JCTVC-G226

MEDIATEK

Non-CE11: Extending MDCS to 16x16 and 32x32 TUs

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Overall Summary

- In this contribution, MDCS is applied to larger TU sizes including 16x16 and 32x32
- Two scan patterns for horizontal and vertical scanning are proposed
- The first scan pattern can achieve 0.1% and 0.4% coding efficiency gains for HE-AI and LC-AI, respectively
- The second scan pattern can achieve 0.1% and 0.5% coding efficiency gains for HE-AI and LC-AI, respectively
- Run times are unchanged on average

Introduction

- In HM-4.0, MDCS is only used for TU sizes of 4x4 and 8x8
- Three scan patterns are selected by intra modes
  - For CABAC, they are diagonal, horizontal, and vertical scans
  - For CAVLC, they are zigzag, horizontal, and vertical scans
- In this contribution, MDCS is extended to TU sizes of 16x16 and 32x32
  - Two kinds of scan patterns are proposed for horizontal and vertical scans

Proposed Method

- Scan patterns selections for TU sizes of 16x16 and 32x32
  - 0, 1, and 2 stand for diagonal/zigzag, horizontal, and vertical scans, respectively

Intra Mode / TU size	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
32x32	**0**	**1**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**0**	**0**	**0**
16x16	**0**	**1**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**0**	**0**	**0**
8x8	0	1	2	0	0	1	1	0	2	2	0	0	1	1	0	0	2	2	0	0	0	1	1	1	1	0	0	0	0	2	2	2	2	0	0
4x4	0	1	2	0	0	1	1	0	2	2	0	0	1	1	0	0	2	2	0	0	0	1	1	1	1	0	0	0	0	2	2	2	2	0	0

- Two alternative scan patterns for horizontal and vertical scans are proposed

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First Scan Pattern

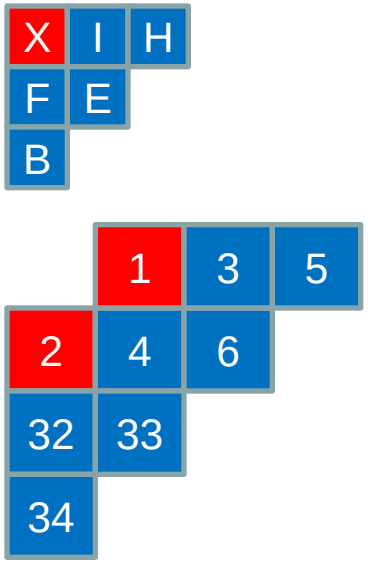
- Scan positions are grouped into pairs except the first position and the last position
- For CABAC, the context formation for one significant flag is independent of the other significant flag in one pair

First horizontal scan pattern for TU size of 16x16

Different colors indicate pairs for parallel processing

0	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	31
32	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61
34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	63
64	65	67	69	71	73	75	77	79	81	83	85	87	89	91	93
66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	95
96	97	99	101	103	105	107	109	111	113	115	117	119	121	123	125
98	100	102	104	106	108	110	112	114	116	118	120	122	124	126	127
128	129	131	133	135	137	139	141	143	145	147	149	151	153	155	157
130	132	134	136	138	140	142	144	146	148	150	152	154	156	158	159
160	161	163	165	167	169	171	173	175	177	179	181	183	185	187	189
162	164	166	168	170	172	174	176	178	180	182	184	186	188	190	191
192	193	195	197	199	201	203	205	207	209	211	213	215	217	219	221
194	196	198	200	202	204	206	208	210	212	214	216	218	220	222	223
224	225	227	229	231	233	235	237	239	241	243	245	247	249	251	253
226	228	230	232	234	236	238	240	242	244	246	248	250	252	254	255

Context formation for significant flag



Second Scan Pattern

- From F124, first eight positions in the first row have the highest variances for horizontal scan
  - The eight positions should be scanned first to get better coding efficiency
- Other scan positions are grouped into pairs

Second horizontal scan pattern for TU size of 16x16

0	1	2	3	4	5	6	7	8	10	12	14	16	18	20	22
9	11	13	15	17	19	21	23	24	26	28	30	32	34	36	38
25	27	29	31	33	35	37	39	40	42	44	46	48	50	52	54
41	43	45	47	49	51	53	55	56	58	60	62	64	66	68	70
57	59	61	63	65	67	69	71	72	74	76	78	80	82	84	86
73	75	77	79	81	83	85	87	88	90	92	94	96	98	100	102
89	91	93	95	97	99	101	103	104	106	108	110	112	114	116	118
105	107	109	111	113	115	117	119	120	122	124	126	128	130	132	134
121	123	125	127	129	131	133	135	136	138	140	142	144	146	148	150
137	139	141	143	145	147	149	151	152	154	156	158	160	162	164	166
153	155	157	159	161	163	165	167	168	170	172	174	176	178	180	182
169	171	173	175	177	179	181	183	184	186	188	190	192	194	196	198
185	187	189	191	193	195	197	199	200	202	204	206	208	210	212	214
201	203	205	207	209	211	213	215	216	218	220	222	224	226	228	230
217	219	221	223	225	227	229	231	232	234	236	238	240	242	244	246
233	235	237	239	241	243	245	247	248	249	250	251	252	253	254	255

Simulation Results

- Anchor: HM-4.0
- All Intra cases were tested for two scan patterns

First scan pattern

	All Intra HE			All Intra LC		
	Y	U	V	Y	U	V
Class A	0.0%	-0.3%	-0.3%	-0.2%	-0.7%	-0.8%
Class B	-0.1%	-0.7%	-0.7%	-0.7%	-1.4%	-1.3%
Class C	-0.1%	-0.2%	-0.3%	-0.2%	-0.5%	-0.5%
Class D	0.0%	-0.3%	-0.3%	-0.2%	-0.5%	-0.4%
Class E	-0.4%	-0.8%	-0.8%	-0.7%	-1.6%	-1.5%
Overall	-0.1%	-0.5%	-0.5%	-0.4%	-0.9%	-0.9%
	-0.1%	-0.5%	-0.5%	-0.4%	-0.9%	-0.9%
Enc Time[%]		100%			101%	
Dec Time[%]		100%			101%	

Second scan pattern

	All Intra HE			All Intra LC		
	Y	U	V	Y	U	V
Class A	0.0%	-0.3%	-0.3%	-0.2%	-0.8%	-0.8%
Class B	-0.2%	-0.7%	-0.7%	-0.8%	-1.7%	-1.6%
Class C	-0.1%	-0.3%	-0.3%	-0.2%	-0.6%	-0.6%
Class D	-0.1%	-0.3%	-0.3%	-0.3%	-0.5%	-0.4%
Class E	-0.4%	-0.9%	-0.8%	-0.9%	-1.9%	-1.7%
Overall	-0.1%	-0.5%	-0.5%	-0.5%	-1.1%	-1.0%
	-0.1%	-0.5%	-0.5%	-0.5%	-1.1%	-1.0%
Enc Time[%]		101%			100%	
Dec Time[%]		102%			100%	

Conclusions

- In this contribution,
  - MDCS is extended to TUs of 16x16 and 32x32
  - Two scan patterns were proposed
  - 2-parallel processing can be achieved for almost all context formation of the significance map
- The first scan pattern can achieve 0.1% and 0.4% bit rate savings for HE-AI and LC-AI, respectively.
- The second scan pattern can achieve 0.1% and 0.5% bit rate savings for HE-AI and LC-AI, respectively
- No run time change is observed