

G783: Context reduction for level coding in CABAC

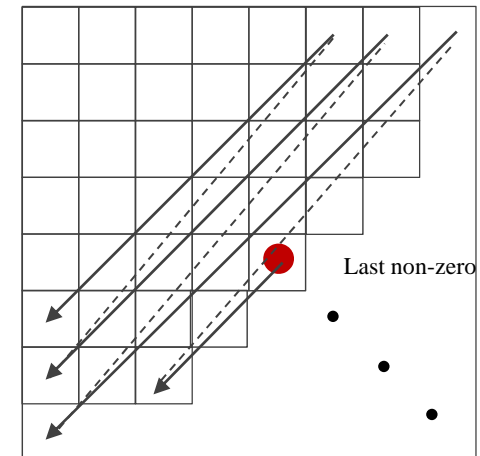
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● Level coding in HM4.0

- Backward scan with same scan type of significance map
- Every 16 coefficients in reverse scan comprise one sub-set

To be coded:

- Greater_than_1 flag
- Greater_than_2 flag
- Sign: *bypass code*
- Greater_than_2 level: *RiceExpGolomb code*



Contexts used in level coding

- Same context derivation rule for luma and chroma

Total **120** contexts

- Greater_than_1 flag of luma : 6x5 contexts
- Greater_than_1 flag of chroma : 6x5 contexts
- Greater_than_2 flag of luma : 6x5 contexts
- Greater_than_2 flag of chroma : 6x5 contexts

Luma/Chroma

Context Set (inverse 16 scan)		
0	Sub-set 0	0 LargerT1 in previous sub-set
1		1-3 LargerT1 in previous sub-set
2		>3 LargerT1 in previous sub-set
3	Other sub-sets	0 LargerT1 in previous sub-set
4		1-3 LargerT1 in previous sub-set
5		>3 LargerT1 in previous sub-set

X

Model bin 1	
0	1 or more larger than 1
1	Initial - no trailing ones
2	1 trailing one
3	2 trailing ones
4	3 or more trailing ones

== Greater_than_1 flag context

X

Model bin 2	
0	Initial - no larger than one
1	1 larger than one
2	2 larger than one
3	3 larger than one
4	4 or more larger than one

== Greater_than_2 flag context

● Proposed_Set1

- Remove 4 context from context set of chroma, no change in luma
- Save 40 contexts (33%)
 - 4x5 contexts from greater_than_1 flag of chroma
 - 4x5 contexts from greater_than_2 flag of chroma

Luma

Context Set (inverse 16 scan)		
0	Sub-set 0	0 LargerT1 in previous sub-set
1		1-3 LargerT1 in previous sub-set
2		>3 LargerT1 in previous sub-set
3	Other sub-sets	0 LargerT1 in previous sub-set
4		1-3 LargerT1 in previous sub-set
5		>3 LargerT1 in previous sub-set

Chroma

Context Set (inverse 16 scan)	
0	0 LargerT1 in previous sub-set
1	>0 LargerT1 in previous sub-set

● Proposed_Set2

- Remove 2 context from context set of luma
- Remove 4 context from context set of chroma
- Save 60 contexts (50%)
 - 2x5 contexts from greater_than_1 flag of luma
 - 4x5 contexts from greater_than_1 flag of chroma
 - 2x5 contexts from greater_than_2 flag of luma
 - 4x5 contexts from greater_than_2 flag of chroma

Luma

Context Set (inverse 16 scan)		
0	Sub-set 0	0 LargerT1 in previous sub-set
1		>0 LargerT1 in previous sub-set
2	Other sub-sets	0 LargerT1 in previous sub-set
3		>0 LargerT1 in previous sub-set

Chroma

Context Set (inverse 16 scan)	
0	0 LargerT1 in previous sub-set
1	>0 LargerT1 in previous sub-set

Common test configuration

– Context Set 1

	All Intra HE			Random Access HE			Low delay B HE			Low delay P HE		
	Y	U	V	Y	U	V	Y	U	V	Y	U	V
Class A	0.0%	0.0%	0.1%	0.0%	0.2%	0.1%						
Class B	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%
Class C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Class D	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
Class E	0.0%	0.0%	0.0%				0.1%	0.0%	0.3%	0.0%	-0.1%	-0.1%
Overall	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	100%			100%			100%			100%		
Dec Time[%]	101%			101%			100%			99%		

– Context Set 2

	All Intra HE			Random Access HE			Low delay B HE			Low delay P HE		
	Y	U	V	Y	U	V	Y	U	V	Y	U	V
Class A	0.2%	0.2%	0.2%	0.0%	0.0%	-0.1%						
Class B	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	-0.2%	0.0%	-0.1%	0.3%
Class C	0.0%	0.1%	0.1%	0.0%	-0.1%	0.1%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%
Class D	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	-0.3%
Class E	0.1%	0.1%	0.1%				0.0%	0.1%	-0.4%	0.0%	0.2%	-0.9%
Overall	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	-0.1%	0.0%	0.0%	-0.1%
	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%	-0.2%
Enc Time[%]	101%			100%			100%			100%		
Dec Time[%]	100%			100%			99%			100%		

● Reduced context for level coding

- Context set 1
 - Removal of 40 contexts from chroma → Saved **33%** level context
- Context set 2
 - Removal of 20 contexts from luma and 40 contexts from chroma → Saved **50%** level context

● Coding performance

- Context set 1
 - 0.00% / AI_HE, 0.01%/RA_HE, 0.03%/LD_HE, 0.02%/LDP_HE
- Context set 2
 - 0.07% / AI_HE, 0.04%/RA_HE, 0.00%/LD_HE, 0.03%/LDP_HE

● Propose adoption of one of the context set into next version of HM

Thank you !