

H0131: Simplified Multi-level significance map coding

Junghye Min, Yinji Piao

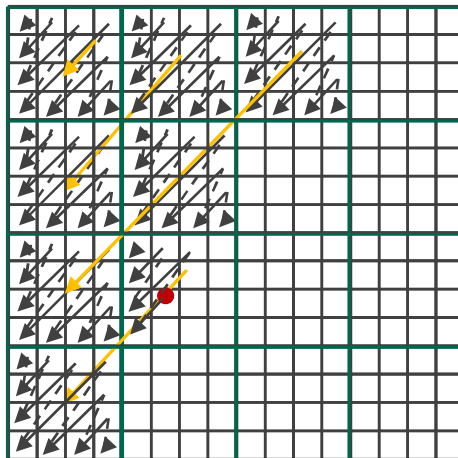
Multi-level significance map coding in HM5.0

SAMSUNG

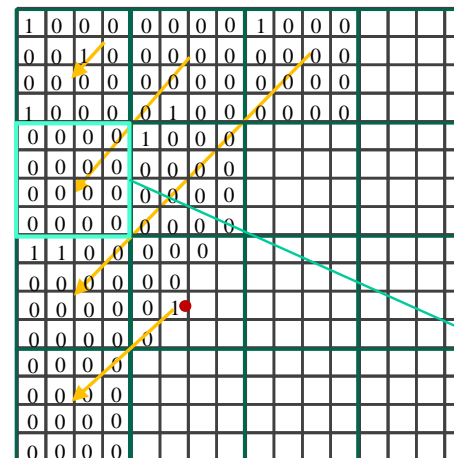
Significant coefficient group flag

- Context 0: if both neighbors are 0
- Context 1: if one of neighbors is 1
- Inferred to be 1: if both neighbors are 1
- Inferred to be 1: if current is the first subblock with DC
- Inferred to be 1: if current is the last subblock with last non-zero coefficient

Sub-block scan



Example



SigGrpFlag

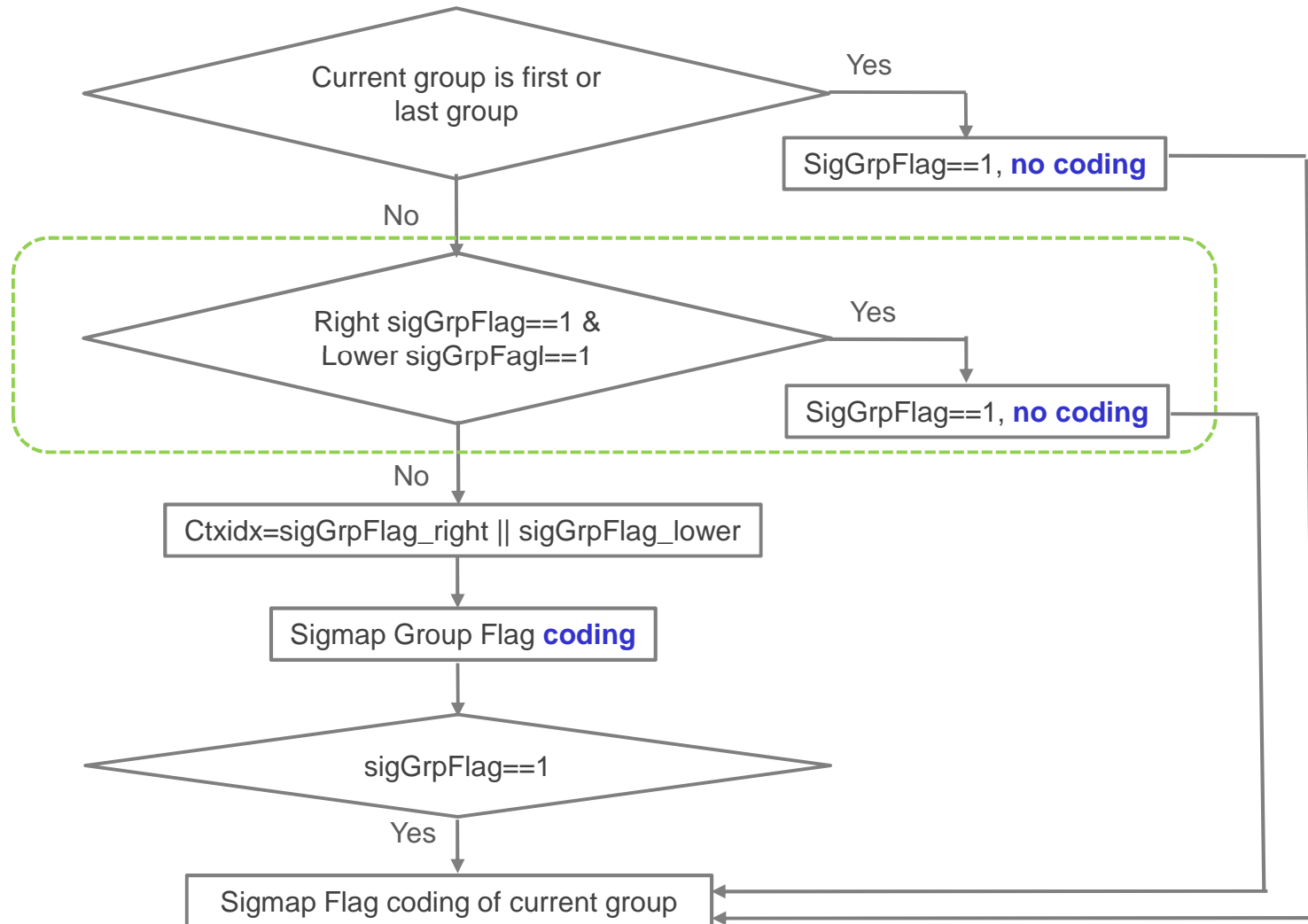
1 1 1 0
1 1 0 0
1 1 0 0
0 0 0 0

Unnecessary Zero-block coding !

Multi-level significance map coding in HM5.0



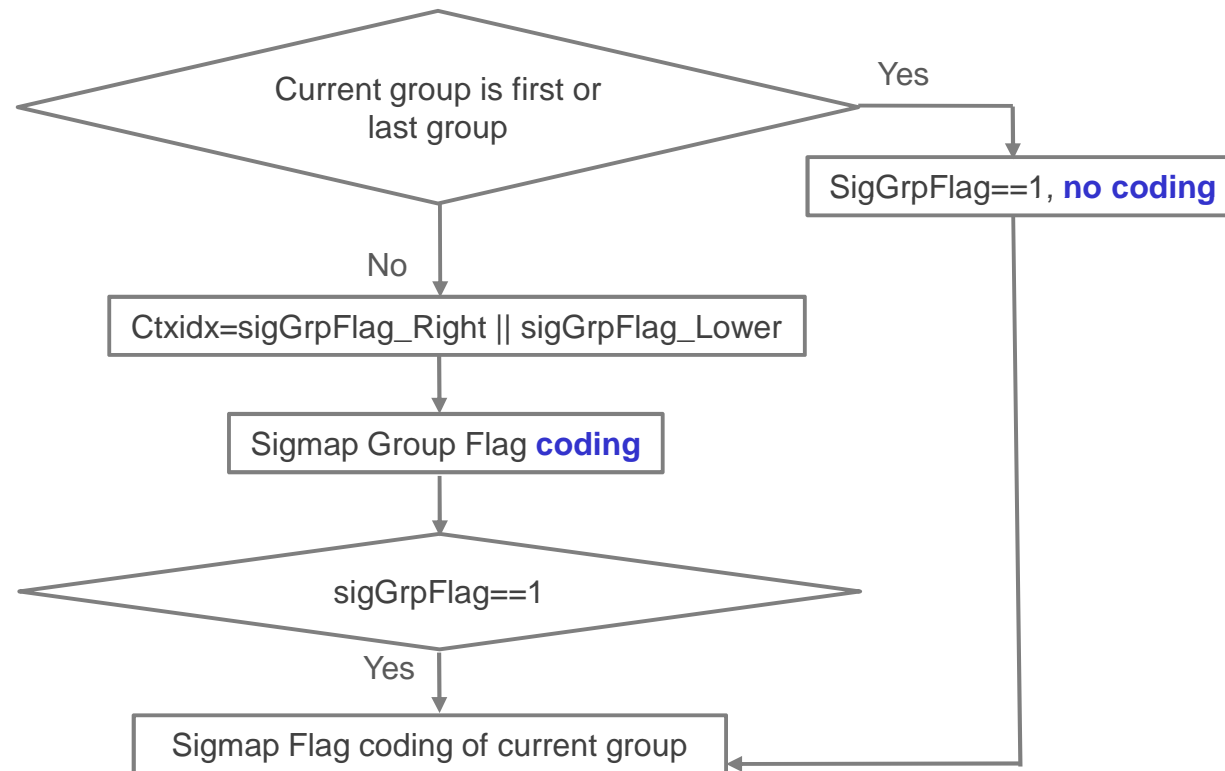
Flow chart of multi-level significance map coding



Proposed simplification



- No inferred flag except the first and last subblocks
 - To remove condition-checking process of neighbouring significance_group_flags
 - To skip significance_flag coding for zero-subblock



Experimental results



Common test condition

	All Intra HE			Random Access HE			Low delay B HE			Random Access HE-10		
	Y	U	V	Y	U	V	Y	U	V	Y	U	V
Class A	0.0%	0.0%	0.1%	0.0%	0.1%	-0.1%				0.1%	0.9%	1.3%
Class B	0.0%	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%	0.3%	0.3%	0.1%	0.1%	0.0%
Class C	0.0%	0.1%	0.1%	0.0%	0.0%	0.2%	0.0%	0.0%	0.1%			
Class D	0.0%	0.1%	0.0%	0.0%	0.1%	0.2%	0.0%	-0.1%	0.4%			
Class E	0.0%	0.2%	0.1%				0.0%	0.4%	-0.3%			
Overall	0.0%	0.1%	0.1%	0.0%	0.1%	0.1%	0.0%	0.1%	0.2%	0.1%	0.5%	0.6%
ClassF	0.0%	0.0%	0.1%	0.0%	0.0%	0.2%	0.0%	-0.3%	-0.1%			
Enc Time	101%			100%			100%			100%		
Dec Time	100%			99%			98%			100%		
	All Intra LC			Random Access LC			Low delay B LC					
	Y	U	V	Y	U	V	Y	U	V			
Class A	0.0%	0.1%	0.1%	0.0%	0.1%	0.1%						
Class B	0.1%	0.2%	0.3%	0.1%	0.3%	0.2%	0.0%	-0.1%	0.3%			
Class C	0.0%	0.1%	0.1%	0.0%	0.2%	0.1%	0.0%	0.1%	0.0%			
Class D	0.0%	0.2%	0.1%	0.0%	0.1%	-0.2%	0.0%	0.5%	0.4%			
Class E	0.0%	0.1%	0.1%				0.0%	-1.1%	-0.6%			
Overall	0.0%	0.2%	0.2%	0.0%	0.2%	0.1%	0.0%	-0.1%	0.1%			
ClassF	0.0%	0.1%	0.0%	0.1%	0.0%	0.1%	-0.1%	-0.7%	-0.5%			
Enc Time	100%			100%			100%					
Dec Time	99%			99%			98%					

Experimental results



Decoded bins

	All Intra HE			Random Access HE			Low delay B HE			Random Access HE-10		
	Sig flag	Sig grp flag	sum	Sig flag	Sig grp flag	sum	Sig flag	Sig grp flag	sum	Sig flag	Sig grp flag	sum
Class A	-0.2%	33%	0.4%	-0.4%	20%	0.0%				-2.7%	47%	-1.4%
Class B	-0.5%	24%	0.2%	-0.8%	16%	-0.4%	-1.0%	12%	-0.6%	-0.7%	16%	-0.3%
Class C	-0.4%	28%	0.0%	-0.7%	11%	-0.4%	-0.6%	1%	-0.5%			
Class D	-0.5%	24%	-0.2%	-0.7%	6%	-0.6%	-0.6%	3%	-0.5%			
Class E	-0.3%	21%	0.4%				-1.2%	8%	-0.8%			
Overall	-0.4%	26%	0.2%	-0.6%	13%	-0.4%	-0.8%	6%	-0.6%	-1.7%	31%	-0.8%
	All Intra LC			Random Access LC			Low delay B LC					
	Sig flag	Sig grp flag	sum	Sig flag	Sig grp flag	sum	Sig flag	Sig grp flag	sum			
Class A	-0.5%	30%	0.2%	-0.4%	14%	-0.1%						
Class B	-1.3%	20%	-0.6%	-0.9%	9%	-0.6%	-1.3%	7%	-1.0%			
Class C	-0.6%	23%	-0.2%	-0.6%	7%	-0.5%	-0.6%	1%	-0.6%			
Class D	-0.7%	24%	-0.4%	-0.7%	5%	-0.7%	-0.9%	4%	-0.8%			
Class E	-0.5%	21%	0.3%				-1.8%	5%	-1.5%			
Overall	-0.7%	24%	-0.1%	-0.7%	9%	-0.5%	-1.1%	4%	-1.0%			

- Proposed method

- **Simpler coding process** for two-level significance map coding
- **More reductions in number of decoded bins** for significance maps

- Coding performance

- HE: 0.0% / 0.0% / 0.0%
- LC: 0.0% / 0.0% / 0.0%
- HE10: 0.1%

- **The simplified process is proposed to be included in the next version of HM.**

Thank you !

Experimental results



Low QP test

	All Intra HE			Random Access HE			Low delay B HE			Random Access HE-10		
	Y	U	V	Y	U	V	Y	U	V	Y	U	V
Class A	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%				0.1%	0.3%	0.4%
Class B	0.1%	0.0%	0.1%	0.0%	0.0%	-0.1%	0.0%	0.0%	-0.1%	0.1%	-0.1%	-0.1%
Class C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
Class D	0.0%	0.1%	0.1%	0.0%	-0.1%	0.0%	0.0%	-0.1%	0.1%			
Class E	0.0%	0.0%	0.1%				0.0%	0.1%	-0.1%			
Overall	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%
ClassF	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%	-0.1%	-0.1%	-0.1%			
Enc Time	100%			100%			100%			100%		
Dec Time	99%			99%			100%			100%		
	All Intra LC			Random Access LC			Low delay B LC					
	Y	U	V	Y	U	V	Y	U	V			
Class A	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%						
Class B	0.1%	0.2%	0.2%	0.0%	0.2%	0.2%	0.1%	0.1%	0.2%			
Class C	0.0%	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%			
Class D	0.0%	0.1%	0.1%	0.0%	0.1%	0.1%	0.0%	0.2%	0.1%			
Class E	0.1%	0.1%	0.1%				0.0%	-0.3%	0.2%			
Overall	0.0%	0.1%	0.1%	0.0%	0.1%	0.1%	0.0%	0.1%	0.2%			
ClassF	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.4%	0.4%	0.1%			
Enc Time	100%			99%			100%					
Dec Time	99%			100%			99%					

Experimental results



RDOQ off

	All Intra HE			Random Access HE			Low delay B HE			Random Access HE-10		
	Y	U	V	Y	U	V	Y	U	V	Y	U	V
Class A	0.0%	0.1%	0.1%	0.0%	0.1%	0.1%				0.1%	0.6%	0.5%
Class B	0.1%	0.2%	0.2%	0.1%	0.1%	0.2%	0.0%	0.2%	0.5%	0.0%	0.0%	0.0%
Class C	0.0%	0.1%	0.1%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%			
Class D	0.1%	0.2%	0.2%	0.0%	0.1%	0.2%	0.0%	-0.1%	0.2%			
Class E	0.0%	0.1%	0.1%				0.1%	1.3%	0.0%			
Overall	0.0%	0.1%	0.1%	0.0%	0.1%	0.1%	0.0%	0.3%	0.2%	0.1%	0.3%	0.2%
ClassF	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	-0.1%	0.1%			
Enc Time	99%			100%			99%			99%		
Dec Time	101%			101%			100%			101%		
	All Intra LC			Random Access LC			Low delay B LC					
	Y	U	V	Y	U	V	Y	U	V			
Class A	0.0%	0.1%	0.1%	0.0%	0.1%	0.1%						
Class B	0.1%	0.2%	0.3%	0.1%	0.3%	0.2%	0.0%	-0.1%	0.3%			
Class C	0.0%	0.1%	0.1%	0.0%	0.2%	0.1%	0.0%	0.1%	0.0%			
Class D	0.0%	0.2%	0.1%	0.0%	0.1%	-0.2%	0.0%	0.5%	0.4%			
Class E	0.0%	0.1%	0.1%				0.0%	-1.1%	-0.6%			
Overall	0.0%	0.2%	0.2%	0.0%	0.2%	0.1%	0.0%	-0.1%	0.1%			
ClassF	0.0%	0.1%	0.0%	0.1%	0.0%	0.1%	-0.1%	-0.7%	-0.5%			
Enc Time	99%			99%			99%					
Dec Time	101%			99%			98%					