CE2-related: IntraBC constraint for multiple tiles

Tzu-Der (Peter) Chuang, Xiaozhong Xu, Yu-Wen Huang, Shan Liu, Shawmin Lei

Overview Summary
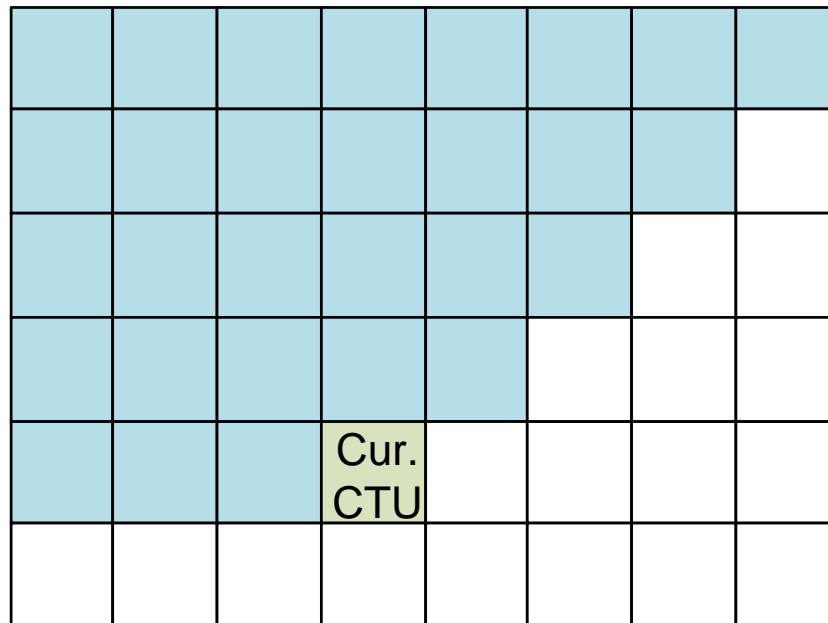
- Proposed to limit the reference area of an IntraBC block to reconstructed samples within the same tile such that each tile can be reconstructed independently
  - In SCM-3.0, when the multi-tile configuration is applied, the search area includes the CTUs of non-current tiles
  - Violates the principle of reconstructing each tile independently

IntraBC Search Area Constraint

- In SCM-3.0 IntraBC search, a ladder shape search area constraint is applied
  - For an IntraBC block in current CTU, its available search area is constrained to the blue CTUs and the reconstructed blocks in the current CTU

IntraBC Search Area for Multi-tile Configuration

- In SCM-3.0, when the multi-tile configuration is applied, the search area includes the CTUs of non-current tiles
  - Violates the principle of reconstructing each tile independently
- **Mismatch between encoder and decoder occurs in SCM-3.0**
  - When CTU-31 is processed, CTU-36 is used for prediction but CTU-36 should be not available

0	1	2	3	12	13	14	15
4	5	6	7	16	17	18	19
8	9	10	11	20	21	22	23
24	25	26	27	36	37	38	39
28	29	30	31	40	41	42	43
32	33	34	35	44	45	46	47

Proposed IntraBC Search Area Constraint for Multi-tile Configuration

- Proposed to limit the reference area of an IntraBC block to reconstructed samples within the same tile

0	1	2	3	12	13	14	15
4	5	6	7	16	17	18	19
8	9	10	11	20	21	22	23
24	25	26	27	36	37	38	39
28	29	30	31	40	41	42	43
32	33	34	35	44	45	46	47

Lossy Coding Result for Multi-tile Configuration

- Multi-tile configuration with 1x2 tiles per frame
  - Anchor: SCM-3.0
  - Test: proposed constraint for multi-tile configuration

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	35	36	37	38	39
40	41	42	43	44	45	46	47

	All Intra			Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p & 720p	3.0%	2.9%	2.9%	1.6%	1.5%	1.5%	0.6%	0.6%	0.6%
RGB, mixed content, 1440p & 1080p	1.9%	1.8%	1.9%	1.3%	1.2%	1.1%	0.5%	0.5%	0.2%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.1%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%
YUV, text & graphics with motion, 1080p & 720p	3.2%	3.1%	3.1%	1.6%	1.6%	1.6%	0.6%	0.6%	0.9%
YUV, mixed content, 1440p & 1080p	1.9%	1.6%	1.7%	1.3%	0.9%	1.0%	0.5%	0.0%	0.2%
YUV, Animation, 720p	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	-0.1%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	-0.1%	0.0%	-0.1%	0.0%	0.1%	-0.1%

Lossless Coding Result for Multi-tile Configuration

- Multi-tile configuration with 1x2 tiles per frame

  – Anchor: SCM-3.0

  – Test: proposed constraint for multi-tile configuration

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	35	36	37	38	39
40	41	42	43	44	45	46	47

	All Intra				Random Access				Low Delay B			
	Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)	Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)	Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)
RGB, text & graphics with motion, 1080p & 720p	1.4%	1.6%	0.0%	4.0%	1.1%	1.0%	0.0%	2.5%	1.2%	0.6%	0.0%	2.6%
RGB, mixed content, 1440p & 1080p	1.6%	1.5%	0.3%	2.5%	0.3%	0.3%	0.0%	0.6%	0.2%	0.2%	0.0%	0.4%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p & 720p	1.5%	1.8%	0.1%	4.2%	1.1%	1.0%	0.0%	2.4%	1.2%	0.7%	0.0%	2.5%
YUV, mixed content, 1440p & 1080p	1.8%	1.7%	0.4%	2.8%	0.3%	0.4%	0.0%	0.7%	0.2%	0.2%	0.0%	0.4%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Conclusion

- Proposed to limit the reference area of an IntraBC block to reconstructed samples within the same tile

- Each tile can be reconstructed independently