



Variable Length Coding for Coded Block Flag and Large Transform (JCTVC-B098)

Current Coded Block Flag Coding

- At CU level
 - 1 bit flag for each of Y, U and V component
- At block level
 - 1 bit flag for each transform block



A coding unit

Proposed Solution on Coded Block Flag

- At CU level
 - Group the three flags for Y, U and V component and code with a single codeword
 - Use coded block flags from neighboring CU as context
 - Both the flags of the upper and the left CU are zero
 - Only one flag of the upper or the left CU is zero
 - Both the flags of the upper and the left CU are non-zero

Coded block flag (U V Y)	Unary codeword
0 0 0	1
0 0 1	01
0 1 0	001
0 1 1	00001
1 0 0	0001
1 0 1	000001
1 1 0	0000001
1 1 1	0000000

Proposed Solution on Coded Block Flag (cont.)

- At block level
 - When available, for each of Y,U and V component, group the four coded block flags of the same video component and code with a single codeword
 - Use coded block flags from neighboring CU as context
 - Both the flags of the upper and the left CU are zero
 - Only one flag of the upper or the left CU is zero
 - Both the flags of the upper and the left CU are non-zero
 - For each context, 15 possible combinations to be coded
 - The four coded block flags can not all be zero
 - Under each context, a 3-bit codeword is assigned to the most likely combination

Blk0	Blk1
Blk2	Blk3

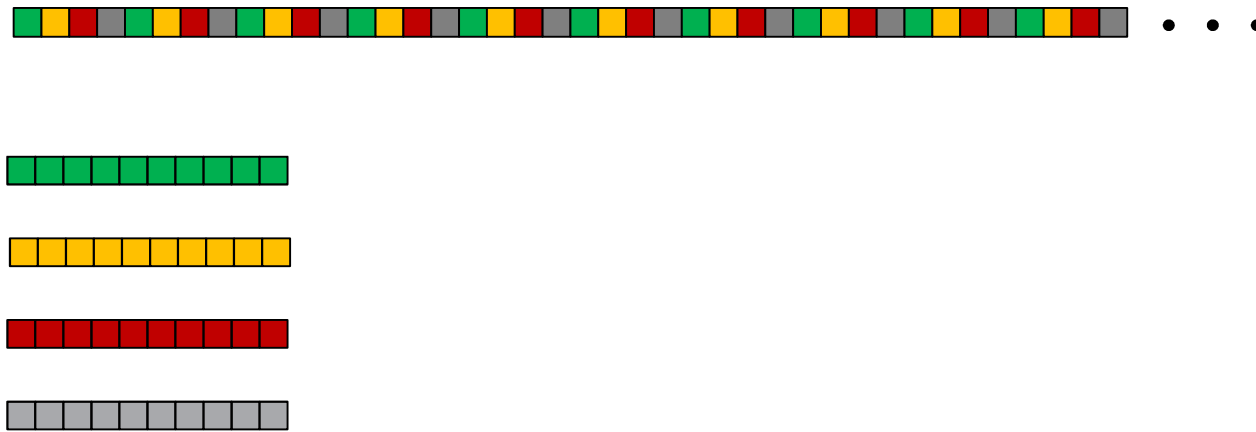
A coding unit

Simulation Results on Coded Block Flag

	grouping CBP (IPPP)	grouping CBP (Hierarchical B)
WQVGA30_RaceHorses	-2.52	-2.51
WQVGA50_BasketballPass	-2.50	-2.24
WQVGA50_BlowingBubbles	-2.58	-2.20
WQVGA60_BQSquare	-3.27	-3.09
WQVGA AVE	-2.72	-2.51
WVGA30_RaceHorses	-2.45	-2.34
WVGA50_BasketballDrill	-1.60	-2.16
WVGA50_PartyScene	-2.38	-2.44
WVGA60_BQMall	-3.14	-3.04
WVGA AVE	-2.39	-2.49
720p60_Vidyo1	-3.32	-3.29
720p60_Vidyo3	-3.54	-3.42
720p60_Vidyo4	-2.64	-2.69
720p AVE	-3.17	-3.13
1080p24_ParkScene	-2.45	-2.56
1080p24_Kimono	-2.31	-2.34
1080p50_BasketballDrive	-2.49	-2.41
1080p50_Cactus	-2.40	-2.40
1080p60_BQTerrace	-2.84	-2.56
1080p AVE	-2.50	-2.45
Average	-2.65	-2.61

Current VLC on Large Transform

- Interleaved coding for transform size 16x16 and above
 - Interleave coefficients into a number of 8x8 block
 - Depending on transform block size, take one out of every N coefficients to form N 8x8 blocks
 - Code each 8x8 block using 8x8 VLC coefficient coding



Coefficient interleaving with $N=4$

Proposed Solution for Large Transform Coding

- Simply code the first 64 coefficients based on scan order using 8x8 coefficient coding
 - For large transform, non-zero coefficients are mainly located at the beginning of the scan
 - By doing so, 8x8 block level coded block flag is no longer needed

Simulation Results on Large Transform

	Zero-out vs Interleaved (All Intra)	Zero-out vs Interleaved (IPPP)
WQVGA30_RaceHorses	-0.48	-0.85
WQVGA50_BasketballPass	-1.51	-0.87
WQVGA50_BlowingBubbles	-0.51	-1.55
WQVGA60_BQSquare	-0.13	-0.60
WQVGA AVE	-0.66	-0.97
WVGA30_RaceHorses	-0.99	-1.26
WVGA50_BasketballDrill	-1.34	-3.06
WVGA50_PartyScene	-0.34	-0.45
WVGA60_BQMall	-1	-1.30
WVGA AVE	-0.92	-1.52
720p60_Vidyo1	-4.91	-5.26
720p60_Vidyo3	-3.9	-2.41
720p60_Vidyo4	-3.51	-6.72
720p AVE	-4.11	-4.80
1080p24_ParkScene	-1.35	-0.97
1080p24_Kimono	-8.25	-6.36
1080p50_BasketballDrive	-5.91	-4.41
1080p50_Cactus	-0.99	-4.79
1080p60_BQTerrace	-0.29	-2.01
1080p AVE	-3.36	-3.71
Average	-2.21	-2.68

Conclusions

- The coded block flags can be grouped and coded in a very simple manner with a coding gain of 2.6% in average in BD-rate
- For large transform, coding gain can be achieved by only coding the first 64 coefficients, with 2.2% for intra and 2.7% for inter in terms of BD-rate reduction in average
- We recommend such coding schemes be considered for adoption into TMuC