

JVET-N0086: CE4-related: Reduction of interactions between bi-prediction coding tools

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Overall Summary

- Proposed method1
 - Disallowing coupled usage of {DMVR, BDOF, BiCW, CIIP} except DMVR+BDOF
- Proposed method 2
 - Disallowing coupled usage of {DMVR, BDOF, BiCW, CIIP}, no exception

			Over VTM 4.0				
			Y	U	V	EncT	DecT
1	{DMVR, BDOF, BiCW, CIIP} off	RA	2.82%	2.48%	2.50%	84%	89%
		LB	0.83%	1.49%	1.58%	91%	99%
2	Method 1	RA	0.06%	-0.04%	-0.01%	100%	100%
		LB	0.02%	0.07%	0.12%	100%	100%
3	Method 2	RA	0.35%	0.12%	0.10%	100%	99%
		LB	0.02%	0.07%	0.12%	100%	100%

Introduction to Bi-prediction Tools

- In VTM-4.0, cascading operations of some bi-prediction tools are
 - DMVR => BDOF => BiCW => CIIP
 - Introducing additional buffer cost due to long pipeline latency or more pipeline stages

Table : Interactions between DMVR, BDOF, BiCW, and CIIP

	DMVR	BDOF	BiCW	CIIP
DMVR	NA	O	O	O
BDOF	O	NA	X	O
BiCW	O	X	NA	O
CIIP	O	O	O	NA

NA = not applicable

O = coupling exists between two tools

X = no coupling between two tools

Proposed Method 1

- One modification for **CIIP**
 - When selecting a bi-prediction merge candidate, the prediction from list 0 or list 1 with lower POC distance is used
 - Then, the bi-prediction tools, such as DMVR, BDOF, and BiCW, are disallowed automatically
- Another modification for **BiCW and DMVR**
 - When BiCW is applied (BiCW index indicates unequal weights), DMVR is turned off

Table : Interactions between DMVR, BDOF, BiCW, and CIIP in method 1

	DMVR	BDOF	BiCW	CIIP
DMVR	NA	O	X	X
BDOF	O	NA	X	X
BiCW	X	X	NA	X
CIIP	X	X	X	NA

Proposed Method 2

- Based on Method 1, some additional changes
 - When DMVR is applied, BDOF is turned off
 - For DMVR, an eight-neighbor search pattern is used for each integer sample search iteration
 - For BDOF, SbTMVP is supported

Table : Interactions between DMVR, BDOF, BiCW, and CIIP in method 2

	DMVR	BDOF	BiCW	CIIP
DMVR	NA	X	X	X
BDOF	X	NA	X	X
BiCW	X	X	NA	X
CIIP	X	X	X	NA

Simulation Results

		Over VTM-4.0				
		Y	U	V	EncT	DecT
Method 1	RA	0.06%	-0.04%	-0.01%	100%	100%
	LB	0.02%	0.07%	0.12%	100%	100%
Method 2	RA	0.35%	0.12%	0.10%	100%	99%
	LB	0.02%	0.07%	0.12%	100%	100%

Conclusions

- Proposed methods can reduce cascading behaviors for inter prediction with most gain preserved
 - Method 1
 - Disallowing coupled use of {DMVR, BDOF, BiCW, CIIP} except DMVR+BDOF
 - 98% coding gain of {DMVR, BDOF, BiCW, CIIP} is preserved
 - Method 2
 - Disallowing coupled use of {DMVR, BDOF, BiCW, CIIP} with no exception
 - 88% coding gain of {DMVR, BDOF, BiCW, CIIP} is preserved

Backup

Test

- {DMVR, BDOF, BiCW, CIIP} off

	Random access Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	2.64%	3.05%	3.36%	85%	91%
Class A2	3.73%	3.17%	2.98%	84%	94%
Class B	2.75%	2.08%	2.13%	84%	88%
Class C	2.37%	2.05%	1.97%	85%	87%
Class E					
Overall	2.82%	2.48%	2.50%	84%	89%
Class D	2.86%	2.18%	2.11%	87%	84%
Class F	1.47%	1.45%	1.26%	86%	85%

	Low delay B Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	1.06%	1.57%	1.83%	91%	99%
Class C	0.75%	1.23%	1.57%	91%	101%
Class E	0.52%	1.71%	1.16%	91%	94%
Overall	0.83%	1.49%	1.58%	91%	99%
Class D	0.57%	1.49%	0.72%	92%	100%
Class F	1.28%	1.18%	0.96%	95%	102%

Test of Method 1

- Method 1 :
 - Disallow coupled use of {DMVR, BDOF, BiCW, CIIP} except DMVR+BDOF

	Random access Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	0.08%	-0.03%	0.10%	100%	100%
Class A2	0.04%	-0.02%	0.11%	100%	100%
Class B	0.04%	-0.19%	-0.09%	100%	100%
Class C	0.07%	0.11%	-0.07%	100%	99%
Class E					
Overall	0.06%	-0.04%	-0.01%	100%	100%
Class D	0.05%	0.00%	0.00%	101%	99%
Class F	-0.05%	-0.01%	-0.03%	100%	99%

	Low delay B Main10				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.04%	0.08%	0.25%	100%	100%
Class C	0.04%	0.06%	0.00%	100%	101%
Class E	-0.02%	0.06%	0.08%	100%	96%
Overall	0.02%	0.07%	0.12%	100%	100%
Class D	-0.03%	0.13%	-0.39%	101%	100%
Class F	0.00%	0.35%	0.27%	100%	100%

Test of Method 2

- Method 2 :
 - Disallow coupled use of {DMVR, BDOF, BiCW, CIIP} with no exception

	Random access Main10				
	Over VTM-4.0			EncT	DecT
	Y	U	V		
Class A1	0.21%	0.03%	0.11%	100%	100%
Class A2	0.47%	0.09%	0.17%	100%	100%
Class B	0.33%	0.03%	0.05%	100%	99%
Class C	0.40%	0.34%	0.10%	100%	98%
Class E					
Overall	0.35%	0.12%	0.10%	100%	99%
Class D	0.58%	0.38%	0.30%	101%	98%
Class F	0.10%	0.08%	0.00%	100%	100%

Test of Sub-Item in Method 2

- Sub-item :
 - For DMVR, an eight-neighbor search pattern is used for each integer sample search iteration

Over VTM 4.0			VTM				
			Y	U	V	EncT	DecT
1	Eight-neighbor DMVR	RA	-0.04	-0.03	-0.05	100	101
		LB					