of level-mode loops.

❖ Threshold table (*atable*) is changed from {4, 6, 14,28,Max}
   to {3, 7, 15, 31, Max}

```
8 5 4 3
5 4 3 0          Zigzag scan
5 0 3 0
3 0 0 0
```
4x4 coefficients

last non-zero coefficient

start position of **{** *if(coefficient > atable[vlctable])*
table adaptation   *vlctable ++*

DC coefficient

HM3.0:   0 0 0 0 3 0 3 0 3 **3** 4 4 5 5 5 8

run-mode loop

**level-mode loop
(table adaptation)**

Proposed one: 0 0 0 0 3 0 3 0 **3** 3 4 4 5 5 5 8

start position of table adaptation is changed (10th to 9th)

Experimental results

❖ Threshold table changing only

	All Intra LC			Random Access LC			Low delay B LC		
	Y	U	V	Y	U	V	Y	U	V
Class A	0.2	0.0	-0.2	0.2	-0.2	-0.4			
Class B	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	-0.2	-0.5
Class C	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	-0.1	0.0
Class D	-0.2	-0.1	-0.1	-0.1	-0.2	-0.2	0.0	0.4	0.0
Class E	0.0	0.0	0.0				-0.1	0.4	-0.4
Overall	**-0.1**	**-0.1**	**-0.1**	**0.0**	**-0.1**	**-0.2**	**0.0**	**0.1**	**-0.2**
Enc Time[%]	100%			100%			100%		
Dec Time[%]	100%			99%			99%		

❖ Table changing + VLC table adaptation

	All Intra LC			Random Access LC			Low delay LoCo		
	Y	U	V	Y	U	V	Y BD-rate	U BD-rate	V BD-rate
Class A	-0.1	-0.1	-0.1	0.1	-0.3	-0.1			
Class B	-0.2	-0.2	-0.1	-0.1	-0.1	0.0	0.0	-0.2	-0.4
Class C	-0.2	-0.1	-0.1	-0.1	-0.1	-0.3	-0.1	0.1	-0.3
Class D	-0.2	-0.1	-0.2	-0.1	-0.3	-0.1	0.0	0.2	0.0
Class E	-0.2	-0.1	-0.1				-0.1	0.5	-1.1
Overall	**-0.2**	**-0.1**	**-0.1**	**-0.1**	**-0.2**	**-0.1**	-0.1	0.1	-0.4
Enc Time[%]	100%			100%			100%		
Dec Time[%]	100%			98%			100%		

Conclusions

❖ Change:
  - The last level of run-mode loop participates in VLC table adaptation
  - The threshold table is changed.

❖ Coding efficiency impact:
  - -0.2/-0.1/-0.1% on average
  - Performance improvement without noticeable impact on complexity

❖ Suggest to adopt the proposed scheme in next HM