

AHG5: Motion prediction for Intra Block Copy

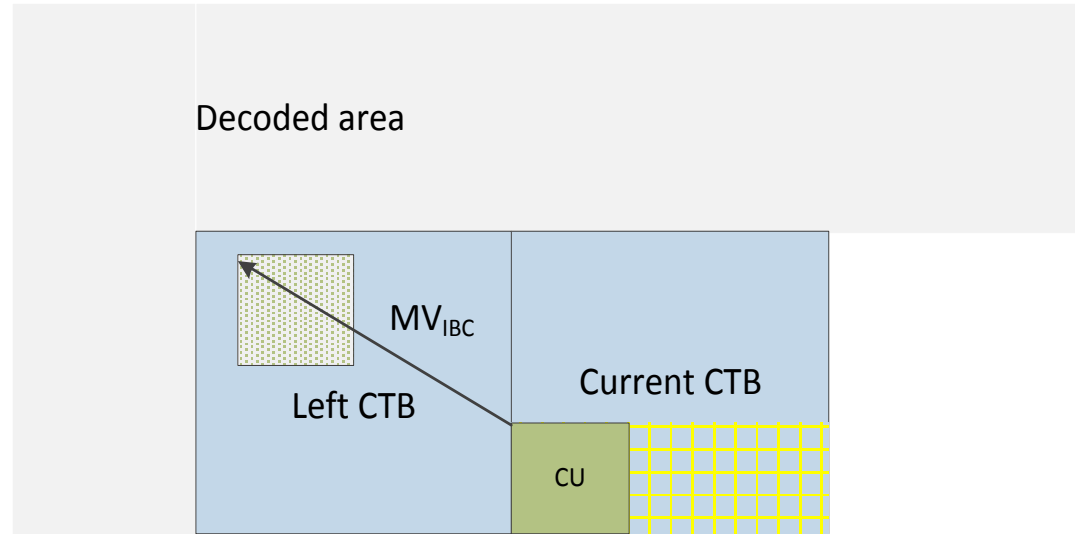
JCTVC-00122

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15th JCTVC Meeting, Geneva, October 2013

Principle of the Intra Block Copy

- Use of a previously reconstructed block in the causal neighborhood as predictor of the current CU.



- Some weaknesses of current IBC design
 - Use of the MVD coding scheme of the HEVC Inter mode
 - No motion vector prediction scheme has been adopted so far.

Simple prediction method

- The vector of the Intra Block Copy is predicted by $\overrightarrow{P_{IBC}}$ as follows:
 - $\overrightarrow{MV_{IBC}} = \overrightarrow{P_{IBC}} + \overrightarrow{MVD_{IBC}}$
- Main characteristics of the predictor $\overrightarrow{P_{IBC}}$
 - Use the very last encoded IBC vector as predictor for the current CU.
 - Reset the predictor $\overrightarrow{P_{IBC}}$ to (0,0) at each CTB.
- Advantages
 - Very limited memory to store a single vector of the current CTB
 - No line buffer needed
 - This was the case when considering a Left/Above prediction scheme.
 - No additional syntax element required
 - Just change of the decoding process.
 - Two additions.
 - Parallel vector estimation at CTB level at encoder side.

Experiments results/lossless

■ Reference: RExt4.0

■ Average BDR performance

- 1.2% and 1.4% for SCC content in INTRA configuration
- No loss
- Max 5.7%

	AI Main											
	compression ratio (Total)		compression ratio (Average)		compression ratio (min)		compression ratio (max)		Bit-rate saving (Total)	Bit-rate saving (Average)	Bit-rate saving (Min)	Bit-rate saving (Max)
	Ref.	Tested	Ref.	Tested	Ref.	Tested	Ref.	Tested				
Class F	4.57	4.58	5.57	5.59	2.27	2.27	11.14	11.15	0.2%	0.3%	0.0%	1.1%
Class B	2.24	2.24	2.26	2.26	2.08	2.08	2.44	2.44	0.0%	0.0%	0.0%	0.0%
SC RGB 444	7.88	7.90	9.5	9.55	5.23	5.23	14.73	14.84	0.2%	0.3%	0.0%	0.7%
Animation RGB 444	2.48	2.48	2.5	2.52	2.15	2.15	3.05	3.05	0.0%	0.0%	0.0%	0.0%
SC YUV 444	11.09	11.13	13.2	13.29	7.87	7.87	19.32	19.51	0.3%	0.4%	0.0%	0.9%
Animation YUV 444	3.00	3.00	3.2	3.16	2.57	2.57	3.93	3.93	0.0%	0.0%	0.0%	0.0%
RangeExt	1.92	1.92	2.38	2.38	1.46	1.46	4.37	4.37	0.0%	0.0%	0.0%	0.0%
SC GBR 444 Optional	20.30	20.60	24.82	25.65	9.69	9.69	36.10	38.29	1.5%	2.2%	0.0%	5.7%
SC YUV 444 Optional	31.85	32.22	34.39	34.98	22.30	22.40	51.97	53.33	1.2%	1.3%	0.4%	2.6%
Enc Time[%]									100%			
Dec Time[%]									99%			

Experiments results/lossy

■ Reference: RExt4.0

■ Average BDR performance

● Intra : 1.1%

● RA: 1.0%

● LDB: 0.8%

	All Intra HE Main-tier			All Intra HE High-tier			All Intra HE Super-High-tier		
	Y	U	V	Y	U	V	Y	U	V
Class F	-0.7%	-0.8%	-0.8%	-0.5%	-0.6%	-0.6%	-0.4%	-0.4%	-0.4%
Class B	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	0.0%	0.0%	0.0%
SC RGB 444	-1.0%	-1.1%	-1.1%	-0.9%	-0.8%	-0.9%	-0.7%	-0.7%	-0.7%
Animation RGB 444	-0.2%	-0.2%	-0.2%	-0.1%	-0.1%	-0.1%	0.0%	-0.1%	-0.1%
SC YUV 444	-1.7%	-1.7%	-1.7%	-1.3%	-1.3%	-1.3%	-1.0%	-1.0%	-0.9%
Animation YUV 444	-0.3%	-0.3%	-0.3%	-0.2%	-0.2%	-0.2%	-0.1%	-0.1%	-0.1%
RangeExt	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SC(444) GBR Optional	-4.6%	-4.7%	-4.6%	-4.2%	-4.4%	-4.3%	-4.0%	-4.1%	-4.1%
SC(444) YUV Optional	-3.1%	-3.2%	-3.2%	-2.5%	-2.6%	-2.7%	-2.0%	-2.2%	-2.2%
Average	-1.3%	-1.3%	-1.3%	-1.1%	-1.1%	-1.1%	-0.9%	-0.9%	-0.9%
Enc Time[%]	100%			100%			100%		
Dec Time[%]	98%			98%			98%		

	Random Access HE Main-tier			Random Access HE High-tier		
	Y	U	V	Y	U	V
Class F	-0.7%	-0.7%	-0.7%	-0.5%	-0.5%	-0.5%
Class B	0.0%	-0.1%	-0.1%	0.0%	-0.1%	0.0%
SC RGB 444	-0.8%	-0.9%	-0.9%	-0.7%	-0.7%	-0.7%
Animation RGB 444	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
SC YUV 444	-1.3%	-1.4%	-1.3%	-1.0%	-1.1%	-1.0%
Animation YUV 444	-0.1%	-0.2%	-0.2%	-0.1%	-0.2%	-0.2%
RangeExt	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
SC(444) GBR Optional	-3.9%	-4.0%	-3.9%	-3.6%	-3.7%	-3.6%
SC(444) YUV Optional	-3.5%	-3.5%	-3.8%	-3.1%	-3.1%	-3.2%
Average	-1.1%	-1.2%	-1.2%	-1.0%	-1.0%	-1.0%
Enc Time[%]	100%			100%		
Dec Time[%]	103%			103%		

	Low delay B HE Main-tier			Low delay B HE High-tier		
	Y	U	V	Y	U	V
Class F	-0.5%	-0.7%	-0.4%	-0.3%	-0.5%	-0.4%
Class B	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
SC RGB 444	-0.8%	-0.8%	-0.8%	-0.6%	-0.5%	-0.6%
Animation RGB 444	-0.1%	-0.1%	-0.1%	0.0%	-0.1%	-0.1%
SC YUV 444	-1.3%	-1.3%	-1.3%	-1.0%	-0.9%	-1.0%
Animation YUV 444	-0.1%	-0.2%	0.0%	-0.1%	-0.1%	-0.1%
RangeExt	0.0%	0.0%	-0.2%	0.0%	0.0%	-0.2%
SC(444) GBR Optional	-1.6%	-1.6%	-1.6%	-2.7%	-2.7%	-2.8%
SC(444) YUV Optional	-3.8%	-3.4%	-3.8%	-2.5%	-2.3%	-2.7%
Average	-0.9%	-0.9%	-0.9%	-0.8%	-0.8%	-0.8%
Enc Time[%]	100%			100%		
Dec Time[%]	102%			102%		

Conclusion

- Recommend considering this straightforward approach for RCE regarding the improvement of the Intra Block Copy method.